

62<sup>nd</sup> ANNUAL CONFERENCE OF THE  
INDIAN SOCIETY OF AEROSPACE MEDICINE,  
23-25 NOV 23

SOUVENIER







**62<sup>nd</sup> Annual Conference  
of  
the Indian Society of Aerospace Medicine**



**at**

**Institute of Aerospace Medicine  
Bangalore, India**

**23 to 25 November 2023**



# Institute of Aerospace Medicine Indian Air Force



A WARM WELCOME TO ALL THE PARTICIPANTS

Conference logo



Designed and conceptualised by

**Sqn Ldr Gaurab Ghosh**



### Logo Description

1. This logo is to commemorate the rich and illustrious years of the Society, and to celebrate **62<sup>st</sup> Annual Conference of Indian Society of Aerospace Medicine**.
2. The logo for the Conference has been designed keeping in view the all-encompassing speciality of Aerospace Medicine. The logo highlights the distinct facets of Aerospace Medicine as a specialty.
3. Description of the individual elements of the logo: -
  - (a) **ISAM logo**. The symbol of the Indian Society of Aerospace Medicine in the centre of conference logo depicts the omnipresence of society for the last 62 years towards STRENGTHENING, SUPPORTING and RESOLVING the issues in the Aerospace domain.
  - (b) **Fixed and Rotary wing**. The society is the cornerstone in providing Strength to our flight surgeons enabling them to make the perfect Aeromedical Decision, to provide possible Solutions to all Aeromedical issues and thereby Supporting the aviation organizations in developing, operating and maintain the platforms aiming high to touch the sky & space (Gaganyaan Mission).
  - (c) **Gaganyaan logo**. It highlights the Society's contribution to India's maiden Human Space Flight Programme – Gaganyaan. Some of the contributions that the society is making to the mission include selection of crew, their periodic aeromedical and physical evaluation, flight surgeon support and consultancy in design and development of various human-use products.
  - (d) The colour combination of the logo highlights the immense contribution of this society to IAF and its sister organisations.





# MESSAGES





**एयर चीफ मार्शल वी आर चौधरी**

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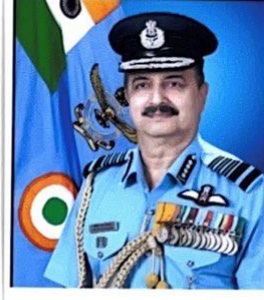
***Air Chief Marshal VR Chaudhari***

***PVSM AVSM VM ADC***

Tel : (011) Off : 23012517

Res : 23017300

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वायु सेना मुख्यालय

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Air Headquarters

New Delhi - 110011

1. I am pleased to learn that the Indian Society of Aerospace Medicine (ISAM) is organising its 62<sup>nd</sup> Annual Conference at IAM.

2. The IAF has stabilised its position as one of the most professional Air Forces in the world and is well on the path towards becoming a leaner, yet stronger force with highly focused multi-skilled personnel to fight tomorrow's wars. Continual development of technology in the field of aviation and the increasingly complex operational environment have placed greater demands on all operators associated with aviation. Aviation specialists have been responsive to the rapidly changing military aviation environment where the physiological and mental capacity demands on aircrew have increased exponentially. ISAM members, with their wealth of domain knowledge and experience can contribute immensely towards enhancing our operational potential.

3. The theme of the conference this year, 'Aerospace Medicine: Strength, Support and Solutions' is a clarion call to display and discuss accomplished researches and exchange ideas with renowned innovators in the field of aerospace medicine. I am confident that the painstakingly designed scientific program will act as a beacon for the medical fraternity in enhancing their knowledge and experience to help address their future envisaged roles.

4. On the occasion of the 62<sup>nd</sup> annual conference, I pay tribute to our veterans from the aerospace medical fraternity and acknowledge their outstanding contributions. I extend my greetings to the organisers as well as delegates of ISAM 2023 and wish the conference great success.

Jai Hind!

**Air Chief Marshal  
Chief of the Air Staff**

20 Nov 23





एयर मार्शल आर राधीश अ वि से मे वा मे

*Air Marshal R Radhish AVSM VM*

वायु अफसर कमांडिंग-इन-चीफ

*Air Officer Commanding-in-Chief*

Telefax : (O) 080-23412821

AFNET : 4111-7202

प्रशिक्षण कमान मुख्यालय, भा वा से  
जे सी नगर पोस्ट  
बेंगलुरु - ५६०००६

HQ Training Command, IAF  
JC Nagar Post  
Bengaluru - 560 006



## MESSAGE

1. The Indian Society of Aerospace Medicine is organizing its 62nd Annual Conference from the 23rd to 25th Nov 23 at the Institute of Aerospace Medicine. It is indeed a matter of great pride to the Training Command and Indian Air Force.
2. This event is organized to gather medical professionals dedicated to the advancement in the field of Aerospace Medicine, to discuss developments in the field of aviation and space exploration that relate to human beings. We have already reached the surface of the Moon, orbited the Mars, and launched explorations in to deep space. With human space flight about to become a reality, and expeditions to Mars appearing to be a distinct possibility, the role of Aerospace Medicine professionals has become very crucial. Whether it is in the Earth's atmosphere or beyond, Flight Surgeon's role has become pivotal to the success of the mission, as well as the safety and wellbeing of the operators. The theme of the conference: 'Aerospace Medicine: Strength, Support and Solutions' is therefore very pertinent.
3. This conference brings together, a diverse array of medical professionals, engineers and researchers who share a common commitment to enhance mission safety, and assure mission achievement. It is a platform for exchanging ideas, discussing issues and forging collaborations for the benefit of all. I am sanguine that the conference will be instructive, and will showcase the progress made by us in the niche field of Aerospace Medicine.
4. I wish all those involved in organising the conference great success and the very best.

Jai Hind!

Air Marshal

Air Officer Commanding-in-Chief

21 Nov 23



ले जनरल दलजीत सिंह, ए वी एस एम, वी एस एम, पी एच एस  
महानिदेशक सशस्त्र सेना चिकित्सा सेवा एवं वरिष्ठ कर्नल कमांडेन्ट, एएमसी

*Lt Gen Daljit Singh*, AVSM, VSM, PHS

Director General Armed Forces Medical Services &  
Sr Col Commandant, AMC

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ASCON : 33080



### MESSAGE

1. It is with immense pleasure that I extend my warmest greetings to the Indian Society of Aerospace Medicine on the occasion of its 62<sup>nd</sup> Annual Conference.
2. This gathering of dedicated professionals plays an integral role in ensuring the health, safety and wellbeing of those who furrow the skies. Aerospace Medicine represents a unique intersection of healthcare, aviation and space travel where the knowledge and expertise of medical professionals is critical to the success and safety of air and space operations. The mission of the Flight Surgeons is to support those who dare to reach new heights in the atmosphere and beyond.
3. The Conference theme, 'Aerospace Medicine: Strength, Support and Solutions' is testament to our collective commitment to advance the science of Aerospace Medicine, improving the health of aviation personnel and enhancing flying safety.
4. May this Conference be a source of inspiration, a hub of knowledge and a catalyst for advancement in this amazing field. I wish the Conference, a grand success.

**'Jai Hind'**

Station: New Delhi

Dated: 20 Nov 2023

कार्यालय महानिदेशक  
सशस्त्र सेना चिकित्सा सेवा  
रक्षा मंत्रालय  
रक्षा कार्यालय परिसर  
'ए' ब्लॉक, (चौथी मंजिल)  
अफ्रीका एवेन्यू, नई दिल्ली-110023  
Office of Director General  
Armed Forces Medical Services  
Ministry of Defence  
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'A' Block, (4<sup>th</sup> Floor)  
Africa Avenue, New Delhi-110023

*Daljit Singh*

(Daljit Singh)  
Lt Gen  
DGAFMS





एयर मार्शल आर के आनन्द वि से मे  
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नई दिल्ली-११० १०६  
Air Headquarters (Vayu Bhawan)  
Rafi Marg, New Delhi-110 106



### MESSAGE

1. I am delighted to learn that the Indian Society of Aerospace Medicine is conducting its 62<sup>nd</sup> Annual Conference from 23 – 25 Nov 23. The conference's theme is '**Aerospace Medicine: Strength, Support and Solutions**', which underscores the contribution of this specialty towards safe and successful aerospace operations.
2. Aerospace Medicine specialists play a pivotal role in maintaining the physical and mental wellbeing of our aircrew. Their proactive approach significantly reduces the risk of in-flight medical issues that could jeopardise mission success. Through ongoing research, these specialists identify potential risks to the aircrew and work on strategies to mitigate them. By doing this, they contribute directly to mission safety. As we continue to advance in the world of aviation and space travel, the role of the Aerospace Medicine specialists remains indispensable.
3. On this occasion, I wish to congratulate everyone who has worked tirelessly to develop the specialty and attain such heights.
4. I wish the 62<sup>nd</sup> ISAM Conference a grand success.

Jai Hind !



एयर मार्शल राजेश वैद्या वि से मे  
महानिदेशक चिकित्सा सेवा ( वायु )  
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### MESSAGE FROM DGMS (AIR)

1. It is a matter of great pride that the Indian Society of Aerospace Medicine is holding its 62<sup>nd</sup> Annual Conference at IAM, Bangalore from 23-25 Nov 23.
2. This Conference holds special significance as it underscores the critical importance of the interface between aviation and medicine, an interface that is at the heart of our commitment to excellence and safety in the aerospace domain.
3. Aerospace Medicine is not merely a discipline; it is committed to ensure the wellbeing of our dedicated aircrew and astronauts who venture into the skies and beyond. It is a testament to our unwavering commitment to safeguarding aircrew health, pushing the boundaries of human potential and advancing the frontiers of aerospace operations.
4. This Conference, with its theme of '**Aerospace Medicine: Strength, Support and Solutions**', serves as a beacon of knowledge, bringing together experts, researchers and professionals from diverse backgrounds who share a common purpose; to ensure that aviation safety and aircrew health preservation remain paramount. It is a forum where ideas converge, innovations are born and partnerships are forged for the betterment of this world of aviation and space.
5. As the President of the Society, I extend a warm welcome to all delegates and veterans in the field of Aerospace Medicine and allied specialties and wish the Conference every success.

**Best wishes & Jai Hind!**

Place: New Delhi

Date: 15 Nov 23

(Rajesh Vaidya)  
Air Mshl  
DGMS (Air)





एयर वाईस मार्शल रेणुका कुंटे

प्रधान चिकित्सा अधिकारी

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HQ Training Command  
Indian Air Force  
JC Nagar Post  
Bengaluru - 560 006



### MESSAGE FROM PMO

1. On the occasion of the 62<sup>nd</sup> Annual Conference of the Indian Society of Aerospace Medicine, I extend my warm felicitations to all members of the society. The theme of the Conference this year is '**Aerospace Medicine: Strength, Support and Solutions**'. This theme highlights the important role that the practitioners of this specialty play in ensuring aerospace safety and mission effectiveness.
2. Aerospace Medicine doesn't just focus on preventing problems; it also strives to enhance and optimize aircrew performance. The knowledge gained from past and ongoing research allows the specialists to maximize the efficiency of our aircrew during missions. Study of the interactions between humans and complex aviation systems allows the Aerospace Medicine specialists to help in improving system and interface designs, thus directly contributing towards enhancing aircrew effectiveness.
3. This Annual ISAM Conference will not only highlight accomplishments in this field, but also discuss emerging aeromedical challenges and strategies to tackle them. The discussions and interactions in this forum will definitely help everyone enhance their knowledge and widen their horizons.
4. It is my pleasure, as the Conference's Chief Coordinator, to welcome all attendees and dignitaries to Bangalore. I also welcome the illustrious veterans in the field of Aerospace Medicine, who, by their very presence, will contribute to the success of this conference.

Jai Hind !

*Renuka Kunte*  
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एयर कमांडोर विपिन शर्मा

समादेशक

*Air Commodore Vipin Sharma*

**Commandant**

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वांतरिक्ष औषधि संस्थान

भारतीय वायु सेना

विमानपुरा पोस्ट

बेंगलूरु - ५६००१७

Institute of Aerospace Medicine IAF

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Bengaluru-560 017



### **MESSAGE**

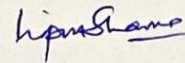
1. It is indeed a privilege and an honour for me to serve as the Executive Coordinator for the 62<sup>nd</sup> Annual Conference of the Indian Society of Aerospace Medicine, which is being held at the Institute of Aerospace Medicine from 23-25 November 23.
2. This Conference serves as a niche platform for Aerospace Medicine specialists, clinicians, human factors experts and engineers from India and across the globe to discuss, deliberate and find solutions to problems confronting the world of aviation and space travel. As old ideas and paradigms make way for new ones, this is the time to test new and innovative approaches towards aircrew health preservation and promotion.
3. The theme for this year's Conference is '**Aerospace Medicine: Strength, Support and Solutions**'. With India already having set its foot firmly on the moon and the first indigenous manned space mission just around the corner, aeromedical support to flight operations and space travel has never garnered more attention. The flight surgeons, often working behind the scenes, ensure that the men and women in their flying machines remain fit and ready to undertake any mission. To ensure that they complete this task wholly and in full measure, this Conference will serve as a forum for them to listen to experts in various disciplines, enrich their knowledge and expand their horizons. The



carefully planned social events will also ensure that while enjoying themselves, our younger colleagues also get to interact with luminaries in this field and imbibe some of their brilliance and aura.

4. It gives me immense pleasure to extend a warm welcome to all dignitaries and delegates to Bangalore and to the 62<sup>nd</sup> ISAM conference. I sincerely hope that you savour this academic feast and go back richer in knowledge and experience.

Jai Hind !



Date: 21 Nov 23



# COMMITTEES





**62<sup>nd</sup> Annual Conference of  
the Indian Society of Aerospace Medicine  
Aerospace Medicine: Strength, Support & Solutions**

**Conference Advisory Committee**

**Society President**

Air Mshl Rajesh Vaidya VSM, DGMS (Air)

**Society Secretary**

Gp Capt NK Tripathy

**Chief Coordinator**

AVM Renuka Kunte VSM

**Executive Coordinator**

Air Cmde Vipin Sharma

**Conference Organising Committee**

**Organising Secretary**

Gp Capt SS Mohapatra S

**Asst Organising Secretaries**

Wg Cdr Biplab Bhowmick  
Wg Cdr BN Vasudev

**Organising Secretariat**

Sqn Ldr Sourav Gain  
Sqn Ldr Anubhav Upadhyay  
Maj Sunil Kumar  
Surg Lt Cdr Harsha  
Sqn Ldr Gaurav Garg  
Maj Jeya Kartik  
Dr Pranav

**Scientific Programme Committee**

Gp Capt YS Dahiya  
Dr CHN Sowgandhi Sc-F

Sqn Ldr DD Ghosh  
Sqn Ldr Varun Y  
Sqn Ldr Ketan Deshpande  
Dr Harshini  
Dr Harshita

### **Stage Committee**

Wg Cdr MD Sharma  
Wg Cdr Nidhi Singh  
Sqn Ldr Gaurab Ghosh  
Sqn Ldr Uday Bansal  
Sqn Ldr Meghna  
Dr Ruchika Rana  
Dr Bhavana

### **MC**

Sqn Ldr Gaurab Ghosh  
Sqn Ldr Uday Bansal  
Sqn Ldr Meghna

### **Invitation, RSVP Seating and ushering**

Gp Capt MB Suja  
Wg Cdr Fatima SS  
Surg Lt Cdr Karthikeyan S  
Sqn Ldr Avishek Sharma  
Surg Lt Cdr Arjun  
Maj Venkatesh E  
Dr Harshini H

### **Slide Projection & Photography**

Gp Capt Urmila Sahu  
Gp Capt Bornali Gogoi  
Sqn Ldr Avishek Sharma  
Sqn Ldr Uday Bansal  
Surg Lt Cdr Arjun  
Surg Lt Cdr Alla Rakesh  
Dr Pranav

### **Poster Presentation**

Lt Col Srinivasa Bhattachar  
Wg Cdr Nidhi Singh



**Folders, Banners, Printing  
& E-Souvenir**

Surg Lt Cdr Karthikeyan S  
Sqn Ldr BN Bhowmick  
Dr Harshini H  
Dr Sneha Kahalekar

**Accommodation & Catering**

Lt Col Srinivasa Bhattachar  
Surg Lt Cdr Karthikeyan S  
Sqn Ldr Shaleen P Singh  
Sqn Ldr Shivaling  
Sqn Ldr Ketan Deshpande  
Flt Lt Suhas

Gp Capt Yogesh Tripathi  
Wg Cdr Vikram Singh  
Wg Cdr Y Dinker  
Wg Cdr KK Singh  
Wg Cdr Arunabh Ghosh  
Sqn Ldr BN Bhowmick  
Sqn Ldr Nikeata Jha  
Maj Venkatesh E  
Dr Shawn  
Dr Gokul Harish

**PRO**

Dr Biswajit Sinha Sc F  
Wg Cdr Nidhi Singh

**Treasurer**

Dr SR Santosh Sc F  
Wg Cdr Indu Gautam

**Ladies Day Out**

Wg Cdr Sneha Dinakar  
Surg Lt Cdr Shireen Deepthi  
Sqn Ldr Krishnaveni

**Reception, Registration  
& Delegate Kits**

Wg Cdr Namita Choudhary  
Wg Cdr Pallavi Dhanvijay  
Surg Lt Cdr V Rajesh Reddy  
Dr Preethi R  
Dr Sneha Kahalekar  
Dr Gokul Harish

**Transport**

Gp Capt Urmila Sahu  
Gp Capt Bornali Gogoi

**Business meetings & SMO's  
Conference**

Wg Cdr Nidhi Singh  
SqN Ldr Santosh

**TMS Co-ordination**

Gp Capt YS Dahiya  
Wg Cdr Sneha Dinakar  
Surg Lt Cdr Karthikeyan S

**Technical Support**

Gp Capt Urmila Sahu  
Gp Capt Bornali Gogoi  
SqN Ldr Avishek Sharma

**Administrative Support**

Gp Capt MK Chopra  
Wg Cdr Ankit Jain

**Medical Cover**

Gp Capt MB Suja  
Wg Cdr Pallavi Dhanvijay

**Facilitation of BAIL**

SMO Yelhanka

**Officers Mess Support**

PMC, Offrs Mess

**Beverages**

OIC Canteen

**Orations**

Org Secretariat

**Trophies & Awards**

Wg Cdr Nidhi Singh  
Lt Col Srinivasa Bhattachar

**CME Credits**

Wg Cdr BN Vasudev

**ISAM Video**

Wg Cdr Sneha Dinakar  
SqN Ldr Gaurab Ghosh  
SqN Ldr Avishek Sharma  
SqN Ldr Uday Bansal  
Surg Lt Cdr Alla Rakesh





**SCIENTIFIC PROGRAMME**



**SCIENTIFIC PROGRAMME**  
**62<sup>nd</sup> Annual Scientific Conference of ISAM**  
**23 - 25 Nov 23**

| Day 1 (23 Nov 23, Thursday)  |   |  |   |   |
|--|---|--|---|---|
| Time   | Srinagesh Auditorium  |  | Engineer Auditorium   |   |
| 0845 - 1000 h  | Scientific Session 1  | Military Medicine: New Horizon & Challenges  | Scientific Session 2  | Field Experience: Mixing Science and Administration |
|  | <i>Chairpersons: AVM Shankar Subramanian, Gp Capt Rahul Pipraiya (Retd)</i>   |  | <i>Chairpersons: Surg Capt PD Ayengar, Col Saurabh Bhardwaj</i>   |   |
|  | <i>Navigating the World of Aviation Dentistry- New Horizons &amp; Challenges</i>  | <i>Air Cmde M Panwar VSM</i>   | <i>A Field Study to Evaluate Need for Re-design of Flying Overalls for Female Fighter Pilots</i>                                | <i>Lt Col Ummimala Bhattacharya</i>                 |
|  |   |  | <i>Ejection Procedure Simulator Training at 2AMTC - A Retrospective Analysis of Training Imparted to Flt Cadets and Aircrew</i> | <i>Wg Cdr Omesh Nath</i>                            |
|  | <i>A Case Study on Rapid Action Medical Team Deployment in Northern Part of West Bengal in a Military Exercise</i>  | <i>Wg Cdr Suraj Giri</i>   | <i>Incidence of Physical Symptoms &amp; Disorientation in Apache 64E Aircrew</i>  | <i>Wg Cdr Sushree Sangita Khatusa (Retd)</i>        |
|  | <i>Thromboembolic Disorder in High Altitude Area</i>  | <i>Flt Lt Hardik Sahi</i>  | <i>Poland Syndrome in a Civil Aircrew- Aeromedical Decision Dilemma</i>   | <i>Sqn Ldr Anubhav Upadhyay</i>                     |
| <i>Accelerated Rehabilitation after Anterior Cruciate Ligament Reconstruction – Blood Flow Restriction, Normobaric Hypoxia vs Standard Exercise Therapy: A Protocol for Randomized Study</i> | <i>Wg Cdr Anjan Prabhakara</i>  | <i>Lessons Learnt during a Joint Exercise with USAF at a Transport Base of IAF</i> | <i>Sqn Ldr Mohin Sakre</i>  |   |
| 1000 - 1030 h  | High Tea  |  |   |   |
| 1030 - 1200 h  | Plenary Session   |  |   |   |
|  | <i>1100 h: Arrival of CAS at Srinagesh Auditorium, IAM</i><br><i>1101 – 1104 h: Audio-visual presentation on 62<sup>nd</sup> Annual Conference of the ISAM</i><br><i>1106 – 1110 h: Welcome address by Commandant, Institute of Aerospace Medicine</i><br><i>1111 – 1123 h: Presidential Address by DGMS (Air)</i><br><i>1126 – 1141 h: Inaugural Address by CAS</i><br><i>1143 – 1155 h: Award Ceremony, Release of Journal &amp; Presentation of Mementos</i> |  |   |   |
| 1210 - 1255 h  | <p style="text-align: center;"><b><i>Air Marshal Subroto Mukherjee Memorial Oration</i></b></p> <p style="text-align: center;"><i>Orator: Padma Shri Dr Syed Mujtaba Hussain Kirmani</i></p> <p style="text-align: center;"><i>Topic: Playing International Sports for Two Decades – What it Takes!</i></p> <p style="text-align: center;"><i>Chairperson: Lt Gen Daljit Singh AVSM VSM PHS</i></p>   |  |   |   |
| 1300 - 1400 h  | Lunch   |  |   |   |



|   |  |   |  |  |
|---|--|---|--|--|
| <b>1400 – 1500 h</b>  | <b>Scientific Session 3</b>  | <b>Cut-Off Point: Science behind Crew-Cockpit-Compatibility</b>   | <b>Scientific Session 4</b>  | <b>Aeromedical Stressors: Understanding the Core Issue</b> |
|   | <i>Chairpersons: Gp Capt Mona Dahiya, Col S Venkatesh</i>  |   | <i>Chairpersons: Gp Capt PC Ghosh (Retd), Gp Capt P Rastogi</i>  |  |
|   | <i>Comparison of 3D Laser Scanning Anthropometric Technique with Conventional Direct Method for Head and Facial Parameters</i>   | <i>Wg Cdr V Raghunandan</i>   | <i>Combined Altitude Depleted Oxygen vis-à-vis Hypobaric Hypoxia - Efficacy in Hypoxia Indoctrination</i>                | <i>Flt Lt Sanjay P</i>                                     |
|   | <i>Aircrew Selection for an Advanced Fighter Jet - An Anthropometric Standpoint</i>  | <i>Wg Cdr Biplab Bhowmick</i>   | <i>Incidence of Otitic Barotrauma During Decompression Test in Indian Armed Forces Between 2019 -2022</i>                | <i>Sqn Ldr Avishek Sharma</i>                              |
|   | <i>Bayesian Instrument for Spinal Disability (Bis) - A Predictive Model for Aircrew Flying Fitness</i>   | <i>Gp Capt P Biswal</i>   | <i>Aeromedical Aspects in a Canopy Burst Incident - A Case Report</i>  | <i>Sqn Ldr HS Harshith</i>                                 |
|   | <i>To Be Seated or Not - Maximum Permissible Sitting Height for Garud Microlite Aircraft</i>   | <i>Wg Cdr Avinash BK</i>  | <i>Study of Combat Aircraft Cabin Pressurization and Occupant Physiology During Cabin Air Supply Failure</i>             | <i>A Sathiyaseelan</i>                                     |
|   | <b>Poster Session 1</b>  |   |  |  |
|   | <i>Cardiovascular Deconditioning on Orthostatic Challenge After Exposure to Microgravity Simulation in the Form of Dry Supine Thermoneutral Water Immersion for Eight Hours Among Sports Personnel: Endurance Trained Versus Resistance Trained Participants</i> |   |  | <i>Col N Suhasini Reddy</i>                                |
|   | <i>Screening for Haemoglobinopathies Using HPLC Among Candidates Aspiring for Induction in Armed Forces at an IAF Boarding Centre: A Retrospective Analysis</i>  |   |  | <i>Wg Cdr Smita Rani Borgohain</i>                         |
|   | <i>Photo Dermatitis and High UV Index in Jorhat (North East India) Due to Single Time Zone - A Study</i>   |   |  | <i>Wg Cdr Chetan Patil</i>                                 |
| <i>Lab in Space: Point of Care Testing for Astronauts in Space Missions of Emerging Economies</i>   |  |   | <i>Dr Saswati Das</i>  |  |
| <i>Renewing the Understanding of Aviation and Aerospace Medicine with Substitutive Physiological Adaptations to Weightlessness: Beyond Boundaries of Earth Environments</i> |  |   | <i>Dr Jayashri D Sharma</i>  |  |
| <i>Suicide Prevalence &amp; Cause Analysis in One of the Commands of IAF</i>  |  |   | <i>Wg Cdr Vijay S</i>  |  |
| <b>1500 – 1600 h</b>  | <b>Scientific Session 5</b>  | <b>Space Medicine: When Man Matters</b>   | <b>Scientific Session 6</b>  | <b>Aviation Physiology: Back to Basics</b>                 |
|   | <i>Chairpersons: Dr Santosh SR Sc 'F', Gp Capt P Biswal</i>  |   | <i>Chairpersons: Maj Gen Vanamalni Tewari, Gp Capt HMK Murthy</i>  |  |
|   | <i>Space and Entry Motion Sickness in Short Duration Spaceflight: Challenges and Way Forward for India's Maiden Human Spaceflight Mission</i>  | <i>Wg Cdr Polash Sannigrahi</i>   | <i>Head-up Tilt Test in Cases of Unexplained Syncope</i>   | <i>Maj Savina Oommen George</i>                            |
|   | <i>Design, Development and Fabrication of a Comprehensive Health Care Kit for Indian Astronauts</i>  | <i>Dr Ratnesh Singh Kanwar Sc 'F'</i>   | <i>A Comparative Study of Utricular Function Between Healthy Aircrew and Groundcrew Using Subjective Visual Vertical</i> | <i>Surg Lt Cdr Karthikeyan S</i>                           |
|   | <i>Blood Clot in Spaceflight Could Be Catastrophic: Requisite for Risk Assessment and Countermeasures</i>  | <i>Dr. Iti Garg Sc 'E'</i>  | <i>Prolonged Stay at HA &amp; its Effect on Persistence of High BP</i>   | <i>Lt Col Srinivasa A Bhattachar</i>                       |
| <i>Enhancing Exploration Platforms and Analog Definition: The Future of Commercial Spaceflight</i>  | <i>Dr Emmanuel Urquieta</i>  | <i>A Comparative Study to Evaluate Aerobic and Anaerobic Capacity in Mild Anaemic Individuals (As per WHO Criteria) with Their Healthy Counterparts</i> | <i>Wg Cdr Ashwini Kumar</i>  |  |

| Poster Session 2   |   |   |  |   |
|--|---|---|--|---|
|  | Same Diagnosis, Different Story: First Case of Holme's Adie Syndrome in Current Epidemic of Viral Conjunctivitis  |   |  | Dr Agrima Bhatia                                |
|  | MI – Air Evacuation – A Case Report   |   |  | Sqn Ldr Anurag Singh                            |
|  | Comparison of Outcomes of Simulated Ejections Among Trained and Under-Trainee Aircrew During the Training on Ejection Procedure Simulator                                 |   |  | Gp Capt HMK Murthy                              |
|  | Report on Subject Matter Expert Exchange (SMEE) to Republic of Korea  |   |  | Sqn Ldr Billa Nanda Kishore                     |
|  | Aerodontalgia – A Case Report   |   |  | Wg Cdr Jaipreet Singh Joneja                    |
| 1930 h   | Society Banquet at 'Sterlings Mac Hotel'  |   |  |   |
| Day 2 (24 Nov 23, Friday)  |   |   |  |   |
| 0830-0930 h  | Scientific Session 7  | G Tolerance: From Strength (Training) to Support (Operations) | Scientific Session 8   | Fitness for Flying: Aeromedical Decision Making |
|  | Chairpersons: AVM A Agarwal VSM, Gp Capt MS Nataraja  |   | Chairpersons: AVM Tanmoy Roy VSM, Surg Cmde Jandhyala Sridhar  |   |
|  | Changes in +Gz Endurance After a G warm-up Maneuver and the Duration for which this Change in +Gz Endurance Persists  | Wg Cdr Sneha Dinakar  | Liver Histopathology in Healthy Aircrew - An Insight into Aetiopathology of Incidental Abnormalities Found During Routine Medical Examinations   | Wg Cdr Neha Gupta                               |
|  | Postural Dysautonomia in Response to Head-Up Tilt in a Military Pilot Aspirant - Aeromedical Considerations   | Sqn Ldr Gaurab Ghosh  | Gender Based Difference in Computerized Dynamic Visual Acuity  | Sqn Ldr Anitha T                                |
|  | Study of Heart Rate Changes and Relaxed +Gz Tolerance Levels in Correlation with Different BMI Levels on Exposure to GOR Profile and ROR Profile in DFS Among IAF Aircrew | Sqn Ldr SP Singh  | A Study of Plate wise Probability of Errors While Reading 38 Plate Ishihara Chart Among Colour Normal Individuals                                | Wg Cdr Sridhara Reddy                           |
|  | Phase Angle from Bioelectrical Impedance Analysis Correlates with Gravitational Blood Pooling in the Human Leg  | Dr Munna Khan   | A Case Report on Obstructive Sleep Apnea (OSA) in a Non-Obese Aviator with Resistant Hypertension: Screening Policies and Future Recommendations | Wg Cdr Snehangsh Dash                           |
|  | Poster Session 3  |   |  |   |
|  | Sports Injuries in Aircrew: Prevention  |   |  | Gp Capt Pallavi Goswami                         |
|  | Recurrent Bilateral Nasal Polyp- A Case Report  |   |  | Lt Col TS Rana                                  |
|  | Normal Digital Contribution to Grip Strength Assessed by Digital Hand Grip Dynamometer  |   |  | Wg Cdr V Raghunandan                            |
| Accidental Exposure to Cyanide in an Occupational Setting: A Case Report   |   |   | Sqn Ldr Abhay Singh Tomar  |   |
| Retrospective Audit of Medical Evacuations in the IAF in Recent Past   |   |   | Wg Cdr V Raghunandan   |   |
| Otolaryngological Challenges in Prolonged Spaceflight Assessing and Addressing Vestibular and Auditory Changes in Zero Gravity |   |   | Wg Cdr Sanjay Kumar  |   |



|   |  |  |   |  |
|---|--|--|---|--|
| 0930 – 1030 h   | <p align="center"><b>AVM MM Srinagesh Memorial Oration</b><br/> Orator: Air Mshl (Dr) Pawan Kapoor AVSM VSM &amp; Bar (Retd)<br/> Topic: Patient Safety: Drawing Lessons from Aerospace Safety<br/> Chairperson: Air Mshl Rajesh Vaidya VSM</p>  |  |   |  |
| 1030 – 1100h  | Tea  |  |   |  |
| 1100 - 1200 h   | <p align="center"><b>JHF Manekshaw Panel</b><br/> Speaker 1: AVM (Dr) Deepak Gaur AVSM (Retd) Topic: OPTRAM – The Evolution of a Revolution<br/> Speaker 2: Prof Srikanth Kondapalli Topic: Psychological Warfare of China<br/> Chairpersons: Air Mshl CK Ranjan AVSM VSM (Retd), AVM MS Sridhar</p> |  |   |  |
| 1200 – 1300 h   | <b>Scientific Session 9</b>  | <b>Cognitive Integration in Flying Ops</b> | <b>Scientific Session 10</b>  | <b>Residents in Aerospace Medicine (RAM) Session</b> |
|   | Chairpersons: Surg R Adm R Ravi, Gp Capt R Sarkar  |  | Chairpersons: Gp Capt SS Mohapatra, Wg Cdr Ajay Kumar   |  |
|   | Effects of Sleep Inertia, Post a Short Nap on Cognition and Psychomotor Task   | Lt Col Binu Sekhar M                       | Comparison of Range of Movements of Spine vis-a-vis IAM-EMP Protocol: A Retrospective Analysis                                      | Dr Ruchika Rana                                      |
|   | Effect of Noise on Visuo-spatial Working Memory: An Aviation Perspective   | Sqn Ldr Devdeep Ghosh                      | MTHFR Gene Mutation and Risk of Venous Thrombosis: Aeromedical Decision Making  | Maj Jeya Karthik                                     |
|   | Assessing and Predicting Mental Workload using Affective Computing: An Explorative Conceptual Approach   | Mr Sabin Raj K Sc 'C'                      | A Case Study of Non-specific Tinnitus in a Helicopter Pilot: Aeromedical Perspective  | Dr Preethi R   |
|   | Decoding Air Sickness: Predictive Factors and Psychological Insights   | Ms Saroja Roy Grandhi, Sc Asst             | A Retrospective Study on the Effect of Hyperbaric Oxygen Therapy on Hearing Outcome in Idiopathic Sudden Sensorineural Hearing Loss | Sqn Ldr Biswajit Bhowmick                            |
|   | <b>Poster Session 4</b>  |  |   |  |
|   | To Study the Changes in Pulmonary Volumes, Flow Rates and Capacities Following 12 Hours of Dry Supine Immersion  |  |   | Maj Hemanth KA                                       |
|   | Unexplained Physiological Event: A Case Report   |  |   | Lt Col Iyer Srihari                                  |
|   | Outbreak of Food Poisoning at Military Establishment   |  |   | Wg Cdr Aniket Kulkarni                               |
| Android Phone Based Audiometry for Screening of Hearing Loss            |  |  | Wg Cdr Sunil Mathews  |  |
| KAP of Armed Forces Personnel in an Air Force Station Regarding Obesity |  |  | Sqn Ldr Anubha Shukla   |  |
| 1300 – 1345 h   | Lunch  |  |   |  |



# ORATIONS





## Air Marshal Subroto Mukerjee Memorial Oration



Air Marshal Subroto Mukerjee, OBE

Air Marshal Subroto Mukerjee OBE (05 Mar 1911- 08 Nov 1960) lived a life of determination, dedication and total commitment to the cause of the service that he guided from its inception until its transformation into the Air Arm of independent India. In the early 1930's, when the British government in India could no longer ignore the growing demands of the Indian people for greater representation in the higher ranks of the defence services, it grudgingly began the process of 'Indianisation' of the services. As a result, the Indian Air Force (IAF) came into being on 08 October 1932.

While the older services were marked for partial Indianisation, the IAF became the first truly Indian service, as only Indians could be granted commission or enrolled in its ranks. In those early days, a career in the Air Force was an uncharted path for Indians, made all the more difficult by the prevailing discriminatory and obstructive mindset of the majority of the British in India who were extremely skeptical of the ability of the 'natives' to fly military aeroplanes. Air Marshal Subroto Mukerjee was one of the six Indians selected for training as pilots at the RAF College, Cranwell. The date of commission of this small pioneering band coincided with the date of formation of the Indian Air Force. In July 1938, he was put in command of 'B' Flight of the No.1 IAF Squadron in the rank of Flying Officer. He became the first Indian Officer to command a Squadron when he took over No.1 on 16 March 1939. After converting to the Hawker Hart, the Squadron moved to Miranshah in the North West Frontier Province (NWFP). It was here that he led the Squadron into action against the tribals of the NWFP. When the war broke out in the East, Mukerjee was at the Air HQ as a Wing Commander. He served in various staff assignments during the war and for his services, during World War-II, Mukerjee was given the Order of the British Empire (OBE) in 1944. At the time of Independence, Mukerjee was the senior most Air Commodore serving with the IAF. On 15 August 1947, when India achieved Independence, the Armed Forces too became independent forces. They were no longer under the British Army or the King.

However, as there was a lack of senior officers, it was decided to put serving British Officers as Commanders. Accordingly, Air Marshal Sir Thomas Elmhirst became the Air Force Chief. Air Commodore Mukerjee was promoted to Air Vice Marshal and posted as the Deputy Chief of the Air Staff at Air HQ. He served as the Vice Chief for over 6½ years. Working under three different British Chiefs helped him groom himself for the top post. On 01 April 1954, he took over from Air Marshal Gerald Gibbs as the Chief of the Air Staff of the Indian Air Force. At that time, he was just about 43 years old. Upon him fell the task of re-equipping and restructuring the Air Force with newer aircraft & equipment. Under his tenure, the Air Force inducted a variety of state-of-the-art aircraft. The Dassault Mystere, the Hawker Hunter, the BAe Canberra and even the Folland Gnat was inducted during his tenure. Over the next few years, he was to lead the fledgling service through its trials and tribulations, taking it from strength to strength, till it was ready to take its place amongst the leading Air Forces of the world. Mukerjee took care to see that even the personnel and human resources planning, and development received much attention. His task was commendable for he had to deal with the post-independence non-violence driven defence policy.

Tragically, Air Marshal Subroto Mukerjee's brilliant career was cut short in its prime in 1960 at the age of 49. Yet, his legacy lives on, and forms the cornerstone of the hallowed traditions of the service whose very foundations he laid, and whose edifice he built in the early years of its history.

Air Marshal Subroto Mukerjee not only laid the foundation of our Air Force but also the Medical Services of IAF. It is largely due to his unfailing interest and foresight that a well-established medical service, to cater to the needs of the Air Force was formed. The well-known Institute of Aerospace Medicine, which is the first of its kind in Asia, owes its existence mainly due to his patronage and support.

The Aeromedical Society of India (now Indian Society of Aerospace Medicine) was formed in 1952. Air Marshal Subroto Mukerjee was its first patron and remained so till his untimely demise in 1960. He took keen personal interest in the affairs of the Society and was the main pillar of support in its formative years.

As a gesture of the Society's gratitude and appreciation, in 1971, the Aeromedical Society of India instituted an oration in his name to be delivered during the inaugural function of the annual meeting of the Society. A medal is also presented to the eminent personality who delivers the oration.



## Air Marshal Subroto Mukerjee Memorial Orations

1972-2021

| <b>Sl No</b> | <b>Year</b> | <b>Orator</b>                   | <b>Topic</b>   |
|--------------|-------------|---------------------------------|--|
| 1.           | 1972        | Mai Gen Inder Singh             | Rehabilitation of Cases of Ischemic Heart Disease in The Armed Forces            |
| 2.           | 1973        | Dr Rustom Jal Vakil             | Electro-Cardiographic Abnormalities in Normal and Apparently Normal Individuals  |
| 3.           | 1974        | Gp Capt Peter Howard            | Current Research in Aviation Medicine In The Royal Airforce                      |
| 4.           | 1975        | AVM MM Srinagesh                | The Values of Aviation Medicine In The Changing World                            |
| 5.           | 1976        | Dr PN Chuttani                  | Alcohol: The First Drug of Addiction   |
| 6.           | 1977        | Lt Gen RS Hoon (Retd)           | Incidence of Cardiovascular Problems Among Flying Personnel and Their Evaluation |
| 7.           | 1978        | Dr Raja Rammanna                | Aviation and Radiation Hazards   |
| 8.           | 1981        | Dr MMS Ahuja                    | The Art and Science of Adaptation  |
| 9.           | 1986        | Dr Madan Mohan                  | Recent Advances in Ophthalmology and The Development World                       |
| 10.          | 1989        | Dr MR Girinath                  | Role of Coronary Bypass in The Treatment of Ischaemic Heart Diseases.            |
| 11.          | 1990        | Padmashri Dr S Kameshwaran      | Vertigo: Recent Advances   |
| 12.          | 1992        | Dr MS Devanandan                | Peripheral Organization of Movements of The Hand                                 |
| 13.          | 1995        | Dr CA Varghese                  | Perspectives of Aeromedical Research   |
| 14.          | 1996        | Air Mshl MS Boparai AVSM (Retd) | Horizons of Visual Performance and Aviation                                      |
| 15.          | 1997        | Dr Kenneth N Ackles             | Ultimate Air Combat Protection of Pilot  |
| 16.          | 1998        | Dr SK Sikka                     | On Indian Explosions 11-13, 1998   |

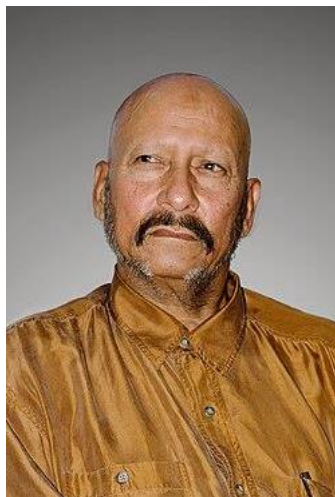
|     |      |                                    |   |
|-----|------|------------------------------------|---|
| 17. | 1999 | Padmashri Dr Naresh Trehan         | New Frontiers in The Management of Cardiac and Cardiovascular Disorders                                   |
| 18. | 2000 | Dr K Kasturirangan                 | Space Medicine and Exobiology: Emerging Scenario  |
| 19. | 2002 | Padma Bhushan Dr VK Atre           | Aeronautics Technologies – Present and Future1  |
| 20. | 2002 | Prof DouglaWeigmann                | A Human Factors: Accident Analysis andPrevention  |
| 21. | 2003 | Dr Ulf L Baldin                    | How Important Is Scientific Research and Testing of Life Support Equipment for High Performance Aircraft? |
| 22. | 2004 | Mr. MB Varma                       | Ergonomic Design of Cockpit of An Advanced Combat Aircraft  |
| 23. | 2005 | Dr Devi Shetty                     | Converting Atom into Bytes  |
| 24. | 2006 | Shri G Madhavan Nair               | Indian Space Programme  |
| 25. | 2007 | Capt GR Gopinath                   | Integrating Civil Aviation and India’s Economic Growth: A Vision andPerspective                           |
| 26. | 2008 | Dr K Radhakrishnan                 | Human Presence in Solar System Director, VSSC   |
| 27. | 2009 | Dr SNA Zaidi                       | Challenges &Opportunities in Civil Aviation Sector  |
| 28. | 2010 | Wg Cdr Rakesh Sharma AC (Retd)     | Space Exploration: Where Do We Go from Here?  |
| 29. | 2011 | Dr AK Gupta                        | Role of Interventional Radiology in Present Day Medicine  |
| 30. | 2012 | Bharath Ratna Dr APJ Abdul Kalam   | Aerospace System: A Possible Profile  |
| 31. | 2013 | Dr AK Chaturvedi                   | Aerospace Toxicology: An Emerging Multidisciplinary Field of Medical Sciences                             |
| 32. | 2014 | Dr Prabhat Kumar, IAS, DGCA        | How to Keep Indian Skies Safe   |
| 33. | 2015 | Ms Shika Sharma MD & CEO Axis Bank | Beyond Glass Ceilings: Challenges and Opportunities for Women In 21 <sup>st</sup> Century                 |
| 34. | 2016 | Sr Soumya Swaminathan              | The Relevance of Making Data Relevant Translational Research in Medicine                                  |
| 35. | 2017 | Air Cmde Harish Malik              | Civil Aerospace Medicine in India   |

(Retd)

|     |      |                                  |   |
|-----|------|----------------------------------|---|
| 36. | 2018 | Air Mshl NB Amaresh<br>VSM(Retd) | The Pilot Physician – What Has Been and<br>What Can Be!                                       |
| 37  | 2019 | Prof K Vijay Raghavan            | The Role of Science & Technology - From<br>India – Forthe Future of Our planet                |
| 38  | 2020 | Dr Scott Shappell                | Developing Novel Intervention Strategies<br>Using Human Factors Intervention Matrix<br>(HFIX) |
| 39  | 2021 | Dr Quay Snyder                   | Pilot Physician’s Evolution to Human<br>Intervention Motivational Study (HIMS)                |
| 40  | 2022 | Dr Gary Kay                      | Analysis and Evaluation of the Cognitive<br>Demands of Flying                                 |



## BIODATA



**Dr Syed Mujtaba Hussain Kirmani**

Dr Syed Mujtaba Hussain Kirmani was born in 1949 in Madras or present-day Chennai. He hails from Hyderabad and settled in Bangalore. He has been regarded as India's finest wicketkeeper till date.

He made his international debut against New Zealand in 1976. He played a very crucial role in India's World Cup triumph in 1983 as he bagged the best wicket keeper award in that Cricket World Cup. He played domestic cricket for Railways and Karnataka.

He has also acted in a Bollywood movie 'Kabhi Ajnabi Thei' in the year 1985 and couple of them later in Kannada, the latest being a Malayalam movie 'Mazhavillinattam Vare' in 2012.

He is married to Habiba Kirmani an educationist and Philanthropist. They have one son and two daughters. He has been recognised by many awards, the recent being from BCCI in the year 2016. He was the recipient of **Col CK Nayudu Lifetime Achievement Award** of the 2015. He was bestowed with **Arjuna award** in the year 1980 and highest civilian award **Padma Shri** in the year 1982.

After retiring from active cricket, he worked as Vice president Karnataka State Cricket Association (KSCA), Chairman of the National selection Committee in 2004, while being public relations manager in State Bank of India. He has played a pivotal role in inclusion of MS Dhoni in Ranji matches when he was East zone selector from where he took off to the international cricket.

## **ABSTRACT**

This year, the society is honoured to have Dr Syed Mujtaba Hussain Kirmani to deliver the Air Marshal Subroto Mukerjee Memorial Oration. The former Indian cricketer played a very crucial role in India's World Cup triumph in 1983 as he bagged the best wicket keeper award in that Cricket World Cup.

The topic of his Oration is 'P\_l\_a\_y\_i\_n\_g\_ \_i\_n\_t\_e\_r\_n\_a\_t\_i\_o\_n\_a\_l\_ \_s\_p\_o\_r\_t\_s\_ \_f\_o\_r\_ \_t\_w\_o\_ \_d\_e\_c\_a\_d\_e\_s\_ \_- \_W\_h\_a\_t\_ \_i\_t\_ \_t\_a\_k\_e\_s!\_'. The topic definitely plays some nostalgic tunes not only in speaker's mind but in the listeners minds as well. In his decade long illustrious career in international cricket as a playing member, he played a significant role which established India on an international platform.

The orator shall take the audience through his journey as a cricketer of international repute who played a phenomenal role as wicketkeeper, leading from the front. He was chairman of National Selection Board and played a crucial role for Indian footprint in global arena. His inspirational journey has been a motivating factor to numerous Indians. The growing sector of aerospace as well as aerospace medicine in India may take significant inspiration from the zeal and striving attitude for excellence in global diaspora.

## **Air Vice Marshal MM Srinagesh Memorial Oration**



**Air Vice Marshal MM Srinagesh**

Air Vice Marshal MM Srinagesh PVSM AVSM VSM was born on 02 Oct 1912. As a young Lieutenant, Madhukar Mallanah Srinagesh was among the first Medical Officers of the IAF who volunteered to join the IAF Medical Service in 1940 while serving in the Indian Medical Service (IMS). He was the first Medical Officer to be posted as Deputy Principal Medical Officer (DPMO) IAF with the creation of this post on the RAF PMO's staff at Air HQ. He was promoted to the rank of Squadron Leader, to fill this appointment, in 1943. Subsequently, in 1945, Sqn Ldr MM Srinagesh was promoted to the rank of Wing Commander to fill the same appointment. On 15 Aug 1947, he was appointed PMO Air HQ in the rank of Gp Capt and he later became DMS (Air) with the same rank. He retired from IAF at the rank of Air Vice Marshal on 10 Sep 1971.

Trained in Aviation Medicine in USA, AVM MM Srinagesh was keen practitioner of the then fledgling specialty of Aerospace Medicine. He contributed enormously to the progress and advancement of this area of expertise in India. The fruits of his labour are being reaped even by the present generation of Aviation Medicine specialists. He was truly the father of Aviation Medicine in India.

As a gesture of our thankfulness and gratitude, the Indian Society of Aerospace Medicine (ISAM) instituted an Oration in his name in 2007. The Oration is delivered during the Annual Conference of the ISAM. A memento is also presented to the eminent personality who delivers this oration.



## Air Vice Marshal MM Srinagesh Memorial Orations

2007-2021

| SI no. | Year | Orator                      | Topic   |
|--------|------|-----------------------------|---|
| 1.     | 2007 | Dr CA Vargheese             | 50 Years of Aeromedical R&D in India: A Ring Side View  |
| 2.     | 2008 | Mr M Madhavan Nambiyar      | Civil Aviation In India In 2020   |
| 3.     | 2009 | Dr Ashok Seth               | Coronary Intervention – Is the Interventionalist a Threat to The Cardiac Surgeon                        |
| 4.     | 2010 | Dr PD Navathe (Retd)        | From Srinagesh To Srinagesh: The Journey from Operation Aviation Medicine to Clinical Aviation Medicine |
| 5.     | 2011 | Dr Jeffery R Davis          | An Earthling to An Astronaut: Medical Challenges  |
| 6.     | 2012 | Prof Stephen DR Harridge    | Skeletal Muscle in Aviation Medicine  |
| 7.     | 2013 | Dr Manas K Mandal           | The Cognitive Science of Uncertain and Unknown Environment  |
| 8.     | 2014 | Dr Jarnail Singh            | Fatigue Risk Management in Airlines Operations  |
| 9.     | 2015 | AVM G Gomez VSM (Retd)      | “The Earthlings Are Coming” Mission Mars Challenges   |
| 10.    | 2017 | AVM P Kharbanda VSM (Retd)  | Stress and Fatigue In Aviation  |
| 11     | 2018 | AVM Pankaj Tyagi VSM (Retd) | Indian Space Program: Past, Present, Future   |
| 12     | 2019 | AVM JS Kulkarni (Retd)      | Aeromedical Research in India: Past, Present and Future   |
| 13     | 2020 | Wg Cdr SN Sharma (Retd)     | Coronary Artery Disease: Pathophysiology & its Therapeutic implications                                 |
| 14     | 2021 | Steve Roberts               | Head & Neck Protection – the Evolving Science   |

15

2022

Dr James Vanderploeg

Private Human Space Flight: Opening  
Space for All

## **Air Vice Marshal MM Srinagesh Oration: Speaker**

### **BIO-DATA**



### **Air Marshal (Dr) Pawan Kapoor, AVSM, VSM and BAR (Retd)**

Air Mshl Pawan Kapoor, an alumnus of the Armed Forces Medical College (AFMC), was commissioned into the Army Medical Corps (AMC) on 10 Oct 1979. He holds a Master's degree in Hospital Administration from the prestigious All India Institute of Medical Sciences (AIIMS), New Delhi. Amongst his other qualifications are Diplomate of National Board (Health & Hospital Administration) from National Board of Examinations (NBE), Diploma in Hospital and Health Management (DHHM), master's in management studies (MMS) (Osmania University), MBA (IGNOU) and M Phil (Defence and Strategic Management).

Air Mshl Pawan Kapoor has held numerous administrative and professional appointments during his career spanning 38 years in the Armed Forces. He has been the Professor & Head of Department of Hospital Administration and Medical Informatics at AFMC Pune. He has commanded 105 bedded multi-speciality Military Hospital and held the important Staff appointments of Training Officer, AMC Centre & College, Lucknow, Directing Staff at Officers Training College, AMC Centre & College, Joint Director Armed Forces Medical Services (Personnel) & Director Armed Forces Medical Services (Human Resources) in the O/o Director General Armed Forces Medical Services (DGAFMS), Brig (Med) of a large Operational Corps, Additional Director General (ADG) (Information Systems, Health & Professional Services) in the O/o DGMS (Army) and Additional Director General Armed Forces Medical Services (Human Resources) in the O/o DGAFMS. After being in the Army from the rank of Lt to Lt Gen, he took over the reins of the medical services of Indian Air Force as Director General of Medical Services (IAF) and superannuated in the rank of Air Marshal on 31 Dec 2017.



He has served for more than a decade as Director Finance of Academy of Hospital Administration of which he is an Honorary Fellow.

Air Mshl Pawan Kapoor is a Hospital and Health Administrator of national repute. He has published more than 40 papers in various journals and contributed more than 10 chapters in published books on varied topics like Quality and accreditation and patient safety, Hospital Accounting and Costing, Communication in Health care, Leadership in health Care, Cost effectiveness of Laparoscopic cholecystectomy, Medical Aspects of disaster management, etc. He is a Post Graduate examiner of several Universities.

He is one of the founder members of National Accreditation Board of Hospitals & Healthcare Providers (NABH) and has been holding appointments as Chairman of Technical Committee and Chairman Accreditation Committee and Ethics Committee of NABH. He is also a lead assessor for International Society of Quality Assurance (ISQUA) in Health care. He is currently the Chairman of the Steering Committee of NABH, C Chairman of the QCI committee on rating of hospitals and Advisor to NABET for rating of medical colleges along with NMC. He has also been instrumental in providing the requisite support to NMC for them to get accredited by the World Federation of Medical Education.

For his contribution to Patient Safety and Quality in Health Care in the country he has been given the Lifetime Achievement Award by the Consortium of the Accredited Health Care Organisations, India

He is National Defence College (NDC) qualified and is the only Armed Forces Medical Services (AFMS) Officer to have been awarded the prestigious Col Pyarelal Gold Medal. He has also undergone Long Defence Management Course in which he was awarded the Chief of the Army Staff Interservice Integration Trophy, the first for any AFMS Officer. He also won the award for Best Dissertation & Case Study.

He is the Architect of several path breaking projects in the Armed Forces Medical Services (AFMS). The important ones are Cadre restructuring of Armed Forces Medical Services, Manpower augmentation in the AFMS, Project Report of Army College of Medical Sciences (ACMS), Automation in AMC Records and DGMS (Army), Blue print for change for AMC Centre & College, Lucknow, Streamlining recruitment procedure of Medical Officers to offset deficiency in AFMS and Upgradation of Military Hospitals. He prepared the white paper on meeting of oxygen requirements in remote locations in 2013. He launched 'Mission Zindagi Campaign' to combat depression and conceptualised watch your Child Grow programme and involvement of parents in the monitoring of psychosocial development of special children. He established an International Consultancy Group along with US Air Force to have mutual consultations regarding complex cases pertaining to medical fitness of pilots. He played a pivotal role in coordinating management of J&K natural disasters. He conceptualised the I REACH (Involving Resource experts for Augmenting Community health care Programme) and MEDWATCH – A Mobile Health App for the Indian Air Force.

For his distinguished services Air Mshl Pawan Kapoor was awarded the Ati Vishisht Seva Medal in Jan 2018, Vishisht Seva Medal in 2009 and Bar to VSM in 2017, COAS Commendation in 1981, 2004, 2008 and His Order of Royal Emblem from Sultan of Oman in 1984, while he was on deputation from Indian Army to the Sultan of Oman Land Forces wef 1984 to 1988.

His interest in medical education and his concern for the fledgling career of doctors who return after acquiring MBBS degrees from foreign medical colleges made him to accept the appointment of Technical Advisor Rus education for monitoring admissions and medical education abroad. He is also the Hony Vice Chancellor of School of Medicine, Lincoln American University in Guyana. Currently he also holds the appointment of Chairman Steering Committee of NABH, C Chairman of the QCI committee on rating of healthcare organisations and Advisor to NABET for ranking of medical colleges along with NMC. His key areas of interest are Quality and Patient safety, Medical Education and Public health.

## **Abstract**

### **Patient Safety: Drawing Lessons from Aviation Safety**

#### **An Overview of the presentation**

In the last one and a half decades patient safety has become a buzz word in healthcare delivery. While much has been written, published, deliberated and discussed about patient safety, there is very little evidence to suggest that the patient safety incidents have actually reduced. It is still shrouded in mystery and any comparisons are quickly dismissed by a commonly held belief that healthcare is unique, is human capital intensive, is highly personalized, not amenable to much standardization and is incomparable with other services. This is one of the reasons that WHO fact file with regard to patient safety has largely gone unchanged in the last one decade. We still have one in ten chances of being harmed during delivery of healthcare, healthcare associated infections continue to proliferate, antimicrobial resistance continues to flourish, more than 25% percent patients continue to die of sepsis, medication errors represent 50 percent of the preventable adverse events in healthcare and communication errors continue to account for almost 70% of the sentinel events occurring in healthcare. To add to our woe, 50% of all the adverse events in healthcare are entirely preventable.

Aviation safety on the other hand has improved by leaps and bounds over the last two decades with the likelihood of harm being as low as 0.51 per one million flights. This has been a remarkable achievement from a figure of 6.35 per million flights in 1970, almost a 12-fold decrease. What did aviation do right? Aviation safety focused on hazard identification and risk assessment with mitigation strategies to reduce risk to as low as reasonably practical (ALARP). They invested in designs, infrastructure, technology and more importantly on one of the most important aspects of any safety that is human factors. To ensure safety apart from regularly doing a failure mode effect analysis, aviation started concepts like check lists, crew resource management, sterile cockpits, preflight medical examinations of pilots, robust incident reporting systems that included near misses and no harm events, improved transparency in reporting



and having an independent autonomous body to investigate incidents and accidents with a view to continually improve and prevent aviation hazards.

To many it may be unfair to compare healthcare with aviation given the type of clientele and the number of interactions between the providers and recipients, but it will be useful to identify the several similarities and differences between aviation and healthcare and focus on one commonality and that is the safety of our clientele. It may again be unfair to apply all concepts but definitely some of the aspects of aviation safety can be imbibed by healthcare organizations to improve its record of patient safety. The presentation shall explore various aspects of aviation safety that are applicable and can be adopted and adapted by healthcare to become safer and match the records set by the aviation industry.

If we focus on the problem, we will only get justifications and excuses for the occurrence of the problems but if we become aware of the problem and focus on the solutions instead, we shall find the path and the ways to solve the problems.

## Air Vice Marshal JHF Manekshaw Panel



### Air Vice Marshal JHF Manekshaw

Born on 28 Oct 1916, Air Vice Marshal Jemi Harmusji Framji Manekshaw, PVSM, AVSM joined Air Force as a doctor after doing MBBS from Punjab University on 22 Jul 1943. He became an Aviation Medical Specialist and served the Armed Forces Medical Services (AFMS) with distinction. He was associated with the School of Aviation Medicine (later Institute of Aviation Medicine) while the transformational changes in the form of advanced simulators were commissioned. He was instrumental in establishing the first Hyperbaric Oxygen Therapy (HBOT) facility at the Institute of Aviation Medicine (IAM).

He commanded the Institute of Aerospace Medicine from 29 Sep 1959 to 05 Sep 1960 and 14 Apr 1967 to 28 Feb 1973 as a Sqn Ldr, Wg Cdr, Gp Capt & Air Cmde. After this he was posted at the office of DGAFMS as the DMS (Medical Research) as an AVM. The Unit Crest with 'Nabahsi Arogyam' was given by the then President of India Shri VV Giri during his command of the Institute of Aviation Medicine. He was awarded the AVSM in 1971 and PVSM in 1976 by the President of India. Field Marshal Sam Hormusji Framji Jamshedji Manekshaw, MC, the Chief of Army Staff was his brother.

In the field of Aerospace Medicine, JHF Manekshaw achieved heights no lesser than his brother, whom the nation reveres. In the memory of this exceptional professional in the speciality of Aerospace Medicine, the Indian Society of Aerospace Medicine, in its 57<sup>th</sup> Annual Conference has decided to start a Panel on Emerging Trends in Aerospace Medicine dedicated to the memory of JHF Manekshaw.

In the Panel of 57<sup>th</sup> ISAM Conference in 2019, Dr Girish S Deodhare, Director CA & ADA delivered a talk on *Challenges in Development of Modern Fighter Aircraft* and Dr Unnikrishnan Nair, Director HSFC delivered a talk on *Human Space Programme*.

## Air Vice Marshal JHF Manekshaw Panel Orations

2018-2021

| Sl no. | Year | Orator                  | Topic   |
|--------|------|-------------------------|---|
| 1.     | 2018 | Dr S Somnath            | Human Space Programme   |
|        |      | Dr Kotesb TM            | Emerging Trends in Flying Clothing  |
| 2.     | 2019 | Dr Gireesh S Deodhare   | Challenges in development of modern fighter aircraft  |
|        |      | Dr Unni Krishnan Nair S | Human Space Programme   |
| 3.     | 2020 | DR. VR Lalithambika     | Human Space Missions: Design Challenges and Strategies  |
|        |      | DR. Taslimarif Saiyed   | Building Cutting-Edge Healthcare Innovations: Discussion on Efforts Towards a Point-of-Care Test for Detection of Sleep Deprivation |
| 4      | 2021 | DR. AK Ghosh            | Human Interface in 5+ Generation Fighter Aircraft   |
|        |      | Dr Pratima Murthy       | Mind Matters in Modernity   |
| 5      | 2022 | Mr Maneesh Kumar        | Risk Based Approach to Management of Safety in India  |
|        |      | Ms. Nandini Harinath    | Glimpses of ISROs inspiring missions  |

## Air Vice Marshal JHF Manekshaw Panel Speaker

### **BIO-DATA**



### **Air Vice Marshal Deepak Gaur AVSM (Retd)**

Air Vice Marshal Deepak Gaur AVSM is a graduate of AFMC, Pune and was commissioned in December 1983. He did his MD (Aviation Medicine) from IAM, Bangalore in 1991. He is also an alumnus of Defence Services Staff College, Wellington.

A Fellow of the India Society of Aerospace Medicine (ISAM), AVM Gaur has several scientific publications and presentations to his credit, both national and international. He is a recipient of the Chief of the Naval Staff award for best published scientific paper in Medicine and Allied specialties in 2007. He has contributed Chapters in two textbooks including the API Textbook of Medicine. The Officer has been awarded commendations by Chief of the Air Staff twice, in 2007 and 2013. In recognition of his meritorious service he was awarded Ati Vishisht Seva Medal on 26 Jan 2017 by Honourable President of India.

A Professor and Examiner of Aerospace Medicine, Rajiv Gandhi University of Health Sciences, Karnataka, he was appointed as the first ever Consultant in Aerospace Medicine in March 2014. He has served as Commandant of the Institute of Aerospace Medicine, IAF, Bangalore, PDMS (Specialist) and as Commandant, Command Hospital Air Force Bangalore. He retired on 31st August 2021 after almost 38 years of service. He is presently a Consultant Aerospace Medicine for JFJ Aviation & Defence, Austria and practices Clinical Medicine from his garage-turned-into-clinic at Dehradun.

He is married to Mrs Namrata Gaur, who is now a full-time homemaker. Both are fond of trekking, traveling and yoga. He also loves to golf.



## **OPTRAM – THE EVOLUTION OF A REVOLUTION**

### **Abstract**

The speaker has been closely associated with the procurement process of modern aeromedical simulators at the Institute of Aerospace Medicine. From drafting the Request for Proposal for the High Performance Human Centrifuge, the SD Simulator and the Explosive Decompression Chamber in the early 2000s while at Air HQ, to being at IAM while these (especially HPHC and Chambers) were being installed was by itself a remarkable journey. As Chief Research Officer at IAM, in 2008 he was charged with the responsibility to conceive a comprehensive aircrew training course that would gainfully utilise these new simulators and provide enhanced awareness and confidence to IAF aircrew. This presentation is on his personal reminiscences during the installation of the simulators, the dedication and commitment of all instructors of those times at the Institute and the remarkable vision of the seniors at the helm, both at IAM and Air Headquarters that made Operational Training in Aerospace Medicine – the OPTRAM course a game-changer in aircrew training and directly contributed to enhancing aerospace safety in the Indian Air Force. The presentation deals with Why we did it, How we did it, What did we achieve and What do we do next? Before concluding the author will deliberate on some leadership and ethical issues that he believes need introspection at all levels in future.

### **BIODATA**



**Dr. Srikanth Kondapalli, Ph.D.**

**Dr. Srikanth Kondapalli Ph.D.** is Dean of School of International Studies and Professor in Chinese Studies at Jawaharlal Nehru University. He was Chairman of the Centre for East Asian Studies, SIS, JNU from 2008-10, 2012-14, 2016-18, 2018-20 and 2022. He is Chair Professor under the Chair of Excellence of Ministry of Defence since August 2022.

He is educated in Chinese studies in India and China with a Ph.D. in Chinese Studies. He learnt Chinese language at Beijing Language & Culture University and was a post-Doctoral Visiting Fellow at People's University, Beijing from 1996-98. He was a Visiting Professor at National Chengchi University, Taipei in 2004, a Visiting Fellow at China Institute of Contemporary International Relations, Beijing in May 2007, an Honorary Professor at Shandong University, Jinan in 2009, 2011, 2013, 2015, 2016, 2017 and 2019; at Jilin University, Changchun in 2014 and at Yunnan University of Finance and Economics, Kunming in 2016 and 2017, a Non-Resident Senior Fellow at People's University since 2014 and a Fellow at Salzburg Global Seminar in 2010.

He has authored two books, China's Military: The PLA in Transition in 1999 and China's Naval Power in 2001. He has written two monographs and co-edited six volumes viz.

- (a) Asian Security & China in 2004
- (b) China and its Neighbours in 2010
- (c) China's Military and India in 2012
- (d) China and the BRICS: Setting up a Different Kitchen in 2016
- (e) One Belt One Road – China's Global Outreach in 2017 and
- (f) China and Covid-19 – Domestic and External Dimensions in 2020

He received the **K.Subramanyam Award** in 2010 for Excellence in Research in Strategic and Security Studies. He is a guest faculty at Indian armed forces units, including at the National Defence College, Army War College, College of Air Warfare, College of Naval Warfare, and College of Defence Management. He is a distinguished

fellow at several think-tanks including Vivekananda International Foundation and Institute for Peace and Conflict Studies. He supervised about 30 Ph.D. researchers at JNU and is also an academic advisor for Ph.D. researchers at Al Farabi Kazakh National University and Ablai Khan University at Almaty and Tamkhang University (Taipei). He is Editor of JNU SIS *International Studies* Journal (being published by the Sage).

## Abstract

Psychological warfare (psywar) is a type of warfare that uses psychological means to manipulate the perceptions and behavior of an enemy or potential enemy, with the aim of achieving a desired political, military, or social outcome. It can be used in both peacetime and wartime, and can include a wide range of tactics, such as propaganda, disinformation, intimidation, and deception.

China has a long history of using psywar, dating back to the ancient Chinese philosopher Sun Tzu, who is considered one of the earliest proponents of psywar. In his book 'The Art of War', Sun Tzu wrote that 'the supreme art of war is to subdue the enemy without fighting'. This principle has been adopted by Chinese military strategists for centuries, and psywar has been a key component of Chinese military doctrine.

In recent years, China has been increasingly using psywar to achieve its goals. This is due in part to the fact that China has become a major global power, and it is now able to project its influence around the world. China is also increasingly using cyberwarfare, which can be used to carry out psywar attacks. Main purpose of this warfare includes Control of Public opinion, Blunting adversary's determination, Transformation of Emotion, Psychological guidance, Collapse of organization, Psychological defence and Restriction through law.

Some of the specific tactics that China has used in its psywar efforts include:- **Propaganda** including state-controlled media, to spread its message demonizing China's enemies, showing discord among its opponents, promoting China's own interests; **Disinformation** to spread false information about its enemies through a variety of channels, including social media, fake news websites, and government-funded media outlets; **Intimidation** to silence its critics and to discourage people from speaking out against its government through threats of violence, imprisonment, or economic hardship; **Deception** to mislead its enemies and to gain an advantage in conflicts through a variety of means, such as using false flags, spreading misinformation, or concealing its true intentions. Through Media, Legal element and utilising Psychological warfare element, it is the constant endeavour of People's Liberation Army (PLA) to increase Geo-political influence in South Asia.

The use of psywar by China raises a number of concerns. One concern is that it can be used to manipulate public opinion and to show discord among China's opponents. Another concern is that it can be used to justify cyberattacks and other forms of aggression. It is important to be aware of the dangers of psywar and to take holistic, preventive steps to protect oneself from its effects.





# ABSTRACTS: PODIUM PRESENTATIONS



## Session-I

### Navigating The World Of Aviation Dentistry: New Horizons And Challenges

*M Panwar*

**Introduction:** The world of aviation dentistry as continues to grow, presents new horizons and challenges for dental professionals which includes demand for specialized dental care for pilots and aviation personnel. Presently, dental composites are the choice of restorative materials for aircrew in the Armed Forces Medical Services and despite the new material advancements, microleakage in dental cements persists as one of the main cause of restoration failure. Keeping in view of the operational flying altitudes experienced by aircrew and limited data available on the subject a study was conducted to study the effect of cyclic decreased pressures on dental composites causing microleakage leading to a variety of adverse effects; such as secondary caries, higher sensitivity of the restored tooth, interfacial staining leading to pulp pathology or Barotrauma/Odotocrexis.

**Discussion:** With the dynamic nature of aviation, dental professionals in this field must stay abreast of the latest regulations and guidelines established which outline specific dental standards that must be met for aviation professionals to ensure their fitness to fly. Dental care provides also need to be well-versed in the latest tools and techniques used, including state-of-the-art imaging systems, modern dental materials, and advanced treatment modalities. Challenges in aviation dentistry exist in areas such as emergency dental condition during changing atmospheric pressure, especially if it is rapid, can cause discomfort and damage to the oral cavities and maxillofacial areas unless the pressure within these cavities containing gas is able to equilibrate with the external air pressure. Out of these conditions barodontalgia (pain due to gas entrapment) and barotraumas (pressure induced tooth fracture, restoration fracture, dislodged restoration and microleakage) are most frequently seen to occur. Due to limited literature on the subject and determine ideal choice of restorative material for pilots to prevent such untoward incidents, a study was conducted on 72 healthy premolar teeth extracted due to orthodontic purpose followed by preparation of Class II cavities which were restored with Bulkfill & Nanofill composite. The samples were compared for marginal leakage in nano and bulk fill composites under Scanning Electron Microscope (SEM), after multiple cyclic exposures to pressure changes at different altitudes. Statistical analysis of the pre and the post op values was done to derive the results.

**Conclusion:** Aviation dentistry is an emerging science, which remains unexplored to large extent. Dental clinicians should take initiative and collates dates pertaining

to dental diseases burden in aviators, work out guidelines on their specific treatment need and also conduct necessary research on the subject. Aviation Dentistry can be best understood and practiced by fostering effective collaboration with Aviation Medicine Specialists.

## Social Media Engagement And Well-Being Among Military Aviators

*Iyer Srihari, Chaturvedula S*

**Introduction:** Social media engagement measures the public shares, likes and comments for an online business' social media efforts. Engagement has historically been a common metric for evaluating social media performance. Soumya Ray et al defined engagement as a holistic psychological state in which one is cognitively and emotionally energized to socially behave in ways that exemplify the positive ways in which group members prefer to think of themselves. User engagement consists of a portion of user experience, a psychological state and user behaviour. Paul M Di Gangi et al defined user engagement as a user's state of mind that warrants heightened involvement and results in a personally meaningful benefit. Social Media like Facebook, WhatsApp, Twitter etc are rapidly permeating into our daily lives and are becoming a major influence on well-being. Social media users feel glad to receive positive reinforcement for their updates in the form of "likes" and "comments," which motivates them to engage and update more in social networking sites and thus lead to eagerly waiting for the responses from their network. Engagement is what may help individuals develop meaningful relationships between individuals or even between a customer and corporate businesses. Social media can contribute to increases in overall smartphone use which has been associated with negative outcomes, such as impaired social interactions, social isolation, as well as both somatic and mental health problems, including anxiety, depression and stress. Social media engagement is harder to resist than tobacco and leads to a state of neglect of personal life, mental depression, aggressiveness, and behavioural disorders. This study tries to study the effect of social media engagement and military aviators' well-being.

**Methods:** A survey was conducted using the Social Media Engagement Questionnaire(SMEQ) and WHO-5 Well-being Index on military aviators. The Social Media Engagement Questionnaire developed by Przybylski et al is a standardized questionnaire which measures the extent to which people's key daily activities tend to involve social media. The SMEQ scale consists of five items on a scale with response choices ranging from "Never" to "Seven" per week. The 5- item World Health Organization Well-Being Index (WHO-5) is among the most widely used questionnaires assessing subjective psychological

well-being. The WHO-5 is a short questionnaire consisting of 5 simple and non-invasive questions, which tap into the subjective well-being of the respondents.

**Results:** A study of the effects of social media engagement and well-being in military aviators was done using Anova and descriptive statistics.

**Conclusion:** In this era of technological revolution in the form of social media and increased presence of individuals in the virtual world, users are wading through an unknown path of social discourse by heightened engagement in online communities and users tend to crave approval of their own identity from other participants. They need a sense of self confidence and self-efficacy about their own knowledge, skills and abilities. This study brings out the effect of social media engagement on the psychological well-being between military aviators. The key to psychological well-being is to create a well-balanced social media engagement and satisfaction which will enhance the psychological well-being and improve flight safety.

### **A Case Study On Rapid Action Medical Team Deployment In Northern Part Of West Bengal In A Military Exercise**

*Suraj Giri*

**Introduction:** Globally disaster is responsible for annual 0.01% to 0.4% deaths, increased morbidity, loss of infrastructure, economic setback to a country & impacts daily livelihood of all living beings. Preparedness to such disasters through constant mock drills helps to contain the damages during the actual disaster. Rapid action medical team is a mobile medical unit which is responsible for providing medical aid at/ near the disaster site, capable of conducting life and limb saving surgery on site, stabilizing the patient and referring to the higher echelons.

**Material and Methods:** 2 RAMT was moved by air and was deployed with full component at Hasimara for providing medical cover and emergency medical and surgical services during one of the Air Force exercises in 2023. Various events were carried out during a three days exercise.

**Conclusion:** It is essential to carry out mock drills to stay well prepared in the event of disaster. Challenges faced and lessons learnt are valuable take home messages, all adding to improving skill levels and boosting confidence of the personnel.

### **Thromboembolic Disorder In High Altitude Area**

*Hardik Sahi*



**Introduction:** Exposure to High Altitude is known to be associated with an increase in the risk of thrombo-embolic disorders. The present study analyzes data on aeromedical evacuations from high and moderate altitude locations to understand the pattern of various disabilities for which evacuations are sought.

**Material and methods:** All casualties evacuated from the northern front of the country, with or without continuous life support and irrespective of age, sex and diagnosis were included in this study. Separate analysis was done for individuals evacuated from high and moderate altitude locations. Individuals having thrombo-embolic disorders were analyzed separately in view of their unusually high numbers seen in this sample.

**Result:** 149 and 141 casualties were evacuated from high and moderate altitude locations, respectively. 40.2% (n=60) and 14% (n=20) of casualties evacuated from high and moderate altitude locations had thrombo-embolic disorders, respectively. Average age of these individuals was  $35.6 \pm 10.3$  and  $36.5 \pm 9.7$  in high and moderate altitude locations, respectively. Out of these individuals 25% (n=20) were in the age group 20-30 Yr, 32% (n=26) in 31-40 Yr, 32% (n=26) in 41-50 Yr, and only 8.7% (n=7) in > 50 Yr age group. 20.2% (n=15) of individuals with thrombo-embolic disorders required a Patient Transportation Unit (PTU) for evacuation. Forty-nine and Thirty-one patients had Arterial and Venous Thrombosis, respectively. Coronary Artery Disease (n=31) and Cerebral Venous Thrombosis (n=9) were the most common arterial and venous thrombotic disorders amongst patients evacuated.

**Conclusion:** Incidence of thrombo-embolic disorders at High altitude locations (Leh/ Thoise) is significantly higher than that in moderate altitude location (Srinagar). There may be a point in assessing the requirement for prophylaxis against thrombo-embolic phenomena at high altitude.

### **Accelerated Rehabilitation After Anterior Cruciate Ligament Reconstruction – Blood Flow Restriction, Normobaric Hypoxia Vs Standard Exercise Therapy : A Protocol For Randomized Study**

Anjan Prabhakara, Vikas Kulshrestha, Seema Gambhir

Anterior cruciate ligament (ACL) injuries are very common in the armed forces. They are extensively being managed by arthroscopic ACL reconstruction (ACLR) surgery. Quadriceps and hamstring muscle recovery after ACLR is a major challenge for early return to sporting and combat training activities in young soldiers. To improve quadriceps muscle mass and strength various approaches have been explored. Two recently introduced techniques in this field are Blood

Flow Restriction (BFR) exercises and muscle strengthening under exposure to intermittent normobaric hypoxia (INH). Although effects of BFR post ACL reconstruction have been studied by a few studies the effect of INH has not been evaluated in this group of patients. We propose to describe the post ACL reconstruction rehabilitation protocols with exposure to BFR and INH in patients undergoing standard ACL rehabilitation schedule in peri-operative period. These protocols, if tested adequately and found successful, can make a sea change in the management of young soldiers with ACL injuries.

**Key words:** Anterior cruciate ligament (ACL), rehabilitation, Blood flow restriction (BFR), Intermittent normobaric hypoxia (INH), Quadriceps

## Session-II

### A Field Study To Evaluate Need For Re-Design Of Flying Overalls For Female Fighter Pilots

*Urmimala Bhattacharya*

**Introduction:** The aircraft has existed much before any aircrew equipment assembly (AEA)/ flying clothing existed. With the increase in capability of aircraft, AEA has become more & more sophisticated over time. However, the flying overall has remained as the accepted standard flight suit. With female aircrew flying fighter jets, a field study was conducted to identify issues with current size & design of available AEA. The study aims to introduce a change in design of flying overall to make it more physiologically suited to female fighter pilots.

**Material & Methods:** Direct interview of a female fighter pilot was conducted to identify major issues with current AEA. Problems, which were hindering the female aircrew from exploiting the full functional capability of fighter aircraft, were identified. Flying overall from salvage was used to introduce several changes to better suit the female physiology. These changes were assessed on ground by the female fighter pilot.

**Results:** Introduction of a single concealed zipline with single zipper in the portion of the flying overall, corresponding to the cut away portion of the Anti-G suit was found acceptable by the female fighter pilot, especially to carry out ORP duties.

**Conclusion:** The field study/ physiologically compatible redesigned overall may be extended to other fighter bases with female fighter pilots and assessed for compatibility & social acceptance.

### Ejection Procedure Simulator Training At 2amtc: Retrospective Analysis Of Training Imparted To Flt Cadets And Aircrew

**Introduction:** Ejection is an inevitable choice in certain aircraft emergencies. Safe ejection procedure requires an aircrew to take timely decision to pull the ejection handle and attain correct posture at the time of ejection to minimize the risk of spinal injuries. Indoctrination of aircrew in correct technique of ejection in safe environment is important in preventing potential risk of injuries. EPS will initiate the process of ejection only if the body posture of aircrew is correct and will give direct feedback to the crew about the incorrect posture through failed ejection.

**Objectives:** EPS training guides aircrew about basic steps prior to initiating ejection (pre-ejection drill), training about timely decision to eject, training about correct body posture during ejection, training and practicing ejection under safe and supervised environment with simulated ejection forces.

**Material & Methods:** The components of EPS are Instructor stn, safety fence, ejection stn and compressor. The **training schedule** for EPS included lectures and discussion on basic anatomy and bio- dynamics of spine, ejection sequence, phases of ejection and probable injuries, correct posture during ejection, psychological issues with decision to eject and issues with delayed decision to eject. EPS training at 2AMTC is being conducted during stage -1 and stage -3 of flying training and all QFI s posted at AFA. Two **profiles** given to cadets for stage 1 is 4G each and for stage 3 cadets is 02 profiles 4G and 6G. Since the commencement of training in Feb 22 till Aug 23, total of 136 Aircrew and QFI were trained. 557 Flt cadets were trained in stage 1 and stage 3 again prior to Hawk flg.

**Data analysis:** EPS is equipped with various pressure sensors in the seats which are; Left and Right rudder paddle, Loin, Thigh, Seat and headrest. On training the Flt cadets and aircrew on EPS, it was found that failure of a sensor or multiple sensors together while pulling the ejection handle resulted in failure of ejection. The headrest sensor failed for **20 aircrew and 55 cadets**. The seat sensor failed for **25 aircrew and 87 cadets**. The thigh sensor failed for **5 aircrew and 20 cadets**. The rudder paddle sensors failed for **10 aircrew and 55 cadets**. The loin sensor failed for **5 aircrew and 16 cadets**. On analysing the data, it was seen that failure of seat sensor was the most common (**18.3%**) followed by failure of the headrest sensor (**14.7%**) during training of qualified aircrew. On analysing the ejection training of cadets, it was seen that seat sensor failure was most common (**15.6%**) followed by failure of headrest (**9.8%**) and rudder paddle sensors (**9.8%**)

**Results & Discussion:** Failure of the headrest sensor and seat sensor was the most common cause of failure of ejection drill both for the Flt cadets and QFIs. The data obtained is in collaboration with the fact that failure of these two sensors is attributable for the high risk of spinal, head and neck injuries during ejection. In cases of QFI, the failure of these two sensors accounted for **[33%]** failed ejection

drills. For the cadets failure of these two sensors accounted for [25.5%] failed ejection drills.

**Conclusion:** A thorough knowledge of the ejection seat and repeated exposures to EPS training will go a long way in protection of spinal injuries during ejection. The hazard of delayed decision to eject will enhance the knowledge and safety drills of aircrew in the event of an ejection. The correct technique of pulling the ejection handle and adopting the correct ejection posture will increase the overall effectiveness and confidence of aircrew in the fighter cockpit.

## Incidence Of Physical Symptoms And Disorientation In Apache 64- E Aircrew

Sushree Sangita Khatua, YS Dahiya

**Introduction.** Indian Air Force (IAF) has inducted AH-64 E aircraft at Pathankot Air Force Base in 2019. The Apache aircrew use helmets with Helmet Display Unit (HDU) which has monocular projection of Forward Looking Infra-Red (FLIR) imagery. Monocular projection with FLIR imagery poses unique challenges to the aircrew. The Integrated Helmet and Display Sighting System (IHADSS) imagery is monochromatic (having no variation in hue), green on black and it is devoid of color contrast. Thus, the pilot must depend solely on luminous contrast for interpretation of the image. The other issues associated with IHADSS are binocular rivalry, Field of Vision (FOV) limitations, small exit pupils, potential for visual illusions, reduced depth cues, increased workload and reduced reaction time.

**Study.** It was a questionnaire survey and the questionnaire was filled by the aircrew.

**Findings.** The various aspects like incidence of physical symptoms and disorientation are discussed in the present study. In the present study Visual discomfort was the most common symptom and was found in 69% of aircrew followed by Headache in 23% of the pilots, blurred vision in 16.7% and after images in 13% during the flight. Faulty height judgement (67.6%) and impaired depth perception (64.7%) are the most common static illusions.

**Conclusion.** The commonly reported physical symptoms and SD can be included in training of the aircrew for better performance and might reduce the number of incidents and accidents due to SD.

## Poland Syndrome In A Civil Aircrew: Aeromedical Decision Dilemma



**Introduction.** Poland syndrome is a rare musculoskeletal congenital anomaly with a varied clinical presentation. It classically consists of combination of unilateral

aplasia or hypoplasia of the sternocostal head of pectoralis major muscle and ipsilateral brachysyndactyly. Aeromedical consideration includes inadequate reach and operation of hand operated controls, decreased power in affected limb, adequate performance of emergency egress procedures and optimum performance in post- crash survival scenarios. This syndrome has been associated with cardiovascular, GI, Renal and craniofacial anomalies. Ibid human factor considerations have aircrew-aircraft compatibility implications and pathological sequel of the said clinical anomalies may result in inflight incapacitation, leading to significant compromise in flight safety. This paper presents a known case of a male aircrew aspirant with Poland Syndrome presently holding a Class-2 (Initial) medical licensure, referred to the Institute of Aerospace Medicine for comprehensive Human Engineering evaluation and aeromedical disposal.

**Case Report.** A 25 year old male aircrew aspirant, was referred for class 2 medical certification to this institute. History revealed diagnosis at age 01 year when he was brought to a pediatrician for chest asymmetry by his parents with otherwise asymptomatic status, MRI Chest revealed left hypoplastic major & minor muscles without any associated aplasia of thoracic wall, lung herniation and dextroposition. He underwent Pulmonology, Cardiology, GE , Urology, Orthopaedics and Medical evaluation to rule out associated anomalies. Recommendations of concerned specialists were complimentary with respect to his job profile. His functional evaluation at Department of Human Engineering showed good functional scores, adequate power in bilateral upper limbs & Normal range of motion of Left shoulder, Arm, wrist and hand. Based on comprehensive clinico-radiological and functional evaluation, that didn't reveal any identifiable risk factor posing a risk to aerospace safety, the aircrew aspirant was considered fit for aeromedical certification.

**Discussion.** Individuals with musculoskeletal congenital affections including those associated with multisystem involvement can present to Aviation medical examiners for aeromedical certification. This paper brings out a similar case of Poland syndrome which was evaluated extensively at a boarding centre prior to his aeromedical certification.

### Lessons Learnt From The Us Airforce At A Transport Base In The IAF

## *Moin Sakre*

**Introduction:** Combat Operations Preparedness Exercise (COPE) 2023 was held between the United States Air Force (USAF) and the Indian Air Force (IAF) with the objective of enhancing the operational readiness of both the countries in regards to various aspects of Aerial Combat.

**Lessons Learnt:** Various aspects of Aerial Combat and Op-readiness were deliberated and discussed such as **TCCC**(Tactical Combat Causality Care), **SMEEs** (Subject Matter Expert Exchange) on several topics such as **CBRN, Fitness Classification in the USAF, DCS, High Altitude & Hypoxia** etc. **AE** (Aeromedical Evacuation) **configurations** were also demonstrated on board the **C130J & C17**. **A mass casevac drill** was also conducted on one of the Dets of the base where medical teams from both the countries evacuated simulated patients of varying severity on-board the US aircraft. This paper has brought out the lessons learnt from the above-mentioned lectures, discussions and demonstrations. The knowledge gained was varyingly utilitarian such as the different practices of Casevac in the USAF, updated practices in CBRN disaster preparedness, different approach in regards to DCS, high Altitude & Hypoxia prevention and treatment etc.

The IAF medical team also had the opportunity of sharing the gamut of their working and practical experiences with their US counter parts that made us efficient in our element. What was impressive to the USAF was the concept of the **SHO** (Station Health Organisation); not a practice in the routine working of the US Air Force. The assimilated **PTU** (Patient Transport Unit) of the base and the **Vertical Litter** stretcher setup of the C130 as practiced in the 87 Squadron was also palatable to the USAF personnel.

**Conclusion:** The paper finally concludes with recommendations that can be practically implemented in the IAF. It mentions enhancements in areas such as the PTU, Casevac/ medevac, para-jumping practices, modernisation of battle casualty care, improved CBRN practices etc.

## **Session-III**

### **Comparison Of 3-D Laser Scanning Anthropometric Technique With Conventional Direct Method For Head And Facial Parameters**

*Raghunandan V, Binu Sekhar M, Sabyasachi N, Tripathy NK*

**Background:** Anthropometric measurements of head and face are critical for design and development of aircrew helmet and oxygen mask. Direct manual anthropometric measurement technique is considered the standard most validated for measurement of head and face anthropometric parameters. The Department of Human Engineering, IAM presently has a 3-D Laser Whole-body scanner which

enables to capture of 3-D image of the head and face. From this 3D image, required anthropometric surface measurements of the head and face can be quantitatively assessed. Unlike other anthropometric parameters, head and face parameters are smaller in magnitude and any deviation from actual measurements would critically affect the sizing and fitment of the aircrew helmet and oxygen mask. Hence, there is a need to assess the reliability of the head and face anthropometric measurements of 3-D Laser scan by comparing with those measured by direct method. This, in addition to performance evaluation of technical equipment, would also assist in preparation for a large-scale anthropometric survey.

**Material and Methods:** 2 Head and face anthropometric parameters were measured on 248 (202 male and 46 female) volunteers using manual anthropometry using measuring tape and calipers and digital anthropometry using Vitus 3-D Laser Scanner. The parameters obtained by the two techniques were compared using suitable statistical tests. Head circumference, head length, head breadth, bizygomatic Breadth, nasion menton length, nasion pogonion distance, nose length, nose breadth, ear length, ear breadth, width of mouth in normal and smiling parameters were measured for 248 volunteers by manual method and laser scanning method.

**Results:** Bland-Altman analysis was carried out for a comparison between the techniques for each anthropometric parameter with analysis on difference of mean and error percentage. Only head circumference, head length, head breadth and nasion menton length parameters were found be comparable between the two techniques. The mean error percentage (maximum absolute error percentage) for these parameters were 1.6% (4.5%), 4.5% (12.9%), 7.2% (15.2%) and 3.4% (15.7%) respectively.

**Conclusion:** The results of this study comparing head and face anthropometric data using laser scanning against manual approach revealed that the laser scanning method produces unreliable results for majority of required anthropometric parameters essential for helmet and mask design. Inaccuracy in measurement from laser scan image can be attributed to subjective difficulty and variation in identifying landmarks on the scan image for taking measurements. Considering the small measurements involved, it is recommended to use markers for head and face scanning and to conduct extensive training on identifying landmarks and measuring parameters from the scan image. Separate high resolution laser scanners may also be explored for head and face laser 3D anthropometry.

## Aircrew Selection For Rafale Fleet: An Anthropometric Perspective

Bhowmick B, Rastogi P, Sekhar MB

**Background.** The primary inputs, in selection of off-the-shelf aircraft from international manufacturer and in indigenous design of aircraft, is anthropometric data of the user population i.e. IAF aircrew. Aircraft design aims for maximization of the aircrew-aircraft compatibility to optimize the operational utilization of the aircraft. The use of specific and accurate IAF aircrew anthropometric measurements during the design phase of the indigenous aircraft is essential to achieve this. However, this may not be always possible, in case it is an off-the-shelf procurement of aircraft like Rafale. Therefore, 'select-in' criterion for existing aircrew is based on specific inputs on anthropometric requirements from the Original Equipment Manufacturer (OEM) to ensure optimal aircrew-aircraft compatibility.

**Methodology and Results.** Anthropometric data were collected using IAM Portable Anthropometry Platform at a IAF boarding centre, for 41 IAF aircrew from various fighter fleets. The aircrew were assessed for fitness, prior to the training in Rafale ac. Data were compared\* with the anthropometric requirement provided by the OEM to assess the compatibility.

**Discussion.** The aircrew aspirants undergo anthropometric measurement at the boarding centre for about 57 parameters of which four parameters were most crucial for aircrew to be compatible for most of the aircraft in IAF inventory. These four parameters are clearly defined either with the minimum, maximum or both the values as an acceptable range for selection. In addition, few additional parameters, clearly poses a compatibility restriction on universality of the aircrew to fly any aircraft.

**Conclusion.** There may be a need to revisit\*\* the parameters recorded during initial selection of aircrew aspirants. This will curtail the need for repeat anthropometry for quick selection of aircrew based on the available initial data.

## Bayesian Instrument for Spinal-Disability (Bis): A Predictive Model For Aircrew Flying Fitness

P Biswal & Divya N

**Introduction.** Spinal Disabilities are a common problem in aircrew with or without obvious pathology in the spine. Department of Human Engineering, Institute of Aerospace Medicine (IAM) evaluates IAF aircrew with spinal disabilities before they can fly again. This study aimed to develop a Bayesian Instrument for Spinal-disability (BIS) based on clinical, radiological, and functional evaluations of IAM aircrew.

**Aims and Objectives.** This research aims to develop a composite model of spinal disability assessment applicable to aircrew of different streams and to assess most factors that determine flying fitness. The study also aims to develop a computerised version of the scale that can be used in the field before referral to IAM.

**Material & Methods.** 120 aircrew reporting with spinal-related disabilities to the Department of Human Engineering, IAM participated in the study. 14 predictors that determine the return to flying in an aircrew were incorporated in a Bayesian Belief Network using an Augmented Naïve Bayes algorithm to develop the Bayesian Instrument for Spinal-disability (BIS). The predictive characteristics of the final model were independently tested on an incomplete data set of 29 aircrew.

**Result & Analysis.** Validation of the Spinal Disability Scale was carried out using the Leave one out (LOO) method. The Accuracy was found to be 0.97, Sensitivity was 0.97, and Specificity was 0.96. The Spinal Disability Scale was also tested on partial data (11 predictors only) from 29 aircrew. It has a Sensitivity of 0.94 and a Specificity of 0.75 even when using just 11 predictors that are available before reporting to IAM.

**Conclusion.** The composite predictive model indicates the relative importance of ongoing evaluations and predicts focus areas affecting aircrew's return to flying. It also functions as a decision assist tool for the Medical Officer in the field before referral to IAM for evaluation.

## To Be Seated Or Not - Maximum Permissible Sitting Height For Garud Microlite Aircraft

Avinash BK, Murtaza, NK Tripathy

**Introduction.** Garud SW-80 Pipistrel Virus aircraft commonly referred as Microlite is a two seat single engine light sport aircraft commonly used for aerial inspection of air base as a part of aerospace safety inspection.

**Case Report.** A routine interaction of Flight Surgeon with aircrew of microlite aircraft at a forward base of IAF brought out that a tall statured pilot was finding the cockpit cramped and was apprehensive about his body fouling with cockpit structures while flying. The aircrew usually removes some part of seat cushion to



accommodate his body within aircraft and had safely accumulated numerous flying hours in spite of this discomfort. Cockpit trials were conducted and all the issues were confirmed. There is neither any specified anthropometric limitations for the aircraft nor there are any safety equipment worn by aircrew who fly the aircraft.

**Findings.** This presentation attempts to deliberate on significance of aircrew equipment assemblies on safety ergonomics, limitations of anthropometric assessments at field and importance of periodic review of guidelines along with proposed solutions to current obstacles.

## **Session-IV**

### **Combined Altitude Depleted Oxygen Vis-À-Vis Hypobaric Hypoxia: Efficacy In Hypoxia Indoctrination**

Sanjay P, Ranjan Sarkar, Vijay V Joshi VSM, Manu N

**Introduction:** The Combined Altitude and Depleted Oxygen (CADO), as an alternate method for hypoxia indoctrination, has the dual advantages of exposing to an altitude less than the threshold for Decompression Sickness, a known risk in training using Hypobaric Hypoxia (HH) while accounting for the pressure changes due to altitude, a limitation of using Normobaric Hypoxia. This study aimed to evaluate the efficacy of CADO in hypoxia indoctrination by comparing it with the time tested gold standard method of HH.

**Methods:** 40 subjects were exposed to both CADO and HH, simulating 25,000 ft for a maximum period of 05 minutes. CADO was achieved by combining exposure to an altitude of 10,000 ft in the hypobaric chamber and breathing a hypoxic gas mixture of 10.3% oxygen and 89.7% nitrogen. Physiological parameters (oxygen saturation, heart rate and respiratory rate) and psychomotor performance (Dual Task Test component of pSuMEDhA) were compared between the two exposures. The incidence and severity of subjective symptoms were also compared at the end of exposures.

**Results:** No significant difference was observed in the physiological parameters and psychomotor performance during the two exposures. Out of the 24 common symptoms of hypoxia assessed, there was a higher incidence of 20 symptoms in subjects exposed to HH compared to CADO. The severity of 15 symptoms was also found to be significantly greater ( $p < 0.05$ ) in subjects exposed to HH.

**Conclusion:** The similarity of physiological changes in CADO and HH shows the potential application of CADO as a tool for hypoxia demonstration. However, in view of decreased incidence and severity of subjective symptoms in CADO compared to HH, CADO cannot be considered equivalent to the gold standard (HH) for hypoxia indoctrination for high risk individuals viz aircrew and Combat Free Fall (CFF) personnel. CADO as a modality can be used as a tool for hypoxia

demonstration for persons not involved in flying duties and for high altitude research.

### **Incidence Of Otitic Barotrauma During Decompression Test In Indian Armed Forces Between 2019 To 2022**

Avishek Sharma, G Harshavardhan, Karthikeyan S

**Introduction:** Combat Free Fall (CFF) jumps are undertaken by special forces of the Armed forces for conduct of various operations. These jumps expose paratroopers to barometric changes that make them prone to various types of barotraumas. Indoctrination on middle ear pressure equalisation techniques in Decompression chamber prior to the actual training helps the personnel to understand the physiological changes and thereby helps in reducing the probability of injuries. However, simulation of these barometric changes for training in decompression chamber also have the potential to cause injuries.

**Material and Methods:** A retrospective analysis of Otitic barotrauma occurring in Indian Armed forces personnel prior to combat free fall training in Institute of Aerospace Medicine was done between Oct 2019 to Sep 2022. Total of 639 soldiers in the age group of 20 to 40 years volunteered for CFF training out of which 609 were exposed to DC test. The test protocol includes Hypoxia Indoctrination at 25,000 feet altitude with 3000 ft/min rate of ascent and decent after the Ear Clearance Run.

**Result:** Over a period of 3-years, a total of 639 soldiers volunteered for combat free fall training. Out of that 30 were unfit after initial clinical examination, otoscopic findings and Ear clearance run. In the remaining 609 soldiers, a total of 40 suffered barotrauma. Out of these 6.51% cases of barotrauma were in Army Paratroopers, 3.33% in Marcos and 8.40% in Garuds.

**Conclusion:** This study brings out the incidence of Otitic barotrauma in Paratroopers of Indian Army, MARCOS of Indian Navy and Garuds of Indian Air Force, where total incidence was 6.56% as compared to previous study done in the same institute in 2018 i.e., 7.1%.

### **Aeromedical Aspects In A Canopy Burst Incident - A Case Report**

*HS Harshith*

**Introduction:** This case report describes an in-flight canopy burst incident. Canopy burst incidents are rare emergencies. The article brings about the practical aeromedical aspects involved in such incidents and importance of aircrew equipment assemblies in preventing potential injuries.

**Case details:** The incident occurred in a Sukhoi-30 MKI, a twin-seater fighter aircraft, where in there was spontaneous in-flight disintegration of the rear cockpit transparency during a routine day time training sortie at an altitude of 11.3 km and

1.3 Mach airspeed. The rear cockpit pilot experienced a loud bang and was impacted by canopy fragments over his helmet and trunk. He recognized the canopy burst and the consequent cabin depressurization, took corrective actions of immediately descending and landing the aircraft with the help of his co-pilot.

**Clinical findings:** On landing, his examination revealed only minor injuries and bruises around his forehead, nose, around right eye and right shoulder. Examination of his helmet revealed a linear crack over the right side of his helmet and broken visor. The aircrew did not report any symptoms of decompression sickness and barotrauma. He also did not report losing consciousness or any decrement in performance following the in-flight incident.

**Discussion:** There have been multiple canopy burst incidents of Sukhoi 30 MKI aircraft. In this particular incident, the aircrew did not develop any adverse physiological consequences of the sudden cabin depressurization (like expansion of gases in body cavities, decompression sickness, hypoxia and hypothermia) because of the protection offered by breathing 100% oxygen, timely recognition of the emergency and immediate descent. Meanwhile, the aircrew protective equipment offered the pilot with adequate protection from the windblast and impact of canopy fragments preventing serious injuries. The aircrew was fortunate enough to escape from the impact injuries from the canopy fragments as the single tinted helmet visor was in down position as per the protocol for day flying. A similar incident during night flying with tinted visor in up position would have resulted in more serious injuries. The paper further deliberates upon the advantages, disadvantages and importance of dual visor vis-à-vis single visor aircrew helmets.

**Conclusion:** Aircraft emergencies are rare occurrences which provide an insight into the practical aspects of aviation medicine. It is important to identify and investigate the causes of any adverse effects resulting from such emergencies. It is also imperative to assess the effectiveness of various levels of protection offered to aircrew in preventing serious injuries, increasing their survivability and allowing their operations without much interference. This will help the field practitioner to identify practical problems an aircrew may face during operations and make necessary recommendations to address the same.

## **Study Of Combat Aircraft Cabin Pressurization And Occupant Physiology During Cabin Air Supply Failure**

A Sathiyaseelan

**Introduction.** The purpose of an aircraft cabin pressurization system is to maintain a safe and comfortable environment in the cabin for the crew and the passengers on-board and allowing the flight crew to operate efficiently at required cruise or economic altitude. Cabin pressurization schedule of an aircraft depends on the altitude up to which the aircraft flies the mission, the breathing and comfort

requirements of the crew or personnel on-board. Unlike commercial aircraft, combat aircraft flies at high altitude and even up to 60000 ft in the case of modern fighters.

**Findings & Discussion.** A pneumatically operated cabin pressurization system and its schedule for a typical fighter aircraft are explained in this paper with the case studies of cabin air supply failure at 23000 ft. The effect on the physiological condition is also studied considering the breathing pattern. The cabin pressure control system of a fighter aircraft is modeled in AMESim and the dynamic behavior of the system has been studied. The physiological response of the crew was also investigated during steep descent during the failure event.

## **Session-V**

### **Space And Entry Motion Sickness In Short Duration Spaceflight: Challenges And Way Forward For India's Maiden Human Spaceflight Mission**

Sannigrahi P, Ghosh G, Mishra S, Sharma V, Prusty P

Two major health issues faced by spaceflight crew are Space and Entry Motion Sickness (SMS and EMS). SMS can be defined as a state of diminished health characterized by symptoms that occur in response to the unaccustomed motion environment of weightlessness. The symptoms make SMS an operational challenge, especially in Short Duration Missions (SDMs). Similarly, when crewmembers return to Earth, certain physiologic changes occur during the initial post-flight period, referred to as Earth-readaptation syndrome, and the post-flight motion sickness component is referred to as EMS.

India's maiden human spaceflight mission 'Gaganyaan' is being planned for a SDM, culminating with a splashdown over Indian waters. These factors present the perfect recipe for SMS and EMS. This paper deals with the challenges in mitigating SMS and EMS following a SDM. The approaches of NASA and Roscosmos in mitigating SMS have also been discussed in this paper.

### **Design, Development, And Fabrication Of A Comprehensive Health Care Kit For Indian Astronauts**

Reena Wilfred, **Ratnesh Singh Kanwar**

**Introduction.** Optimal Human Performance in hazardous Space environment requires special attention in areas of Health and personal care. Developing a state-of-the-art medical kit entailing support and protection of human life and physiology is core requirement in any space mission. Providing adequate medical support in

a remote and challenging environment with limited possibilities of intervention is an uphill challenge.<sup>1</sup> India has announced the launch of first Human Flight Mission and it aims to send a crew of two to three astronauts on a short mission under Indian Space Research organization (ISRO) in Gaganyaan mission. Comprehensive Medical kit for this mission should contain drugs to handle occasional incidences during in-flight operations and the sea landing phase.

**Materials and Methods.** A thorough literature survey and detailed in-depth discussions on medical conditions were done during the preliminary design phase. Experts from Indian Aerospace medicine and Internal Medicine were consulted to finalize the in-flight medicine requirements. While designing the outer case, constraints in the mass and volume along with ability to resist fire hazard and other wear and tear issues were taken into consideration.

**Results.** Prototype of a Comprehensive Medical Kit adhering to international and intercultural medical Standards intended to assist space crews to handle clinical events in space was designed.

**Discussion.** The critical challenge in developing a comprehensive medical kit for astronauts is identifying the normal medical considerations, spacecraft emergency scenarios and the extreme environmental survival factors that are likely to occur during Mission. The kit prototype addressed these issues during the design and development phase.

**Conclusion.** The kit developed with Flexible and adaptable health care considerations is expected to undergo quality tests to ensure compatibility with the space vehicle design to ensure that health and performance of the astronaut is maintained throughout the Gaganyaan mission.

## **Blood Clot In Spaceflight Could Be Catastrophic: Requisite For Risk Assessment And Countermeasures**

Iti Garg, Swati Srivastava, Rajeev Varshney

**Introduction.** During spaceflight, there is chronic exposure to weightless environment which leads to blood and tissue fluid shift in comparison to upright posture on Earth. These kind of changes could be primary contributors for increased risk of venous thrombosis or clot formation. A recent case report revealed about formation of blood clot of the left internal jugular vein in the astronaut aboard the International Space Station. There is no established method of treatment of clot formation at microgravity.



**Aims & Objectives.** To understand the impact of microgravity on the components of Virchow's Triad and to assess the relative risk of clot formation in space flight by reviewing the various case reports.

**Materials & Methods.** Under the present study, information was collected from the available reports pertaining to microgravity and venous thrombosis. Reports show effect of ground based analogue and microgravity on coagulation system which contain substantial variability in study designs, objectives and outcomes.

**Result.** Based on available information, it was observed that limited data is available regarding the risk factors, pathological modulation and consequences/ clinical presentations associated with coagulation systems in spaceflight (microgravity). However, data suggests that astronauts may be exposed to an enhanced coagulation state in the cephalad venous systems in spaceflight, due to increase in venous pressure and decreased/ reversed blood flow. Endothelial damage, high fibrinogen levels and to some extent hypercoagulation were also reported.

**Conclusion.** Study comprehends that more research is urgently needed to evaluate the pathological processes in the blood that occur in actual spaceflight. This critical information will suggest risk assessment, diagnostic candidates, mitigation countermeasures for thrombosis under microgravity environment in future spaceflight.

### **Enhancing Exploration Platforms And Analog Definition: The Future Of Commercial Spaceflight**

Emmanuel Urquieta, Eric Bershada, Dorit Donoviel, Jennifer Fogarty, Mohammad Hirzallah, Jimmy Wu

**Background.** The successful Inspiration4 all civilian, orbital spaceflight mission had an array of biomedical data collected from the commercial astronauts during pre/in/post phases of the mission. With anticipation of the emerging commercial spaceflight industry blossoming into a highly desired enterprise and experience for humanity, TRISH has established the Enhancing eXploration Platforms and Analog Definition (EXPAND) Program.

**Overview.** EXPAND collects biomedical data and bio-samples from early commercial spaceflight pioneers; store the original and processed biomedical, environmental, and mission data in a robust database; and distribute the data to researchers, stakeholders, and government agencies with legitimate scientific inquires.

**Discussion.** EXPAND is an all-encompassing program with (a) a funding opportunity for researchers to perform biomedical research on private astronauts, (b) a biobank that preserves and stores bio-samples as well as a space omics

protocol. Assay results will be stored in the EXPAND database so that these do not need to be repeated on the limited samples available, (c) the EXPAND database ingests a variety of biomedical, environmental, and mission data types. The data access and governance model allows researchers to access and visualize their authorized data quickly and easily, (d) EXPAND has one unified, generic institutional review board (IRB) protocol. The protocol also covers how the above biomedical data and bio-sample specimens are ingested into the EXPAND database and bio-sample repository, respectively. A broad single consent form allows the future use of data and bio-samples with compliance with international privacy laws (HIPAA, GDPR, etc.), (e) a data privacy and release board will review, approve, and release data and bio-samples to requesters with legitimate scientific inquiries that advance public safety and human health/performance in human spaceflight, (f) EXPAND has established a set of essential measures to serve as a foundational dataset that will be proposed to all commercial astronauts for data collection during their spaceflight mission. The EXPAND Essential Measures standardize the data/ biosamples collected and the hardware, training, and procedures for data collection. EXPAND has already successfully collected data from Inspiration-4, MS-20, Ax-1, Ax-2, and Polaris Dawn.

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## Session-VI

### Head-Up Tilt Test In Cases Of Unexplained Syncope

Savina O George, B Sinha, TD Khaling

**Introduction.** Head up tilt test is an important diagnostic tool to investigate syncope of unknown aetiology. In individuals working in high-risk profile professions, even one episode of loss of consciousness needs to be thoroughly investigated and treated accordingly. Retrospective analysis of the tilt test data of 110 individuals is presented.

**Material & Methods.** The Akron multipurpose automatic Tilt table was used, which has foot board support and subject restraints. The vital monitoring was done using the multiparameter patient monitor. The patients/ individuals with history of syncope were tested at rest in supine for about 10 min, then tilted to 70 ° for 45 min, then again brought back to supine for 10 min. The vitals were recorded along with signs/ symptoms of any haemodynamic instability in the form of hypotension and bradycardia. Drug free passive head up tilt was used.

**Results.** The analysis was carried out for 200 patients (males and females) who reported with history of syncope with unknown aetiology. It was seen that, 36 patients had positive response in the form of Neurocardiogenic Syncope, Postural Orthostatic Tachycardia Syndrome, Orthostatic Intolerance.

**Discussion.** About 300-800 ml of blood shifts to lower limb on rapid tilting to upright posture (70 degrees). In some individuals the left ventricular mechanoreceptors are activated leading to intense sympathetic activity. The test is positive when the patient has symptoms reproducing the original symptoms accompanied by bradycardia, hypotension

**Conclusion.** Neurocardiogenic Syncope is a benign condition and situations provoking/ causing syncope needs to be avoided. Manoeuvres – Carotid Sinus Massage, sufficient fluid intake, behavioural therapy, tilt training are beneficial.

### **A Comparative Study Of Utricular Function Between Healthy Aircrew And Ground-Crew Using Subjective Visual Vertical**

Surg Lt Cdr S Karthikeyan

**Background & Objectives.** The perception of gravitational vertical is crucial for maintaining an upright posture, gait, and majority of motor functions. Numerous studies have been conducted on the function of visual and vestibular information in the perception of verticality, and it has been asserted that this multimodal integration plays a role in the way that verticality is represented. The direction of gravito-inertial vectors can be ascertained via otoliths (utricle& saccule), which are also useful for navigation. Thus, the perception of verticality is one of the most important functions of utricle. Objective of the study was to determine and compare utricular function between aircrew and ground crew using Subjective Visual Vertical (SVV) test.

**Methods.** In present study, Subjective Visual Vertical tests, including Vertical Static Tilt, Dynamic Clockwise and Dynamic Anticlockwise, were performed on 50 healthy aircrew and ground crew members and degree of tilt were measured for measuring the perception of verticality. Degree of tilt was statistically compared using Student's unpaired T-test between aircrew & ground crew.

**Results.** The study group consisted of 100 healthy subjects out of which 50 were aircrew and 50 were ground crew. Their age ranges from 21-36 years and the flying hours of aircrew range from 150-1250 hours. The obtained mean value of Static SVV, Dynamic Clockwise & Dynamic Anticlockwise SVV in ground crew were  $+0.99^{\circ} \pm 0.41^{\circ}$ ,  $+4.35^{\circ} \pm 1.85^{\circ}$  and  $-5.81^{\circ} \pm 3.24^{\circ}$  respectively and in aircrew were  $+0.70^{\circ} \pm 0.35^{\circ}$ ,  $+3.6^{\circ} \pm 1.83^{\circ}$  and  $-4.46^{\circ} \pm 3.46^{\circ}$  respectively. It was found that the tilt degree of aircrew was significantly better than that of the ground crew ( $p < 0.05$ ) in Static SVV, Dynamic Clockwise & Dynamic Anticlockwise SVV test.

**Conclusion.** The SVV test might be an effective way to evaluate utricular function in healthy people as well as in patients who complain of imbalance and/or vertigo and to identify the stages of recovery for otolith involvement. In this study, due to frequent and continuous exposure to motion, aircrew exhibited a better perception of verticality than ground crew, as evidenced by the degree of tilt in the vertical static, dynamic clockwise and anticlockwise SVV test. To the best of our

knowledge, comparison of utricular function among aircrew and ground crew using SVV was not done and this study is one of its kind in doing utricular comparison.

## **Prolonged Stay At High Altitude & Its Effects On Persistence Of High Blood Pressure**

Srinivasa A Bhattachar

**Background:** Health of troops at high altitude (HA) is a major concern. Effect of prolonged stay of lowlanders at HA on blood pressure (BP) is still being elucidated.

**Methodology:** The present prospective observational study was planned to determine BP trends in lowlanders during stay at HA & carried out at sea-level (350m-SL) & HA (3500m/3100m). The study population included healthy Indian males with no previous HA exposure before the present stay of one year duration at 3500m/ 3100m. After taking written informed consent, Ambulatory BP recording for 24 hours (ABP), (Awake systolic-AsBP, Awake diastolic-AdBP, Resting systolic-RsBP, Resting diastolic-RdBP) was carried out at SL. They were evaluated again at HA for ABP monitoring after their stay for seven days-D7, one month-D30, six months-D180 and one year-D365.

**Results:** Complete data was recorded for 136 participants whose Mean Age was 30.01( $\pm$ 6.04) years, Height-172.48( $\pm$ 18.26) cm, and Weight-67.3( $\pm$ 6.76) kg. The AsBP values were significantly higher at D7 (127.13  $\pm$ 11.74) and D180 (124.98  $\pm$ 11.31) ( $p=0.021$ ) compared to SL (124.50  $\pm$ 11.75) and D7 respectively. AdBP for all HA values [D7(83.80 $\pm$ 8.6), D30(85.34 $\pm$ 9.56), D180 (83.94 $\pm$ 7.9), D365(84.82  $\pm$ 10.72)] were significantly higher ( $p<0.000$ ) than SL values (76.94(7.87)). The RsBP at D7 (117.48  $\pm$ 10.41) and D30 (115.95  $\pm$ 11.34) were significantly higher than SL values (111.91  $\pm$ 13.20) ( $p<0.000$  &  $p=0.004$  respectively). RdBP values at HA [D7 ((74.32  $\pm$ 9.4) ( $p<0.000$ ), D30 (72.86  $\pm$ 7.91)( $p<0.000$ ), D180 (71.18  $\pm$ 8.29) ( $p=0.05$ ), D365 (70.83  $\pm$ 10.57) ( $p=0.023$ )] were significantly higher than SL values (68.38  $\pm$ 8.83). At D7, 15.08% and 11.11% participants showed Stage-I hypertension ABP values. Four and three participants, respectively, showed Stage-II hypertension values at 30 and 180 days. At no point did HA values approach or fall below SL values.

**Conclusion:** Prolonged stay at HA could lead to rise in BP approaching maximum values at D7 and D30 at HA with a few individuals showing values diagnosed as hypertension at sea-level.

## A Comparative Study To Evaluate Aerobic And Anaerobic Capacity In Mild Anaemic Individuals (As Per Who Criteria) With Their Healthy Counterparts

Kumar A, Sinha B, Santhosh SR

**Introduction.** According to Indian Air Force publication (IAP) 4303, presently individuals with Hb < 13 g/dL (males) are being placed in lower medical category which makes them unfit for flying. The aim of the present study was to examine the cardiovascular response to hypoxia and exercise in mild anemic individuals (as per WHO criteria, Hb between 11 to 12.9 gm/dL) and healthy controls in order to decide the suitability of flying activities.

**Methods and materials.** 25 individuals with mild anemia (as per WHO criteria) and 15 healthy controls participated in the present study. The participants were subjected to Normobaric Hypoxia (NH) equivalent to an altitude of 15,000 feet. Different physiological parameters were measured during NH. Participants also performed Maximal Aerobic Capacity ( $\dot{V}O_2$  max) and Maximal Anaerobic Capacity test in Bicycle Ergometer.

**Results.** A significant difference in  $\dot{V}O_2$  max between mild anemic (44.35 ml/min/kg) and healthy control (58.4 ml/min/kg) was observed. Anaerobic worked capacity differed significantly between healthy (620 watt-min) and mild anemic (102.7 watt-min). Heart rate and SPO<sub>2</sub> were 75.2 bpm and 81 bpm and 124.8% and 119.2% in mild anemic and control after 30 min of hypoxia exposure.

**Conclusion.** There was a deterioration in exercise capacity and hypoxia tolerance in individuals with mild hemoglobin levels. Adequate precaution should be exercised for permitting the aircrew to fly with low hemoglobin level.

## Session-VII

### Changes In +Gz Endurance After A G Warm-Up Maneuver And The Duration For Which This Change In +Gz Endurance Persists

S Dinakar, SS Khatua, B Bhowmick

**Introduction:** Cardiovascular adaptation to different forms of physical activity (sprinters and distance runners) has been studied. Aircrew flying the high-performance aircraft (HPA) are exposed to repeated macrogravity or high-sustained +Gz. The immediate and intermediate effects of +Gz acceleration on the cardiovascular (CVS) and tolerance to +Gz acceleration is well established. Anecdotal description of subjective G tolerance following their return to flight training after a period of non-flying has been known as “G-layoff” phenomenon. Raghunandan et al have studied this effect at the Institute in 2012. The reduction of G tolerance is being frequently reported by aircrew following an extended layoff. The relationship is, however, still to be explored.



**Methods:** 20 actively flying aircrew of the IAF were exposed to a 6G 'open loop' profile, the end point was fatigue. The aircrew were exposed to 6G on four occasions, twice on day 1 and twice on day 2. The two exposures had a gap of 4 hours between them. The duration to sustain 6G on four exposures were compared. Physiological parameters like the HR and BP were measured.

**Results:** Comparison of the duration of tolerance at first exposure to +6G after initial warm-up revealed a significant difference ( $p < 0.001$ ). However, the subsequent three exposures to +6G did not reveal any significance. Heart rate and BP (both SBP and DBP) showed significant difference across pre-run and subsequent exposure to 6G ( $p < 0.001$ ). However, no significant difference was noticed between the 6G exposures.

**Discussion:** Improvement in cardiovascular responses upon repeated exposure to acceleration stress is established. The study was conducted to know the duration for which the response persists. The results show that the response to repeated G exposure improves the G tolerance. The study reiterates the importance of the G warm-up run.

### **Postural Dysautonomia In Response To Head-Up Tilt In A Military Pilot Aspirant: Aeromedical Considerations**

Ghosh G, Sinha B

**Introduction:** Intolerance to orthostasis encompasses a group of responses on assumption of upright posture. One such response is Postural Dysautonomia. This paper highlights a case of postural dysautonomia in a pilot aspirant in response to Head-up tilt test (HUT).

**Case Report:** A 23-year old female military pilot aspirant reported for evaluation of Syncope and Air Sickness. She gave a history of solitary episode of loss of consciousness on ground while preparing for an early morning sortie. She was diagnosed as a case of neurocardiogenic syncope and was put back to flying training. Subsequently, after about two months she developed features of air sickness while flying and also could not tolerate preliminary motion sickness desensitization at her unit. A thorough medical evaluation failed to reveal any neuro-cardiological abnormality. Before commencing the air sickness desensitization protocol at the Institute of Aerospace Medicine (IAM), she was subjected to HUT during which she developed signs and symptoms suggestive of postural dysautonomia. A test re-test assessment with repeat HUT and passive standing test revealed similar responses.

**Discussion:** An anomalous cardiovascular regulation may show persistent dysautonomic response to orthostasis even though the person may have no signs of cardiopulmonary compromise during routine activities. The challenge, however remains whether one should consider the dysautonomic response as significant in view of no clinical restriction.

## Study Of Heart Rate Changes And Relaxed +Gz Tolerance Levels In Correlation with Different Bmi Levelson Exposure To GOR Profile And ROR Profile In DFS Among IAF Aircrew

Shaleen P Singh, Biplab Bhowmick, Sneha Dinakar, Rahul Pipraiya,  
Sabhyasachi Nayak

**Introduction:** Human centrifuge training is widely recognized as a safe and effective method for assessing the G tolerance of fighter pilots on the ground. In response to G-LOC (G-induced Loss of Consciousness) incidents, the Indian Air Force (IAF) launched a high G training initiative for jet pilots at IAM. Previous studies have indicated a positive link between G tolerance in the centrifuge and factors such as age, weight, flight experience, straining G tolerance, and AGSM proficiency. Nonetheless, the connection between physiological responses in form of heart rate, anthropometric elements i.e. height, weight and BMI, and pilot G tolerance remains inconclusive. This research study aims to address this gap by conducting a comprehensive analysis of data collected from centrifuge training. The study will investigate the relationship between cardiovascular physiological responses in form of heart rate changes and anthropometric parameters (height, weight, and BMI) and their impact on relaxed G tolerance within GOR (0.1G/sec) and ROR profiles (1G/sec). Obesity and its associated metabolic disorders can influence baroreceptor reflex function, potentially heightening sympathetic nervous system activity. Inflammatory processes triggered by obesity could further elevate sympathetic activity, contributing to cardiovascular events. Given these implications, this study seeks to utilize a high G training database to assess the correlation between heart rate changes and G tolerance levels in trainees with varying height, weight and BMI levels exposed to elevated G forces during DFS (Dynamic Flight Simulator) in GOR and ROR profiles.

**Methods:** 100 actively flying aircrew of the IAF exposed to the GOR (0.1G/sec) and ROR profiles (1G/sec) in DFS. The random data pertaining to the aircrew age, height and relaxed +Gz tolerance were monitored and collected with centrifuge run reports and divided into two groups of BMI (<24.9) and BMI (>25-29.9). The relaxed +Gz tolerance of these subject groups was obtained by subjecting them to GOR acceleration of 0.1 G/s and ROR at 1G/s, while the subjects stayed relaxed in the centrifuge gondola until they had a PLL (56°–52°). Physiological parameters like the basal and peak heart rate levels reached on GOR and ROR profile run exposure were also monitored for 30 aircrew with correlation with their respective BMI were drawn. The data were analyzed using Microsoft Office Excel® to find the correlation between BMI with relaxed +Gz tolerance at GOR and ROR profiles. Relaxed +Gz tolerance of Normal BMI (18.5 to <24.9) and Overweight BMI (>25 to 29.9) was compared using unpaired t-test of equal variance. Significance was set at  $P < 0.05$ .

**Results:** The level of relaxed G-tolerance of 100 aircrew with mean age 27.89 +3.91 yrs, mean height of 174.90+ 4.73 cm, mean weight of 75.98 + 7.54 kg and BMI of 24.16+1.99 on exposure to a GOR(0.1G/sec) and ROR profile(1G/sec) were compared and correlations were drawn using Pearson product-moment correlation. Analysis showed significant correlation of relaxed ROR tolerance levels with BMI in comparison to mild correlation between BMI and relaxed GOR tolerance levels. The unpaired t-test of two groups of Normal BMI and overweight with revealed significant correlation of BMI with relaxed +Gz tolerance with GOR profile(p =0.03) and even stronger correlation for ROR(p=0.01). There was significant positive correlation of basal heart rate with BMI across pre-run levels. Further on +Gz exposure in ROR profile significant negative correlation between BMI and peak heart rate levels and change in heart rate were seen, and mild negative correlation when exposed to GOR profiles.

**Discussion:** The study was conducted to know the variation in relaxed G tolerance levels and heart rate changes with variation in BMI on exposure to GOR(0.1 G/sec) and ROR(1G/sec) profiles run. The results shows stronger positive correlation of relaxed G-tolerance level in response ROR profile than of GOR profile with increase in BMI. Higher BMI levels exhibited a statistically significant, higher relaxed +Gz tolerance as compared to lower BMI levels. The study also shows significant negative correlation i.e. drop in peak heart rate levels reached on exposure to +Gz acceleration in ROR profile i.e. lesser change in heart rate as BMI levels raised and mild negative correlation on exposure to GOR profiles with BMI. Study also depicts strong positive correlation between basal heart rate and BMI.

### **Phase Angle From Bioelectrical Impedance Analysis Correlates With Gravitational Blood Pooling In The Human Leg**

Munna Khan and Kashif Islam Khan Serwani

**Introduction:** Phase angle (PhA) derived from bioelectrical impedance analysis (BIA) is being considered as an indicator of cellular health of human being. The higher values reflect higher cellularity, cell membrane integrity, and better cell function while lower PhA values interpreted as indexes of cell loss and decreased cell membrane integrity. Gravity of Earth always affects cellular health of human during blood distribution. Active standing produces less blood flow toward the heart indicating gravitational blood pooling (GBP) in the lower body. In some cases, the GBP may lead to loss of consciousness and ultimately to death.

**Study:** Therefore, an attempt has been made to correlate the measured PhA and GBP assessed using BIA technique. In BIA technique, a pair of surface electrodes ( $I_1$ ,  $I_2$ ) is used as current electrodes to introduce low intensity constant current at high frequency into the body. Other pair of electrodes ( $E_1$ ,  $E_2$ ) called as voltage electrodes measures bioelectrical impedance changes accompanying physiological events. The current electrodes were placed on the hip joint and right

foot. Other two voltage electrodes were placed on 3 cm below from hip joint current electrode and 3 cm up from foot current electrode. The subjects were laid down keeping the leg up 90 degree (<sup>0</sup>) for 10 minutes. The values of Leg PhA and Leg bioelectrical impedance (LBI) of 10 subjects were measured and recoded at frequency of 50 KHz using Imported Maltron body composition analyzer 920 II. Subjects were instructed to stand up and immediately data were taken on the same frequency.

**Findings:** The range of GBP of human leg found from 142.23 ml to 666.63 ml using LBI values during 90<sup>0</sup> leg up and active standing. The minimum and maximum percentage change of PhA values were found as 4.28 and 76.48 respectively. A correlation curve drawn between percentage (%) change of PhA and GBP of all human volunteers. The correlation coefficient calculated and found as 0.924 between % change of PhA and GBP. The % change of PhA may be new biomarker for assessment of GBP in the lower body segments.

**Recommendations:** The correlation curve with some modifications may be used to study cellular health of an aircraft pilot during high G maneuvers.

## Session-VIII

### Liver Histopathology In Healthy Aircrew: An Insight Into Etiopathology Of Hepatic Abnormalities Found During Routine Medical Examinations

Neha Gupta

**Introduction:** A substantial number of ostensibly healthy aircrew individuals have incidentally shown liver abnormalities during routine medical assessments, posing challenges in their fitness evaluation. This study aimed to investigate the etiopathology associated with such aberrations by integrating histopathological examination of liver samples and clinical data obtained from the autopsy records from the same cohort of healthy aircrew.

**Materials & Method:** This retrospective cross-sectional study encompassed 22 years. The inclusion criteria comprised healthy aircrew individuals between the ages of 20 and 55 years, who held a medical category of A1G1 or an equivalent rating. Alcohol intake, whether occasional or none was noted. Exclusion criteria covered aircrew with lower medical categorization or those with obesity (BMI > 30 kg/m<sup>2</sup>), pre-existing systemic diseases such as jaundice, cardiovascular disease, liver disease, diabetes mellitus and chronic alcoholism.

**Results:** Out of the 167 cases included in the study, macrovesicular steatosis was found in 23.8% individuals. The Chi square test did not reveal a significant correlation between steatosis and alcohol intake ( $\chi^2 = 0.724$ ,  $p = 0.39$ ). The severity of macrovesicular steatosis was graded using the NAS score, with scores of 0, 1, 2, 3, and 4 found in 75.9%, 12.7%, 7.8%, 3.0%, and 0.6% respectively. Both univariate and multivariate analysis was conducted using logistic regression to assess the correlation between Age, Body mass index (BMI), and steatosis which

yielded significant results. The odds ratios of age adjusted for BMI and BMI adjusted for age for occurrence of steatosis were 1.11 and 1.57 respectively. Ordinal regression confirmed the association of age and BMI with increasing severity of steatosis, in agreement with the logistic regression results.

**Discussion:** Macrovesicular steatosis accounted for 95.8% of histopathological abnormalities in the liver and was associated with increasing BMI and age, rather than alcohol intake. The severity of macrovesicular steatosis was limited to a maximum NAS score of 4, distinguishing it from Non-alcoholic steatohepatitis (NASH), which requires an NAS score of  $\geq 5$ . Thus, the macrovesicular steatosis was linked to uncomplicated Non-alcoholic fatty liver disease (NAFLD), in contrast to NASH, which is an irreversible condition and carries a graver prognosis.

**Conclusion:** The most likely etiopathology underlying incidental and often transient liver abnormalities including elevated liver enzymes with or without hyperbilirubinemia and fatty liver detected during ultrasonography is NAFLD. The predominant finding of uncomplicated NAFLD, along with the absence of full-blown NASH and Alcoholic liver disease, brings positive news. The fact that dietary and lifestyle modifications can potentially treat the majority of these cases is encouraging.

## Gender Based Difference In Computerized Dynamic Visual Acuity

*Anitha T, Mishra S, A Kumar*

**Introduction:** A fighter jet pilot is often exposed to various visual stimuli. An efficient visual integration and processing is required to accommodate an environment consisting of complex control panels and external visual stimuli throughout the high-speed flying duration. Dynamic visual acuity (DVA) gives a functional measure of visual stabilization which occurs due to the vestibulo-ocular reflex (VOR) along with processes like catch-up saccade and visual motion processing. DVA with transitional motion helps in finding the measure of otolith contribution rather than canals. Induction of women into the fighter stream of IAF has commenced, difference in the dynamic visual acuity of women pilots from men pilots is being assessed in this study. The aim of the study was to find the gender-based difference in computerized dynamic visual acuity.

**Materials & Methodology:** Dynamic visual acuity was performed by a specialized computer system in Neuro vestibular laboratory. Subsets in Dynamic visual acuity test are Static visual acuity and Dynamic visual acuity. A total of 101 healthy volunteers (50 males and 51 females) were made to undergo the dynamic visual acuity test in the Neurovestibular™ lab of IAM.

**Results And Analysis:** The overall age range was 18 to 40 years. The mean of **log MAR (SVA – DVA) value** was found to be  $0.08 \pm 0.06$ . Similarly, the mean angular velocity of the sample is  $142.21 \pm 9$  degree/cycle. The DVA value of male is found to be higher than female and is statistically significant ( $p$  value = 0.007).



The difference in angular velocity was statistically significant. The correlation score (ICC- 0.012) between the visual acuity loss in log MAR value and the angular velocity proves that the DVA is independent of the angular velocity.

**Conclusion:** In conclusion, the results of this study are in congruent with the previous studies where the DVA of male were found to be higher than female. Also, males had a higher average angular velocity than females. The negative correlation between the VA loss and angular velocity indicates that the difference in VA loss may be contributed by other factors such as VOR gain. So, VOR gain needs to be performed to augment the significance of the test statistically and their correlation with each other. This study concludes that the inherent adaptation of the genders may play a significant role in the DVA of individuals.

### **A Study Of Platewise Probability Of Errors While Reading 38 Plate Ishihara Chart Among Colour Normal Individuals.**

Sridhara Reddy, AK Singh, Nithya Nair, Pawan G Kumar, Simran Dhani

**Introduction:** Currently in the Indian Armed Forces the Ishihara pseudo isochromatic plate (PIP) test is one of the commonest primary test used for screening and detection of colour vision defects among recruits and candidates. The studies carried among colour normal individuals have reported 10 to 15 % of false positive errors. These errors have been called 'atypical errors' as they are different from the 'typical errors' made by the colour defective. Identification of plates which have a high probability of erroneous reading could help prevent an incorrect assessment and avoid false positive results. Present study proposes a scientific and quantitative assessment of the reading difficulty of various plates of the Ishihara charts among colour normals and predicts the acceptable atypical errors.

**Methods:** A total of 380 participants in the age group of 16 to 25 years (30 females and 350 males) were tested for colour vision with Martin Lantern and Fansworth D 15 initially. Thereafter, only the colour normal subjects were subjected to colour vision testing using 38 plate Ishihara chart.

**Results:** 256 (67.36%) of colour normal individuals read all the plates in Ishihara chart without any error whereas 124 (32.63%) of colour normal participants gave errors. The distribution pattern of number of error scores by colour normal participants on Ishihara chart showed 78 (20.5%) participants made '1' error, 42 (11.1%) participants made '2' errors and 4 (1.1%) participants made '4' errors respectively.

**Conclusion:** The first 25 plates of the Ishihara test (38 plate ed.) have different probabilities of eliciting a correct response. The consideration of probability error scores is significant for the test specificity. The number of errors the applicant makes on the Ishihara plates should not therefore be solely used to judge suitability for recruitment assessment.

## **A Case Report On Obstructive Sleep Apnea (Osa) In A Non-Obese Aviator With Resistant Hypertension: Screening Policies And Future Recommendations**

*Snehangsh Dash*

Obstructive Sleep Apnea (OSA) is a common sleep disorder in which during sleep the upper airway is obstructed due to loss of tone in pharyngeal musculature. The obstruction can be complete or partial. Obesity is the most common cause of OSA however male sex, increasing age, family history, large tonsils, thick neck, endocrine disorders, cardiac and renal failure, alcohol and smoking are other precipitating factors of this disorder. However, OSA is prevalent in non-obese individuals as well. OSA is associated with an increased risk of CAD, Hypertension and Stroke. OSA is most predominant cause found associated with resistant hypertension.

OSA is common and under diagnosed in general population as well as in aviators. Moderate to severe OSA causes fatigue, excessive day time sleepiness, difficulty in concentration, an unusually high rate of accidents/incidents and impairment of skilled motor tasks. It is of significant aeromedical concern because it can be a serious flight safety hazard.

This case report presents a unique scenario of a non-obese aviator diagnosed with OSA while working up for resistant hypertension. The case underscores the importance of early recognition of sleep disorders in individuals with high occupational demands, such as aviators, and the potential impact on health and aviation industry. This case can also emphasize on formulating screening policies, periodical sleep study evaluation and proper recommendations on disposal of a case of OSA in both aircrew and ground duty personnel.

### **Session-IX**

#### **Effects Of Sleep Inertia, Post A Short Nap On Cognition And Psychomotor Task**

*Binu Sekhar M, Divya N, P Biswal*

**Background:** Short naps of approximately 30 min have been used as a popular countermeasure against fatigue and lack of sleep among pilots in civil aviation and also during some contingencies in military aviation. Sleep inertia is a physiological state of impaired cognitive and sensory-motor performance that is present immediately after awakening. The effect of sleep inertia due to short nap on the cognitive and psychomotor performance has not been well studied. The

study aims to explore the effect of sleep inertia post a short nap on cognition and psychomotor task.

**Methodology:** 50 male healthy volunteer subjects of age range 24-45 years (mean  $\pm$  SD: 33  $\pm$  5.5) participated in the study. The sleep quality and pattern of the subjects were monitored for three days prior to the test using sleep diary and Groningen Sleep Quality Scale (GSQS) to ensure undisturbed normal sleep quality and pattern before the subject undergoes the test. The subjects' sleepiness state before undertaking the tests were recorded using Karolinska Sleepiness Scale (KSS). Subjects' cognitive and psychomotor assessment were done using three tests namely Simple Reaction Time (SRT), Stroop Test (ST) and Digit Symbol Substitution Test (DSST). The tests were administered in the morning at 0800h and at afternoon 1400h to obtain baseline data. The participants were allowed to sleep for 30 min at controlled environment. The depth of the sleep was monitored using EEG recording. The cognitive and psychomotor data was collected for a period of 2 hours post nap. The tests were administered in every 15 min for first one hour and every 30 min for second hour.

**Results and Analysis:** Actigraphy records and GSQS scores were checked initially and adequately slept subjects only were allowed to participate in the study. Comparison of morning recording and the pre nap baseline recording did not show any significant difference for all the three tests. In SRT test response time was found significantly ( $P < 0.0001$ ) higher in post nap period and the effect lasted for the entire 2-hour observation period, whereas there was no significant change ( $P = 0.0527$ ) in accuracy of responses. This confirm that the speed of psychomotor response is affected by sleep inertia while the accuracy remains unchanged. In the case of ST, the response time did not significantly ( $P = 0.379$ ) increase in post nap period. In the case of DSST, the response time showed significant ( $P < 0.0001$ ) differences during the observation period. Immediate post nap response time was unchanged ( $P = 0.367$ ) and which came down to significantly lower values from 30 min ( $P = 0.0088$ ) recording onwards. The lower response time was noticed till the entire observation period of 2 hours. The accuracy of responses in DSST did not show any significant difference in post nap period. This confirms that sleep inertia did not cause any response delays on attention function, rather the short nap has beneficial effect by improving the response time related to attention function.

**Conclusion and Recommendation:** The study confirms that a short nap of 30 minutes is sufficient enough to produce sleep inertia which can adversely impact response time of psychomotor functions. The cognitive functions and accuracy remain unaffected. accuracy. In addition, attention related functions showed improvement in response time after the short nap. Considering the significance of the findings of this study in terms of flight safety, it is recommended to undertake a larger study with age and gender matched controls to confirm the findings and for further implementation towards policy changes on in-flight naps in aviation.

## Effect Of Noise On Visuo-Spatial Working Memory: An Aviation Perspective

Devdeep Ghosh, Deepak Gaur, Biswajit Sinha

**Introduction:** Visuo-spatial working memory is an important cognitive attribute in aircrew and has flight safety implications. Aircraft noise, a commonly encountered aviation stressor, may have effect on this cognitive function. An effort has been made to assess the effect of noise on this aspect in a simulated aviation environment.

**Method:** 30 healthy non-aircrew volunteers (28 male, 02 female) with mean age  $28.7 \pm 4$  years participated in the study. Visuo-spatial working memory function was assessed in the form of Corsi block memory span and Corsi block total score sequentially in four phases viz. baseline (without stressors), 85 dB(A) white noise only, simulated 14,000 ft altitude and 85 dB(A) white noise in simulated 14,000 ft altitude. The experiment was conducted in hypobaric chamber for altitude simulation and white noise was generated through software. Visuo-spatial working memory was assessed with Corsi block test from Psychology Experiment Building Language test battery. Data were analysed using descriptive statistics and rANOVA.

**Results:** The study revealed definite enhancement of performance level in the form of increased Corsi block memory span and Corsi block total score when exposed to noise, both independently and during simulated 14,000 ft altitude exposure. Although statistically insignificant, rANOVA revealed improved memory span ( $p=0.056792$ ) and total score ( $p=0.079220$ ) with noise exposure.

**Conclusion:** Improved memory span and total score affirm the importance of noise upto human tolerance limit to enhance attention and arousal which in turn improve Visuospatial working memory in aviation environment. It signifies the role of auditory stimulus in critical aircrew-aircraft interface to reduce human error. Additional research with a broader cross-section of aircrew community, who differ in age, experience and other influencing factors, would be prudent.

## Assessing And Predicting Mental Workload Using Affective Computing: An Explorative Conceptual Approach

*Sibin Raj K, Chaturvedula S*

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Pilots and other aircrew who perform their task and make decisions during flight operations are most exposed to the volatile mental phenomenon called mental workload. This varies from domain to domain and most intrinsically paired in the aviation sector due to the innate complex and safety-critical nature of the field. Task induced cognitive demands are hardly predictable and causes mental efforts which inherently results in mental workload. It is the mental, physical, and temporal demands leading to the experience of effort, frustration, or performance outcomes

within the framework of a specific task. The study of Human Factors is now significantly advanced through the utilization of technology. Affective computing is one such a technology based on AI (Artificial Intelligence), also known as emotion AI (Artificial Emotional Intelligence) which is for emotion sensing, recognition, interpretation, and simulation through various facial behaviour parameters like facial landmark (FL), head pose (HP), facial action units (FAUs), and eye-gaze (EG). NASA Task Load Index (NASA-TLX) is being used as the classic test for assessing the mental workload for several decades. Combining technology driven tools with the classic traditional assessment of mental workload can lead to new pathways to explore and assess mental workload in an easier and more objective manner among aircrew.

Hence, this paper, (a) systematically reviews the literature on the affective computing technologies capable of exploring the mental workload assessment, (b) analysing the possibilities of using NASA-TLX in an affective computing paradigm for better quantification pre-or post-task, (c) proposing an affective computing protocol intended for measuring or predicting the mental workload using the facial behaviour for the purpose of flight safety and overall operational effectiveness.

### **Decoding Air Sickness: Predictive Factors And Psychological Insights**

*Grandhi SR, Chaturvedula S*

**Introduction:** The pursuit of aviation necessitates a comprehensive and disciplined training regimen for individuals hoping to navigate the vast expanse of the skies. During the course of this training, a significant challenge presents itself in the form of Air Sickness, which is a physiological reaction that occurs due to sensory incongruity and/or psychological distress experienced during flight. The aim of this paper is to retrospectively analyse the psychological characteristics of Air Sickness among flight cadets, successful and unsuccessful attempts to Air Sickness Desensitisation Therapy (ASDT) protocol, thereby examining the predictive factors associated with effective outcomes.

**Methodology:** During a span of five years (2019-2023), a total of 35 cadets were referred for ASDT at the Institute of Aerospace Medicine (IAM). The cadets were administered a psychological protocol with the study variables of Motion Sickness Assessment, motivation and personality. Subsequently ASDT was offered consisting of relaxation therapy, Cognitive Behavioural Therapy (CBT) as per 'caseness' and yielded a success rate of 12 out of 35 cadets.

**Results:** Statistical analyses included mean comparisons of variables under study between the two groups of cadets using test of Significance. Regression analysis was also carried out for identifying predictor variables to Air Sickness susceptibility and prognostic trajectories.



**Conclusion:** The implications of this study have far-reaching effects in the fields of aviation and training for improving diagnostic accuracy and designing tailored interventions in Air Sickness care.

## Session-X

### Construct Validity Study For Comparison Of Range Of Movements Of Spine Vis-À-Vis IAM-EMP Score: A Retrospective Analysis

*Ruchika Rana, Binu Sekhar M, Gaurab Ghosh*

**Introduction:** Institute of Aerospace Medicine (IAM) is a pioneer institute in India which exclusively carries out Human Engineering (HE) assessment of all military and civil aircrew in the country with spinal or musculoskeletal disabilities for assessing their flying fitness. This is done with a series of spinal tests including evaluation of ranges of movements and an indigenously developed functional assessment protocol called the IAM-Exercise Maneuver Protocol (IAM-EMP). The study aims to compare the test scores obtained from IAM-EMP with the ranges of movements of the spine in all aircrew who have reported to the Institute for HE assessment between 2021-22.

**Material and Methods:** A total of 174 military & civil aircrew data between the year 2021-2022 were obtained from the Human Engineering department of IAM and a retrospective analysis was carried with appropriate statistical tools for drawing any association and their relationship with the clinical outcome/ periodicity of monitoring in the individuals.

**Discussion:** The outcome of the study would significantly aid in understanding the specific association of individual subtests of IAM-EMP and help the specialists in deciding the future course of review and follow-up.

### Mthfr Gene Mutation & Venous Thrombosis: Aeromedical Decision Making

*Jeya K, N Suhasini Reddy, Raju Avk, Piush Renjhen*

**Background:** Hyperhomocysteinemia has been identified as an independent risk factor in arterial and venous thrombosis. Mutations in genes encoding methylene tetra-hydro-folate reductase (MTHFR), involved in the metabolism of homocysteine, may account for reduced enzyme activity and elevated plasma homocysteine levels. MTHFR gene mutation has been brought out to cause one of the risk factors for thrombotic disorders like Portal Vein thrombosis, Cerebral venous thrombosis & Deep vein thrombosis. The clinical manifestation varies depending on the site of thrombosis and the system affected. Genetic testing is the testing modality for identification of MTHFR gene mutation and testing of blood homocysteine level. The treatment includes Anticoagulants along with B12, Folic acid supplementations and Recanalisation of thrombosed vessels. It also includes control of homocysteine level and prevention of complications.

**Case Summary:** There are 03 cases of military aircrew with MTHFR gene mutation reported to IAM, who were evaluated, reviewed and aeromedical disposal given at IAF boarding center. Two experienced aircrew presented with cerebral venous thrombosis and one young aspiring Stage III trainee pilot with Portal vein thrombosis. The causal factor for venous thrombosis was found to be MTHFR gene mutation with increased homocysteine level in all 03 cases. After the adequate period of observation in the ground category, two cases were upgraded to restricted flying category and one case was permanently grounded.

**Discussion:** The aeromedical concern in a case of any venous thrombosis is a risk of sudden in-flight incapacitation. In military/ civil flying, the aircrew cannot be considered for unrestricted flying category due to risk of recurrence of thrombosis and complications due to aviation stressors like acceleration (fighter), Hypoxia & prolonged immobilization in long duration flying. Aeromedical decision making in such cases becomes difficult as there are no recommended guidelines for evaluation and disposal of MTHFR gene mutation with venous thrombosis. Hence, the aeromedical concerns and disposal of these cases to be dealt on a case-to-case basis owing to their experience of service and utilize the trained manpower towards organisation, based on clinical evaluation, recovery and risk of recurrence. However, a consensus statement/ broad guidelines are strongly needed to avoid differences in opinion and medical categorisation.

### **A Case Study Of Non Specific Tinnitus In A Helicopter Pilot: Aeromedical Perspective**

*Preethi R, Binu Shekhar M*

**Introduction:** Tinnitus is the perception of noise in the absence of any external sounds. High level exposure of aircrew to noise increases the incidents of hearing loss and tinnitus in this population. It can interfere with the cockpit communication & sensitivity to noise. Tinnitus can be independent of hearing loss also. This paper presents a case of a male aircrew with complaints of non specific tinnitus and how his aeromedical assessment & disposal was carried out at Institute of Aerospace Medicine.

**Case Report:** A 52 year old male helicopter pilot, a known case of primary hypertension (on medication) and pre-diabetes, developed complaints of ringing sensation in both ears which was initially occasional in nature, & progressed to continuous sensation. His MRI brain, PTA (4 occasions) & BERA showed normal reports. He was initially observed in restricted flying category & was upgraded to unrestricted flying category after a satisfactory performance in in-flight evaluation.

**Discussion:** Though the prevalence of tinnitus is comparatively high in aircrew population, proper guidelines for evaluation & disposal have not been described in any military/ civil aeromedical protocols. The aeromedical concerns & a proposed guideline for evaluation & disposal of tinnitus are highlighted in this paper.

## A Retrospective Study On The Effect Of Hyperbaric Oxygen Therapy On Hearing Outcome In Idiopathic Sudden Sensorineural Hearing Loss

Biswajit Nemaï Bhowmick, G Harshavardhan, and Monie Riju Simon

Idiopathic sudden sensorineural hearing loss is often a under recognised medical emergency in a clinical practice. The incidence of ISSNHL is 5%-20% individual per 1,00,000 people per year [1]. Prevalence of ISSNHL is about 4.5% to 18.3% in India [2]. ISSNHL is defined as Sensorineural hearing loss of 30dB or greater over at least three contiguous audiometric frequencies occurring over 72 hours [3,4]. HBOT is the approved treatment for ISSNHL according to undersea and hyperbaric medical society recommendations. The purpose of this retrospective study was to document hearing recovery post Hyperbaric oxygen Therapy (HBOT) in patients with idiopathic sudden sensorineural hearing loss (ISSNHL) at Institute of Aerospace Medicine between Jan 2017 and Dec 2022. Effectiveness of the treatment was evaluated by comparing Pre HBOT and Post HBOT pure-tone audiometry and categorised into complete, partial and no recovery of hearing. T-test, Wilcoxon signed rank test and regression analysis were employed to analyse the statistical significance. Of the 23 patients, 43.4 % (n=10) had complete recovery and 47.8% (n=11) had partial recovery. The mean pre HBOT PTA for patient with Rt Ear SNHL was 88.38 dB, mean pre HBOT PTA for patient with Lt Ear SNHL was 81.65 dB, and mean pre HBOT PTA for patient with B/L SNHL was 88.82 dB. The mean post HBOT PTA for patient with Rt Ear SNHL was 32.02 dB, the mean post HBOT PTA for patient with Lt Ear SNHL was 44.85 dB, the mean post HBOT PTA for patients with B/L SNHL was 53.28 dB.

### Session-XI

#### Prediction Of Non-Communicable Disease (Ncd) Among Civil Pilots Based On Lifestyles

*Pipraiya R, Mohapatra SS, Talukdar D, Ghana P, Dahiya YS, Suryakiran P*

**Introduction:** Commercial Flying mandates a high degree of physical fitness and freedom from infirmity / disability besides a reasonably high psychological adaptability to the challenges of workplace stress. A healthy lifestyle is the key to health/wellbeing, continued performance, flight safety and career. This study was an attempt to develop a risk predicting tool for early identification & risk stratification for developing NCDs in aircrew. A validated tool could go a long way in preventing loss of trained manpower as well as prevent in-flight mishaps.

**Aim:** The aim of the study was also to develop a scoring system, which could be useful towards determining the NCD risk among the civil pilots in India.

**Material & Methods:** A descriptive cross-sectional survey was conducted amongst 276 civil pilots from different airlines in India. “Biological Age Calculator” available in the open source was used to record the life style. Those showing lower Biological age than the actual age was marked as “SMART” and considered as the individuals with healthy lifestyle (HLS). Logistic regression analysis was conducted considering the “Age”, “Biological Age” and the parameter “SMART” as independent variables (IV) and the parameter “NCD” as outcome or dependent variable (DV). Data on occurrence of NCD along with other demographic and occupational variables was used for examining the hypotheses (a) There is a significant association exists between selected demographic variables and the level of healthy lifestyle practice among civil pilots in India. (b) There is a significant association exists between selected occupational variables and the level of healthy lifestyle practice among civil pilots in India. (c) The occurrence of Non-Communicable Diseases (NCD) among civil pilots in India is associated with their lifestyle.

**Results:** No association was found between the demographic variables (age, sex and marital status) and HLS. The association between the occupational variables (length of flying service and quantum of flying) and the HLS was not statistically significant. There was a negative association between the occurrence of NCD and the SMART +ve group (HLS group). A Regression Equation was determined to predict the occurrence of NCD. ROC curve was plotted by using the computed score from this equation and a stratified NCD risk was obtained by considering appropriate values for ‘Specificity’ and ‘Sensitivity’. Score (when computed using the NCD predicting equation) greater than -2.0001 indicated definite risk and less than -3.4970 indicated insignificant risk. Scores in between indicated moderate risk for NCD.

**Discussion:** Aviation, as a profession, mandates maintenance of good health for a continued and fruitful career as a pilot. It is also known that commercial pilots work in a unique stressful work environment. With no or little control over the lifestyle to ensure better health, there is always a risk of NCD in this highly demanding profession. A tool capable of indicating the level of HLS and predicting the associated NCD risk could be an excellent method for any organization to adopt a way to monitor the health in the pilots.

### **Vitamin D Deficiency In Commercial Airline Pilots**

*Swathy Kuppala*

**Background:** Vitamin D deficiency is a common problem, especially in people who live in areas with limited sunlight exposure. Commercial airline pilots are at an increased risk of vitamin D deficiency due to their work environment. They spend long hours in the air, where they are exposed to artificial light and not enough sunlight. This can lead to a decrease in their vitamin D levels.

**Objectives:** To estimate the prevalence of Vitamin D deficiency and its associated risk factors among commercial airline pilots.

**Methods:** A cross-sectional study was conducted among 100 commercial airline pilots in India. The participants were asked to complete a questionnaire about their demographics, dietary habits, and sunlight exposure. Blood samples were collected to measure serum 25-hydroxyvitamin D (25(OH)D) levels.

**Results:** The mean serum 25(OH)D level was 21.4 ng/ml. The prevalence of vitamin D deficiency (defined as 25(OH)D < 20 ng/ml) was 42%. The risk of vitamin D deficiency was significantly higher among pilots who were older, obese and long working hours.

**Conclusions:** The findings of this study suggest that commercial airline pilots in India are at a high risk of vitamin D deficiency leading to a number of health problems, including osteoporosis, muscle weakness, and cardiovascular disease. Commercial airline pilots should be screened for vitamin D deficiency. Those who are found to be deficient should be advised to increase their intake of vitamin D-rich foods, such as oily fish, eggs, and fortified milk and Vitamin D supplements.

### Self-Medication In Civil Aircrew

*Sri Hari E, YS Dahiya*

**Introduction:** In the current scenario of easy access to internet and Artificial intelligence, where information is effortlessly accessible over the click of a button and the availability of medicines often even without prescription of doctors, we often resort to Self-Medication to treat our health issues. It is an undeniable fact that some of the prescription drugs as well as Over-The-Counter (OTC) drugs can impair our cognitive and psychomotor performance which can be detrimental to Aerospace Safety. The aim of this study is to identify the factors influencing the practice of Self-Medication and the level of awareness among flight crew in India.

**Methodology:** 300 Flight Crew were subjected to Subjective Questionnaire. The questionnaire had 43 items divided into four key aspects i.e, Self-Medication Behaviors, Knowledge (about Diabetes), Human Factors, and Background of the crew for a comprehensive analysis. Name of the aircrew was kept anonymous. A descriptive analysis of the data was carried out on the responses using SPSS (Statistical Package for the Social Sciences).

**Results & Discussion:** The fear of medical disqualification was the most significant factor resulting in the prevalence of Self-Medication among Flight Crew. Most of the Flight Crew were aware of the effects of Self-Medication and its threat to flight safety. Furthermore, other factors influencing the level of awareness and knowledge of pilots on Self Medication were also evaluated. Demographic details were also analyzed and correlated to understand the prevalence of Self-Medication.



## **In-Flight Thrombosis: Risks And Prevention**

Swati Srivastava, Iti Garg, Babita Kuamri, Rajeev Varshney

**Introduction:** Immobilization for a longer period of time such as during long flights increases risk of sudden blood clot formation (thrombosis). This alters blood flow in the vessels resulting in obstruction or blockage due to thrombus formation. Blood clot formation generally starts from the deep veins (like calf muscles), a condition referred to as 'deep vein thrombosis (DVT)'. The blood clot (thrombus) thus formed, often dislodges itself from the site of formation and travel to lungs through blood stream, leading to pulmonary embolism (PE), a potentially fatal condition.

**Aims & Objectives:** Ample evidences are available to establish the increased incidences of DVT and PE in long distance flights. Thus, it is extremely important to understand the factors leading to it in order to minimize such incidences. Our aim was to identify the risk factors for thrombosis in-flight and amalgamating it with the preventing measures.

**Materials & Methods:** Research papers, reviews and case reports available on thrombotic events during long-haul flights were thoroughly screened to understand the causative factors and mechanism of thrombus development during flights and the preventive strategies for the same were enlisted.

**Result:** Thrombotic risk factors existing in aircraft cabin include prolonged immobilization, hypobaric hypoxic environment as well as low humidity. Besides these conventional risk factors such as obesity, familial or past history of blood clots, older age, smoking, recent surgical procedures, injury etc. contribute to increased incidences of thrombosis. To maintain proper blood circulation, periodic leg movement is necessary. One can wear compression stockings or take appropriate anticoagulants in case of higher risk, as per medical advice. Standing and moving around once an hour would be beneficial.

**Conclusions:** Sole risk of death due to flight related thrombosis can be avoided by taking specific precaution, especially in high risk individuals. Airline health authorities should give more focus on preventive strategies for pilots and passengers to minimize risk.

## **Session-XII**

### **Human factor involved in aircraft accidents and incidents**

*Sharad Pasricha*

**Introduction:** The mission statement of Aerospace safety is 'To enhance operational capability by conserving human and material resources through prevention of aircraft accidents'. Human factor is one of the most crucial factor in

safe air operations while not compromising on the mission. The human performance depends on all the four pillars of Aerospace safety namely Technology, Capability, Training and Environment. Hence, it is important to holistically study all the aspects leading to Human Error and take measures to prevent.

**Aim:** The aim is to analyse past accidents / incidents pertaining to Human Errors, categorize the human factors and thereby initiate actions towards prevention.

**Brief:** Human error is one of the major causes leading to aircraft accidents / incidents. Numerous study have been carried out in the past, recommendations implements, thereby resulting in significant reduction in human errors. Nevertheless, there is a scope to further improve upon. Past records of accidents / incidents pertaining to various causes of human error and their trend is being presented. Various measures that are under progress towards enhancing aerospace safety through reducing human error would be shared.

**Conclusion:** Any step towards understanding the behaviour of human, multifaceted preconditions leading to the acts and addressing such preconditions would definitely enhance the safety of valuable assets as well as precious lives.

## **Subjective Assessment Of Sleep Pattern Among Aircrew**

*Nataraja MS*

**Introduction.** Fatigue in aircrew has remained an insidious threat in operations involving extended period of wakefulness, sleep loss and circadian desynchronisation. Interaction with aircrew revealed their limited understanding on importance of sleep in alleviating fatigue. Hence, a need was felt to study the subjective assessment of sleep pattern in aircrew.

**Methodology.** This cross-sectional observational study was conducted using an anonymous institutional questionnaire on 300 aircrew (164 transport and 136 helicopter) reporting for OPTRAM (T & H) course at 1 AMTC during the past 18 months. The data was compiled fleet-wise and analysed to ascertain the pattern assessed of 150 aircrew using Pittsburg Sleep Quality Index (PSQI).

**Results.** The study revealed that 34.3% aircrew felt drowsy when they had to fly whereas 7% had dosed off while on controls in the preceding 30 days and 46.3% aircrew reported to have dozed off at least once in their military flying career. In addition, 62% aircrew accepted fatigue affecting the military flying duties and 33% aircrew reported of sleep deficit of an average in excess of one hr/day. Furthermore, the findings of PSQI indicated poor quality of sleep in 43% of the aircrew.

**Discussion and Conclusion.** Sleep loss is a major cause of aircrew fatigue leading to degradation in the performance resulting in compromising the individuals as well as flight safety. The paper ponders on the likely causes for decrement in both quantity and quality of sleep in our aircrew and recommends

possible measures to improve quality and quality of sleep in an effort to reduce aircrew fatigue.

### **Integrating Human Factors Into Investigation Of A Fatal Aircraft Accident: Lessons Learned**

Gaurab Ghosh, P Biswal, P Rastogi

Two fighter aircraft were engaged in a 2v1 Air Combat Maneuver as part of syllabus in a major fighter training base. As they were engaged in scissoring combat, at one instance both aircraft came on a canopy-to-canopy opposite side turn collision course. The actions taken by the aircrew were inadequate as it resulted in a mid-air collision with one of the pilots suffering fatal injuries. Preliminary investigation revealed no contributing factors related to maintenance of the aircraft, weather conditions or underlying medical problems in any of the aircrew. This paper attempts to highlight the major human factors connotations revealed through aeromedical investigation into the accident. The inference drawn could serve as lessons learned for conducting investigation into aircraft accidents of pure human factors nature. The recommendations made for exercising caution during similar flying circumstances with a potential of aerospace safety breach are also brought out in the paper.

### **Session-XIII**

#### **Comparative Assessment Of Center Of Gravity (Cog) And Moment Of Inertia Of A Fighter Aircraft Helmet: Iam Experience**

BN Vasudev, Binu Sekhar M, Sabyasachi Nayak

**Background:** Modern military flying clothing has evolved along with the advancement in aviation industry. Aviators' helmet is an integral part of aircrew flying clothing which provides impact protection to head, platform for various helmet mounted devices and oxygen mask and radio transmission system. The modern aviator's helmet enhances the aircrew performance by improving situational awareness and target sighting and acquisition. However, the addition of HMDs over the helmet has resulted in increasing the overall helmet weight acting over neck region. Resulted shift in weight dynamics and centre of gravity has increased the risk of injury potential due to musculoskeletal strain. At this institute helmet of a fighter aircraft was assessed for CoG and Moment of Inertia.

**Methodology:** The helmet of fighter aircraft (three different types of helmets) was assessed for CoG and Moment of Inertia at this institute using the Trifillar Pendulum Mass Property Measurement System and the medium ATD head form.

Knox-Box criteria is used as reference for CoG coordinates and USAARL recommendation is used for mass moment and force movement measurement.

**Results:** The X coordinate CoG is found to exceed the Knox-Box criteria in two variants. Mass moment was found to exceed the limits as specified by USAARL criteria. In the absence of any threshold criteria a comparative study of the moments of inertia was done.

**Discussion:** The Knox-Box criteria assess helmet mass and CoG taking into account of overall weight of helmet and mask distribution for helmet design considerations. The realistic neck injury potential wearing helmets with HMDs and Mask can be assessed using experimental ejection trials with ATD.

### **Integration Testing And Flight Evaluation Of Integrated Life Support System On Tejas Pv-3 Aircraft**

*A A Bhat, Ankur Bhardwaj, A Prasanna, Rajkumar S, Diwakar Kumar, Chetan Kumar B N*

DEBEL has designed and developed the integrated Life Support System (ILSS) indigenously to address the need for preventing in-flight Hypoxia (during high altitude flying and emergency escape) and G-induced Loss of Consciousness (G-LOC) during high G-Maneuvers. The ILSS consists of 11 Line Replaceable Units (LRUs), pneumatic hoses and electrical cable harness. All the LRUs have been designed, developed and realized and Tejas aircraft is the basic platform for flight evaluation and use. The fitment trials of ILSS have been carried out on Tejas PV-3 aircraft in Aircraft Research and Design Centre (ARDC), Hindustan Aeronautics Limited (HAL), Bangalore. The system hardware consists of a molecular sieve concentrator, breathing gas regulator, backup oxygen supply (BOS). These components replace liquid oxygen (LOX) components and eliminate the need to service lox converters, resulting in faster aircraft turnaround time, increased safety, and decreased cost.

This paper represents the Flight Testing Instrumentation (FTI) installed to capture all the critical parameters related to functioning of ILSS such breathing O<sub>2</sub> concentration, temperature, pressure, flow, humidity and other volatile organic contaminants. These sensors located at critical locations identified so as to understand and analyze the performance behavior of OBOGS based system (ILSS) during flight testing. Flight Trails were performed up to 35,000 feet in steps of 8000ft, 15000ft, 20000ft, 30000ft and 35000ft a course of five flight trials. The flight test parameters like OBOGS functionality check with varying altitude, deceleration, Anti G valve check, Spiral descent, and negative-G were analyzed with various G-maneuvers ranging from -2G to +6G were carried out and the performance results of OBOGS, Breathing Regulator and Anti-G valve was found to be satisfactory and the performance results of OBOGS and other LRUs of ILSS

is described in details. The oxygen concentration of OBOGS has been found within physiological acceptable limits and the performance of the system during acceleration maneuvers is also satisfactory.

## **Man Rating Of Normobaric Hypoxia Enclosure At Iam: Our Experience In A Pilot Study**

*Ranjan Sarkar*

**Introduction:** Intermittent Hypoxia Exposure (IHE) enhances athletes' aerobic capacity and aids altitude acclimatization. Department of HAP & HM has recently installed a Normobaric Hypoxia Enclosure to study rapid acclimatization aiming for a sub-14 day high-altitude acclimatization schedule. The pilot study assessed the Hypoxia Enclosure's functionality using human subjects. It also compared pre- and post-exposure physiological parameters, tested enclosure durability, oxygen level maintenance, and compared results with an Explosive Decompression Chamber (EDC).

**Materials & Method:** The study involved 4 healthy male participants (mean age: 26±4 years). The normobaric hypoxia enclosure at the department was utilized, alongside the EDC chamber. Baseline physiological parameters were recorded at ground level and EDC (15000ft) on Day 0. Intermittent Hypoxia Exposure (8hrs daily, 2200-0600) was conducted for 14 days at a simulated 7K feet altitude. Comfort, hypoxia symptoms, enclosure gas levels, and physiological measures were recorded pre- and post-exposure, then compared with EDC Day 4, 7, 10, and 14 readings.

**Results:** Statistical analysis revealed significant changes in physiological parameters within the normobaric chamber exposure. Notably, during the initial 5 days, SPO2 and RR showed significance ( $p > 0.05$ ), while days 6 to 14 saw significant RR (Respiratory rate) changes. On days 12 to 13, RR and ETCO2 were significant. No significance was found in Pulse Rate, SBP, DBP, or MAP. While Comparing post-normobaric to hypobaric exposure, in EDC days for normobaric exposure Day 0 showed significant ETCO2 and SPO2 changes ( $p > 0.005$ ). However, major significance emerged on Days 4 and 7 in ETCO2, SPO2, SBP, DBP, and MAP ( $p > 0.05$ ). By Days 10 and 14, values were not statistically significant implying trend towards acclimatization.

**Discussion & Conclusion:** All 4 subjects successfully completed the 14-day IHE as per protocol, reporting subjective comfort without major hypoxia symptoms. One subject experienced giddiness and nausea on Day 10, followed by vomiting attributed to indigestion. Carbon dioxide levels remained within the safe range (1000ppm to 1200ppm) which indicated that the enclosure can be safely used for human trials. It can be concluded that the enclosure is suitable for human use and planned for a larger study with various other parameters to assess use of IHE as a means for rapid acclimatization of troops to higher altitude



## Application Of Moment Of Inertia In Helmet Mass Property Assessment For Improving Aviation Safety

*Sabyasachi Nayak, BM Sekhar*

**Introduction:** Aircrew helmets are critical safety equipment for pilots operating helicopters and fighter aircraft. Addition of Helmet Mounted Devices (HMDs) like Night Vision Goggles (NVGs) and Helmet Mounted Sighting Device (HMDS) can lead to increase in total Head Supported Mass (HSM). This increased weight can lead to an increase of the neck injury potential due to neck posture deviations and due to high head and neck loads during adverse events like crash and ejection. So far, only the Helmet weight and Center of Gravity (CoG) of the Head-Helmet System have been considered as the critical parameters affecting neck injury potential. In this study we explore the role played by the Moment of Inertia (Mol) of the helmet system in increasing the possibility of neck injury. In the absence of absolute thresholds for Moment of Inertia, we undertake a comparative assessment between fighter and helicopter helmets with and without their corresponding Helmet Mounted Devices.

**Material and Methods:** The Center of Gravity (CoG) and Moment of Inertia (Mol) measurements were done using the Trifilar Pendulum Mass Property Measurement System. The fighter helmets used were the conventional Russian OEM supplied helmet, the presently in-use Indian Helmet and an indigenously developed Indian helmet. Additionally, two helicopter helmets were also used for the comparative study. The CoG was measured using the method of moment balance after placing the helmet system on the Trifilar plate and the Mol was measured by measuring the time periods of small torsional oscillations of the helmet system placed centrally on the Trifilar plate. A medium size ATD head representative of the 50<sup>th</sup> percentile Indian aviator was also used as a proxy for a real head in order to measure the combined CoG in the anatomical frame as well as to measure the force and mass moments. The X, Y and Z-Axis Moment of Inertia of the helmets were measured with and without their respective HMDs.

**Results and Observation:** Both the fighter and helicopter helmets with HMDs exceeded the helmet safety criteria of mass moment by 08-37%, while one helicopter helmet and one fighter helmet exceeded the Head Supported Mass threshold of 2.5kg. Both the helicopter helmets with HMDs, exceeded the Z-axis CoG limits, while one of them exceeded the X-axis CoG limits. In the comparative analysis of the Moments of Inertia, the Y and Z-axis Mol were found to be significantly larger for the helicopter helmets as compared to the fighter helmets when used with their corresponding HMDs by 50-60%, while the corresponding X-axis Mol was found to be slightly smaller for the helicopter helmets with HMDs than the fighter helmets with HMDs by 05-38%. The Mol of the bare helmets without HMDs were all found to be comparable with each other.

**Conclusion:** The increased Y-axis Moment of Inertia of the helicopter helmets with HMDs as compared to fighter helmets with HMDs will result in higher incidence of neck fatigue and a larger neck injury potential in helicopter helmets. However, in

the absence of established threshold values for Moments of Inertia, experimental crash and ejection studies need to be carried out with the helmets affixed on Hybrid 3 ATDs to measure the loads and moments exerted during these extreme events. The comparison of these experimentally measured values with Injury Assessment Reference Values (IARV) will lead to the establishment of the threshold Moments of Inertia of Aircrew helmets and the estimation of their neck injury potentials.

### **Session-XIV-Closed Door Session**

#### **“Psychological Stress” Among The Service Personnel At Andaman And Nicobar Command: A Cross-Sectional Survey**

*SS Mohapatra*

**Background:** The service personnel posted at Andaman and Nicobar Command (ANC) encounter a unique kind of psychological stressor related to the social, environmental and occupational settings. Since the job performance and work-safety are closely related to the psychological health of the individual, a cross-sectional questionnaire survey was conducted on the service personnel posted at ANC with an aim to assess the level of psychological stress and its association with various demographic, occupational and personal factors including the health habits.

**Materials & Methods:** A total of 508 service personnel which included 289 from Army, 171 from Navy and 48 from Air Force had participated the survey. A bilingual (English and Hindi) version of General Health Questionnaire (GHQ)-12 along with a self-made questionnaire was employed to collect data on psychological stress. After checking the normality and homoscedasticity, the data was analysed by using Chi-square tests, Multiple Regression Analysis to examine the possible associations between the psychological stress and various demographic, occupational and personal health habits. Further, the Exploratory Factor Analysis (EFA) was also conducted to extract the factors having acceptable level of contribution by these variables to confirm their associations with psychological stress.

**Results:** A total of 89 (17.5%) of 508 participants had scored above the cut-off value to be classified as psychologically distressed. There were significant relationships between the level of psychological stress and the Age, Seniority, Qualification, and Family status duration the stay at ANC. The personal health habits like alcohol consumption and smoking were also associated with psychological distress.

**Discussion:** Psychological distress among 17.5% of the studied population was comparable to the results of earlier studies conducted on military personnel. The risk of suffering from this stress is more among younger service personnel especially the junior rankers. The stress coping abilities namely the resource building, resilience and awareness, which could be attributed to age, seniority and

academic qualifications could be the explanation for the findings of the study where the occurrence of distress among the personnel with higher age, rank and qualifications was less. The results of the study had also indicated that the stress level among the married service personnel staying single is more in comparison to those staying with family. The study had also indicated the stress level is higher during the initial period of ANC tenure in comparison to those who spent more than one year. The associations of psychological stress with the afloat appointment at ANC by the naval personnel could not be established in this study though there was an indication that the personnel borne in the ships and other afloat platforms are less distressed in comparison to their counterparts borne in the shore appointments. Similar results were also documented by the earlier studies conducted in the Indian Navy. The percentage of smokers among the participants (17.7%) was comparable to the Indian data (19%). But the same for alcohol was 40.9 %, which is considered as high in comparison to the recent national data of 14.6%. The study could establish a vital association between these poor health habits with the level of psychological distress among the subjects.

### **Post Accident Support System (Pass): Supporting Aircrew Safely Back Into The Cockpit**

*P Biswal & A Agarwal*

**Introduction:** The incidence of post ejection psychological sequelae is at par with spinal injuries (~36% in the IAF). While policies recommend evaluation and close follow up for physical injuries, no clear policy exists for psychological support for aircrew after an accident. This paper presents a basic review of literature, followed by an algorithm for the psychological evaluation and rehabilitation of an aircrew following a flying accident.

**Material and Methods:** The authors carried out a comprehensive review of literature regarding the approach towards post aircraft accident psychological support in the various air forces across the world. The various aspects of psychological sequelae including the effect on flight safety were studied. The spectrum of psychological problems starting from Acute Stress Reaction to PTSD were discussed. The concept of Psychological First Aid as applicable in this context was also studied.

**Results:** The authors propose Post Accident Support System (PASS) as a comprehensive approach to psychological first aid to the aircrew following an accident. Basic The aim is early identification of possible chronic psychological or psychiatric conditions with an aim to institute early interventions. It leverages the inherent ethos of the IAF to help an aircrash survivor aircrew to ensure standard of care in the aftermath of a flying accident. The authors present the composition of the PASS team, the tenets of training this team, along with an algorithm to follow in case of an aircraft accident. Finally, the authors also present a roadmap for implementation of PASS in an aviation organisation, be it the armed forces or the civil airlines.

**Conclusion:** Accidents are life-changing for pilots. Regardless of the cause, the pilot views the accident as traumatic. Psychological effects vary over time and between people. The IAF must recognise aircrew psychological reactions during a crash. This acknowledgement must become a policy to help the pilot after an accident. The policy must promote healthy coping, facilitate early return to flying, and identify pilots who need specialised interventions. A successful post-accident Psychological First Aid programme needs guidelines, training, implementation, and monitoring.

### **Post Accident Support System (Pass) Implementaion: A Field Experience**

*Prathu Rastogi*

Three aircraft got airborne from one of the prominent fighter base for 2 vs 1 Air Combat maneuvering sortie. Approximately 8 minutes after take-off, two of the aircraft had a mid-air collision resulting into crash. The aircrew of one of the aircraft (single seat) sustained fatal injuries while the aircrew of the other aircraft (twin seat) ejected safely without sustaining any obvious significant injuries. Ejected aircrew were rescued by SAR helicopter and admitted at nearby military hospital for treatment and evaluation as per laid down protocol.

As per the prevalent orders (Command HQ) both the ejected aircrew were subjected to PASS questionnaires by local Aerosp Med splt and QFI, on the next day of the accident, after ascertaining their physical and mental wellbeing The PASS questionnaire comprised of (a) Peri-traumatic Dissociative Experiences Questionnaire (PDEQ), (b) Peri-traumatic Distress Inventory (PDI) (c) National Stressful Events Survey Acute Stress Disorder Short Scale (NSESSS). The PASS questionnaires were administered again on day 3 and 7 to follow up the aircrew psychological status and to ascertain need for further psychological intervention at higher centre. In this case both the ejected aircrew did not show any obvious signs and symptoms of psychological stress and coped up well with the support of family and peers.

This was the first time in IAF when aircrew were subjected to PASS questionnaires in field and hence it was obvious to encounter administrative hassles and certain queries on methodology and practical applicability of the test. This paper will discuss the issues encountered and those envisaged in future for smooth implementation of the PASS. A pan-IAF policy along with adequate training of all the stake holders and sensitization of the environment are the mandatory requirements for making this a successful intervention.

## **Post Accident Support System (Pass): Supporting Aircrew Safely Back Into The Cockpit – An IAM Perspective**

*Sowgandhi Chaturvedula, Vipin Sharma*

Cat – A aircraft accident is a traumatic event to the aircrew which may lead to undesirable psychological or psychiatric manifestations either immediately or as an aftermath. The aircrew may be physically unharmed in the event but maybe out of flying due to psychological scarring or undesirable sequelae at a later stage in the form of Acute stress disorder, Post traumatic stress disorder (PTSD) etc. A system offering Post Accident Support System (PASS) to the affected aircrew was developed and implemented by CAC. The SOP was examined at this institute in the light of its ease of implementation, effectiveness and the extant practices in various Air Forces, NATO policies and extensive review of literature. This paper discusses certain modifications proposed to PASS by IAM in terms of structure and extent, implementation, training and resources required, as well as the methods to validate its efficacy.





# ABSTRACTS: POSTER PRESENTATIONS



## Poster Session I

### Cardiovascular Deconditioning On Orthostatic Challenge After Exposure To Microgravity Simulation In The Form Of Dry, Supine, Thermoneutral Water Immersion For Eight Hours Among Sports Personnel: Endurance Trained Versus Resistance Trained Participants

*Nandika Suhasini Reddy*

**Introduction:** Cardiovascular index of deconditioning (CID) is a unitless index and simplistic measure to assess cardiovascular deconditioning ( $CID = \Delta HR - \Delta SBP + \Delta DBP$ ). Assessment of optimum level of exercise training required to maintain pre-flight fitness in order to withstand orthostatic stress after microgravity exposure would provide a better understanding of the operational requirement of physical fitness levels in terms of endurance and resistance training.

**Aim & Objective:** To assess CID among endurance trained (ET) and resistance trained (RT) groups after exposure to microgravity simulation for 8 hours in a dry floatation chamber.

**Method:** Study participants (N=32) included healthy, non-smokers, 20-40 years aged, endurance (ET Group, N=16) and resistance trained sportsmen (RT Group, N=16). Physical fitness of the participants was assessed by standard laboratory based aerobic and anaerobic assessment technique. Physiological effect of microgravity for 8 hours was simulated by Dry supine and thermo-neutral water immersion technique. Baseline Heart rate, Systolic and Diastolic BP were measured 0, 2 and 4 minutes in standing posture before and after microgravity simulation among these two groups. Statistical analysis was done using sampled and paired 't' test.

**Results:** CID was significantly found to be higher in RT Group at 0 minute as compared to endurance trained participants at a significance level of  $p < 0.05$ . It was also found that fainters had a significantly higher CID than non fainters at 2 minutes ( $p < 0.05$ ). This study showed highly resistance trained participants were more susceptible to orthostatic stress as compared to endurance trained participants. **Conclusion:** CID may be utilized as a screening technique to detect susceptibility to orthostatic challenge on a larger sample through ground based simulation studies. Quantification of training in terms of endurance versus resistance training had given controversial results and hence warrants extensive studies to derive the protective role in prevention of orthostatic hypotension following microgravity exposure.

### Screening For Haemoglobinopathies Using Hplc Among Candidates Aspiring For Induction In Armed Forces At An Iaf Boarding Centre: A Retrospective Analysis

*Smita Rani Borgohain*

**Introduction:** Thalassemia and other structural haemoglobinopathies are the major genetic disorders prevalent in certain parts of the world including India. Candidates reporting for medical examination prior to selection in Armed Forces are screened for

haemoglobinopathies and if evidence of haemoglobinopathies are seen using HPLC, the candidates are considered unfit for service as such individuals cannot be deployed at high altitude.

**Objective:** To determine the prevalence of haemoglobinopathies among asymptomatic healthy AFCAT/NDA/CDS candidates.

**Materials and Methods:** The subjects were both male and female AFCAT/NDA/CDS candidates in age group 18 to 25 years. All candidates with or without microcytic hypochromic indices of anaemia were screened for haemoglobinopathies especially beta thalassaemia trait. Haemoglobin analysis was done on Bio-rad D-10 dual program (Extended Hb A2/F/A1c). Findings of the study were analyzed with suitable statistical method.

**Results:** A total of 637 individuals were included in the study over a period of 13 months between July 2022 – July 2023. Among them 419 (65.78%) were males and 218 (34.22%) were females. Out of the 637 individuals tested by HPLC, 27 individuals (4.23%) were positive for haemoglobinopathies (18 were males and 09 were females). Haemoglobinopathies identified in our study were Beta thalassaemia trait, HbE, HbD(Punjab) and HbS. Out of 4.23% haemoglobinopathies, Beta thalassaemia trait was 2.67%, HbE trait was 0.78% in the study population. Similarly other less common haemoglobinopathies were also detected. Other haemoglobinopathies in descending order of frequency were HbD(Punjab) at 0.62% and HbS at 0.16%.

**Conclusion:** The study gives us a comprehensive data on the prevalence of haemoglobinopathies in a seemingly normal population of Armed Forces candidates and reiterates that HPLC is a gold standard to help weed out individuals with abnormal hemoglobin. This will immensely benefit the organization and the Government exchequer from avoidable financial and manpower loss incurred towards training of unfit candidates.

### **Photo Dermatitis And High Uv Index In Jorhat (North East India) Due To Single Time Zone - A Study**

*Chetan Patil*

Photodermatitis is a group of skin conditions caused by a cutaneous reaction to UV rays. Photodermatoses differ in incidence and severity in North Eastern India; a study was conducted at 5 Air Force Hospital (AFH) Jorhat, which included 1000 patients attending OPD with Photodermatitis. Melasma, polymorphic light eruptions, and exacerbations of pre-existing dermatoses such as Discoid Lupus Erythematosus (DLE) were observed in these patients. The reason that appeared to be common among these patients was a shared Indian standard timing. The goal of this study was to look at the prevalence of photosensitivity disorders in India's north-eastern region.

## Lab In Space: Point Of Care Testing For Astronauts In Space Missions Of Emerging Economies

*Saswati Das*

Point-of-care testing (POCT) essentially provides laboratory testing at or near to the site of patient care. POCT cuts down the time to clinical decision-making with the potential for improved medical outcome on site, e.g. for astronauts in space station or deep space missions. At present, POCT on earth ranges from basic blood-glucose measurement, blood gas analysis, routine liver and kidney function testing to complex coagulation assays. Molecular diagnostics is also increasingly becoming point-of-care with miniaturization of instruments. POCT if performed incorrectly or utilized inappropriately can generate misleading results that require additional follow-up at increased cost and risk to the patient. This paper will focus on the advantages and limitations of POCT in Space Environment. We will also describe how to manage the quality of POCT in space stations and deep space missions in order to achieve optimal health outcomes. It is extremely essential to maintain the analytical accuracy of point of care tests in a microgravity environment. Other major concerns are pre-analytical errors, competency mapping, analytical interferences, interface challenges for quick transmission of data to physician/ researcher, difference of capillary, venous or arterial sample results and storage of consumables for testing. Industrial management techniques, such as failure mode and effects analysis (FMEA), Lean Six Sigma, can be applied to POCT to isolate and reduce the sources of testing error in all phases of the testing cycle. In deep space missions one of the fundamental foundations of quality POCT testing will be data management. Real time analysis of POCT data can show quality trends before they affect the result. With increasing venture of humans to space POCT will become an integral part to monitor astronaut health in future missions. The development of better technologies for POCT designed specifically to monitor astronaut health can also be used in low resource settings back on earth.

## Renewing The Understanding Of Aviation And Aerospace Medicine With Substitutive Physiological Adaptations To Weightlessness Beyond Boundaries Of Earth Environments

*Jayashri Devi Sharma*

**Aviators to Astronauts:** This past century, brave men took Balloons, Gliders, and Aircraft within the Earth's mantle of Atmosphere and Gravity with symptoms of "aerostllenia" and 'disorientation' overcoming pressure or weight. The impetus for basic "**Fitness to Fly**" and military uses after the WW1 established the field of Aviation Medicine in India, and, following WW2, encouraged even Medical Doctors, to become Pilots ( JD Sharma ICASMs 2008,2016). The most efficient of the pilot cadets with the endurance required for becoming a Test Pilot can be followed with Occupationally Important Qualities (OIQ) for real time training and performance (I V Agapov 1992) alongwith technically aided self-monitoring. "**Fitness in Space**" or Situational

Awareness are cued to altricial evolution and individual buoyant foetal development on Earth, and responsive in 'critical periods' to 'adequate environic invitation', with a Synchrony as a whole-body-mind syncytial composite continuum(JD Sharma 2019). Educational requirements for such multifactorial aeronautical/astronautical and technical supports for retaining medical normalcy need to be renewed, with the trained "Pilot" with basics in Substitutive Physiological Adaptations(O G Gazenko 1966), predominantly to Weightlessness(TR Macaulay 2023).

**Graviperception in Space:** Galileo's principle of Equivalence, Paul Bert's delineation of Barometric Pressure, and Natural motion in the Atmosphere reinforce the Homeostasis of the *Miliue Interiore* and its Adaptive responses by intersensory interaction and dynamic control mechanisms(T Mergner 1998). Gravitational forces and flow in and of Tissues, from the cardiac and larger muscles and returns from the lymphatics and interstitial spaces retain bodily architecture. Graviception is hardwired (M Jamon 2014 ), between the otoliths along its neural pathways ( JD Sharma 1977), with appropriate adaptation procedures, in parabolic and orbital flight (M Shelhamer 2012).

**Conclusion:** A dedicated syllabus for de novo rapid acquisition of precocial critical programming of functional capabilities to these new 'substitutive' adaptations, can be interdisciplinary for both Pilots and Clinical Physiology teams.

## **Suicide Prevalence & Cause Analysis In One Of The Commands Of IAF**

Vijay S

Each suicide is a preventable loss of life. In recent times, IAF has witnessed a raising trend of suicides which is a serious cause of worry and concern. Suicide is a combination of large factors i.e. Biological, Psychological, Social, work environment and these factors at times can act as tipping points. All these factors need to be analyzed, reduced and tackled. Losing a life to a 'deliberate self harm' is a preventable occurrence and is everyone's responsibility. Prevention of suicides is the concern of all in Air Force and is a complex task that requires integration at multiple levels, with all the agencies working towards a common goal in synergy. The most important of it is the issue of knowing the fighting troops. The seniors and supervisors have a large role in implementation of this aspect effectively by identifying the red flag signs of suicides among the personnel & families. The Commanders play a vital role in prevention of suicide. A study and detailed analysis of all the suicide and attempted suicide cases under HQ CAC AoR for the year 2022 has been carried out. The study brought out salient findings of the suicides and cases of attempted suicides with the various important factors that have contributed towards such incidents among the serving personnel and their families. Based on the study analysis, recommendations for suicide prevention will be discussed in the paper.



## Poster Session II

### Same Diagnosis, Different Story: First Case Of Holme's Adie Syndrome In Current Epidemic Of Viral Conjunctivitis

*Agrima Bhatia, Vikas Sharma*

A case of 35 years old healthy aircrew who presented with bilateral red eyes amidst eye flu epidemic with photophobia left eye, on examination detected to have anisocoria with LE dilated pupil and bilateral absent deep tendon reflexes. Pharmacological testing with diluted 0.1% pilocarpine resulted in constriction of the left pupil with no change in the right pupil. It's the first case of Holme's Adie syndrome in a case of viral conjunctivitis which highlights the importance of meticulous ocular examination even during an epidemic of eye flu which would prevent prejudice of any pre existing or co existing ocular finding. In view of the cohesive working environment and the critical involvement of man with machine amongst aircrew, over the counter treatment must be avoided and specialist consultation be sought by every patient. Moreover, the blurring of vision due to anisocoria can compromise flight safety even in conjunctivitis, therefore, a meticulous ocular examination must always supercede a cursory judgement, however, benign appearing the condition may be.

### MI – Air Evacuation – A Case Report

*Anurag Singh*

**Introduction:** The Indian defence forces including the paramilitary forces have a peculiar deployment across the length and breadth of the country throughout the year. This deployment ranges from deployment in highest battlefield like Siachen to the one across vast stretch of the ocean waters as in Andaman and Nicobar Islands. This deployment coupled with the organisational and operational requirement poses specific challenges in patient evacuation across varied terrains during any medical emergency wherein meticulous planning along with timely evacuation can change the fate of the individual. Air evacuation has provided a significant boon in patient transfer capabilities; however the same has its own share of peculiarities that need to be understood by the evacuating team along with the treating team in case both are different as encountered in some situations. Multiple factors contribute to the final outcome of the air evacuation including patient profile (diagnosis, condition of the patient), air evacuation profile and aircraft type.

**Case Report:** A young male with no MCRF presented to a peripheral MI room with chest pain wherein he was diagnosed with STEAWMI and was referred to a zonal level hospital. Crucial delay in timely communication and evacuation led to failed thrombolysis thereby jeopardising the cardiac functionality of the patient. He was thereafter evacuated by air to a tertiary care center for definitive management. In view of him being intermediate risk for air travel PTU team was utilised for the air evacuation.

## Comparison Of Outcomes Of Simulated Ejections Among Trained And Under-Trainee Aircrew During The Training On Ejection Procedure Simulator (Eps)

*HM Keshava Murthy, SS Mohapatra, Omesh Nath, DD Ghosh*

**Introduction:** Though advance technology largely assists in successful ejection and recovery of aircrew, safe ejection critically depends on timely decision to eject and pulling the handle while maintaining correct ejection posture. Hence, proper indoctrination of fighter aircrew in various aspects of safe ejection is of paramount importance. Realistic ejection procedure training of aircrew in safe and controlled environment is possible through ejection procedure simulator (EPS). IAF has acquired EPS and started ejection procedure training to its ab-initio as well as trained aircrew on regular basis. This study was carried out to compare the outcome of ejection sessions of trained aircrew and under-trainees/cadets.

**Aim & Objective:** To analyse the data generated during ejection procedure training and determine the common causes of ejection failure in the simulated conditions in the EPS.

**Material & Methods:** There were 312 participants, which included 53 trained aircrew from fighter stream and 259 pilot course trainees (under-trainee aircrew/cadets). The newly commission EPS was employed in this study. Data was collected on the outcome (success or failure) of ejection sessions and if failed then causes of the failure of ejection. Chi square statistics was used to compare the proportions among trained aircrew and under-trainees/cadets.

**Results & Discussion:** A total of 780 ejection sessions were conducted. Successful ejection occurred in 605 (77.56%) session. Ejection was failed in 175 (22.44%) sessions. In the trained aircrew category, 112 (77.78%) successfully performed the simulated ejections and 32(22.22%) could not. Similarly, in the under-trainees/cadets category, 493(77.52%) successfully completed and 143 (22.48%) failed in the simulated ejections. When analysed using chi square, the difference of success/failure proportion was not statistically significant ( $p = 0.892$ ) among trained and under-trainee aircrew categories. Ejection failure was either due to incorrect posture or delay in ejection. Most common reasons for failure to eject were due to incorrect hips (seat) position activating the hip sensor followed by incorrect head position activating the headrest sensor. Activation of pedal sensor due to incorrect feet position over pedals is found to be next common reason and is significantly more among under-trainees. Delay in ejection (N=5) due to failure in taking timely decision to eject is nil among trained aircrew and 5 (3.5%) among trained aircrew which lead the simulated air crash. When ranked, there was no difference in the cause for ejection failure among trained aircrew and under-trainee officers. Delay in ejection due to failure in taking timely decision to eject was also compared in these groups. No trained aircrew logged for delayed ejection whereas 5 (3.5%) under-trainee officer recorded delayed ejection leading to the simulated air crash.

**Conclusion:** Apart from under-trainees/cadets, all fighter aircrew should undergo training on EPS and same should be repeated at regular interval. Squadron flight

surgeon should indoctrinate squadron aircrew on ejection procedure, decision making, correct ejection posture and importance of practicing spinal strengthening exercises.

## Report On Subject Matter Expert Exchange (SMEE) To Republic Of Korea

**Introduction:** A three member team of Subject Matter Experts (SME) visited Republic of Korea (ROK) from 05 Jul to 07 Jul 23. The visit was towards sharing of knowledge and understanding best practices to enhance Defense cooperation and bilateral relations between both the countries.

### Details of the Visit.

**Assets and Bases Visited:** The delegates visited the 17 Fighter Wing having two fighter squadrons (F 35A), one Missile squadron (Patriot) and 6<sup>th</sup> SAR helicopter Group at Cheongju-si Airbase on day 1. The Aerospace Medical Centre and the Aerospace Medical Training Centre located in the same town were visited on day 2.

**Visit to 17 Fighter Wing:** Two (2) Fighter Squadrons of type F-35A are present at this Wing.

**Visit to Medical Squadron:** Visited various subsections of medical squadron and available facilities.

**Integrated System Operations Squadron (ISOS):** It has training facilities for the maintenance staff.

**6<sup>th</sup> SAR Group:** Consists of various types of helicopters that include Black Hawk (HH 60), Chinook (H 47), Kamov (H 32).

**Aerospace Medical Training Centre:** This centre is equivalent to AMTC, IAF is equipped with state of the art aeromedical simulators like Human Centrifuge, Decompression Chamber (DC), Rapid Recompression Chamber (RRC), SD simulator, Ejection Procedure Simulator (EPS) and Night Vision Goggles (NVG) laboratory.

**Conclusion:** ROKAF acknowledges the extensive and structured Aeromedical training available in IAF. The visit was a learning experience to both Air Forces. Such engagements are considered essential to refine and evolve SOP and Aeromedical Decision making policies in the IAF by learning and adopting best practices of other operators.

**Lessons Learnt:** The visit was a learning experience for both IAF and ROKAF. The visit to 17 Fighter Wing and Aerospace Medical Centre of ROKAF brought out some issues of comparison and observation.

### **Aerodontalgia – A Case Report**

*Jaipreet Singh Joneja*

**Introduction:** Barometric pressure-induced dental pain, commonly known as barodontalgia or aerodontalgia, is a recognized clinical condition caused by changes in atmospheric pressure. It is of particular concern among pilots, as it can pose a flight safety risk and impact the operational capabilities and performance of personnel. Barodontalgia may go unnoticed until a pressure change occurs, such as during ascent or descent of a flight. Its signs and symptoms can overlap with other dental conditions, further complicating its diagnosis and management. Therefore, understanding and addressing the impact of barodontalgia on pilots is essential for ensuring their well-being and the safety of air travel.

**Case Details:** This case report describes the management of acute exacerbation of a chronic periapical abscess, presenting as severe aerodontalgia in a 27-year-old pilot. The patient reported excruciating toothache during flights, which prompted a dental evaluation. Clinical and radiographic examination revealed a periapical radiolucency involving teeth 21 and 22, with superior extension towards the nasal floor. The treatment plan involved root canal treatment, apicoectomy with cyst enucleation, and long-term follow-up. The surgical procedure was successfully performed, and the patient experienced an uneventful recovery. Aircrew was evaluated by local Aerospace Medicine specialist and was flown as a passenger prior to clearance for flying duties.

**Conclusion:** This case report highlights the importance of prompt diagnosis and appropriate management of aerodontalgia to ensure the airworthiness of flyers.

### **Poster Session III**

#### **Sports Injuries In Aircrew: Prevention**

*Pallavi Goswami*

Injury due to military or sporting activities is tissue damage or derangement of normal physical function due to participation in training resulting from rapid repetitive transfer of kinetic energy. When one has pain from a particular movement or activity, one should ideally stop right away, as continuing the activity may cause further harm. The goals of treatment for a sports injury are recovery of the injured part of the body and prevention of future injuries.

Treatment for sports injuries varies widely, based on mechanism of injury, acute/ overuse/ training/ technique, depending on the type and severity. Many sports injuries heal in a few days or weeks with rest and at-home strategies. However, for an aircrew

and his task at hand, when the reason is surfaces, shoes, equipment, biomechanical abnormality, macroscopic damage can occur with rapid onset of compromising symptoms. Knowing the cause has implications in injury prevention, which is especially important to an aircrew. While extrinsically generated forces can be modified, the intrinsically generated forces (in acute injuries) would include enhancing the aircrew's muscle strength, endurance, flexibility, motor control, joint range, proprioception and biomechanics. The aim is to return to full active functioning status/ health and also to prevent reinjury, in all the sports that an aircrew might be participating in. Here, it is most important to avoid HARM (heat, alcohol, running, massage). Prevention of injury, emergency first response, PRICE and support with recuperation are important aspects of management that treat and rehabilitate in any sports/ training injury.

### **Recurrent Bilateral Nasal Polyp- A Case Report**

*Tushendra Singh Rana*

**Introduction:** Nasal polyps are painless and benign growths in the inside of nose and sinuses. They are caused due to infections and allergies. Incidence in our country is 1-4% of adult population.

**Case details:** 30 years old helicopter pilot with approx. 120 hours of experience was diagnosed as a case of Bilateral Sinonasal Polyposis, after he presented with complaints of nasal obstruction, headache, facial heaviness and hyposmia. He was initially managed with intranasal corticosteroids for 03 months and then underwent Functional endoscopic sinus surgery with endoscopic septoplasty. In the post operative period, due to recurrence of polyps, he was started on anti-IgE antibody injection.

**Discussion:** According to IAP 4303, all cases after FESS are observed in non-flying category. If the surgery is successful and the airway is adequate, the aircrew is assessed for their ability to equalize sinus pressure, preferably, in the Altitude Chamber prior to award of flying category. Recurrence rate of nasal polyp after FESS is 15-25%.

**Conclusion:** Due to recurrence of polyps after surgery, the aviator has been placed in permanent low medical category and is unfit to fly.

### **Normal Digital Contribution To Grip Strength Assessed By Digital Hand Grip Dynamometer**

*Raghunandan V, Binu Sekhar M, Srihari I, Tripathy NK*

**Introduction:** Hand grip strength is an objective measurement of function in the upper extremity and is an important component of Human Engineering assessment. The existing normative data on hand grip is limited due to a small sample size and data has only been captured for the overall force exerted by all fingers collectively, without accounting for the individual contribution of each digit. It has been observed



that functional evaluation of individuals with partial digital amputations requires consideration of the specific contribution of each finger to hand grip. The purpose of this study was to measure the individual digital contribution to total grip strength using a digital hand held dynamometer.

**Material and Methods:** A digital dynamometer was used to assess the contribution of individual fingers to total grip strength in 400 hands from 200 healthy subjects. The dynamometer recorded force data from each digit (index, long, ring, and small) and cumulative grip. The normative values and percentage contribution of each finger force to total grip force was calculated for dominant and non-dominant hands.

**Results:** Individual digital contributions to total grip strength were approximately 28.5%, 34.3%, 24.2% and 13% for the index, long, ring and small fingers respectively. The average percentage difference between dominant and non-dominant hands was approximately 30%. This pattern was consistent irrespective of hand dominance and grip strength.

**Conclusion:** The results of this study can help determine the functional loss of grip after injury and provide design implications for equipment in the workplace. A knowledge of individual digital contribution to total grip also provides insight into the mechanics of grasp and enhances our understanding of the complex function of the hand.

## **Accidental Exposure To Cyanide In An Occupational Setting : A Case Report**

*Abhay Singh Tomar*

Cyanides are highly toxic substances which cause cytotoxic hypoxia due to inactivation of mitochondrial cytochrome oxidase. Cases of cyanide poisoning are rare these days, and are generally seen due to accidental exposure. Cyanide compounds have multiple uses in industry with concomitant risk of accidental exposure in such occupational settings. We report a case of a 20 year old serving air warrior working in the electroplating section at the industrial facility of a base repair depot, who had an accidental exposure to cyanide due to splashing of the liquid on his face and eyes. He was brought to the Station Medicare Centre with restlessness, tachypnea, conjunctival congestion and nasal bleed. He was managed with immediate decontamination and Amyl nitrate inhalation, along with supportive treatment and further managed at nearest tertiary level service hospital with analgesics and steroid eye drops. The prompt response and definitive treatment resulted in uneventful recovery without any neurological deficit. Keywords- amyl nitrate, cyanide, cytochrome oxidase, cytotoxic hypoxia

## **Retrospective Audit Of Medical Evacuations In The IAF In Recent Past**

*Raghunandan V, Tripathy NK, Bhatia M*

The Indian Air Force (IAF) has been carrying out extensive medical air evacuations (MEDEVAC) not only of serving personnel but also of dependent families and are carried out for variety of medical emergencies. Most of the evacuations are assisted by Critical Care Air Evacuation Team (CCAT), while some are without due to certain constraints. The type of aircraft used for MEDEVAC also varies, depending on the location of the patient and distance from the tertiary care centre. The cornerstone of medical air evacuation is the form, fit and function of the provision of en-route care, for which a Patient Transfer Unit (PTU) is utilised during most of the air evacuations. The pre-flight, in-flight and post flight parameters along with the in-flight care given during MEDEVACs are also recorded for documentation and analysis. This paper presents a retrospective analysis of such MEDEVACs carried out across the country by the IAF. The results provide an in-sight into the variety of medical emergencies, patient conditions, air sectors, pre-flight, in-flight and post-flight physiological status, in-flight interventions and difficulties faced during such evacuations.

## **Otolaryngological Challenges In Prolonged Spaceflight: Assessing And Addressing Vestibular And Auditory Changes In Zero Gravity**

*Sanjay Kumar & Angshuman Dutta*

With the increasing scope of space exploration, particularly in the context of extended missions like expeditions to Mars, there is a growing emphasis on understanding and addressing the health-related obstacles encountered by astronauts. One of the issues that arises in the distinctive environment of space is the issue of otolaryngological health, which gives rise to both immediate and long-term concerns.

This study explores the impact of zero-gravity conditions on the auditory and vestibular systems, encompassing both fundamental physiological adaptations and the clinical implications experienced by astronauts. This study aims to go deeper into the diagnostic techniques specifically designed for limited space environments, as well as proactive management strategies and preventive measures that can be used. There is a significant emphasis on the necessity of doing advanced research, particularly in anticipation of forthcoming longer and lonely missions. Comprehending and effectively tackling these issues is not solely a question of accomplishing our mission objectives, but also of safeguarding the comprehensive welfare of our space explorers.

## Poster Session IV

### To Study The Changes In Pulmonary Volumes, Flow Rates And Capacities Following 12 Hours Of Dry Supine Immersion

*Hemanth KA, Sharma V, Malhotra VK, Mahopatra SS*

**Background and Objective:** Studies conducted on respiratory changes in microgravity are usually for long duration exposure. A study of pulmonary responses to short term exposure to micro gravity would provide valuable inputs in formulating counter measures and also in designing training schedules. The study was designed to assess the pulmonary changes and changes in Indian male subjects before and after exposure to simulated microgravity for 24 hrs.

**Methods:** Twenty healthy male volunteers with age of  $27.1 \pm 4.7$  years, participated in the study. The Dry Supine Immersion tanks with a capacity of 1000L of water were used to simulate weightlessness. All participants were examined thoroughly and ensured that they were free of any kind of physiological, physical, and psychological pathologies. Atrial exposure to dry floatation for 60 min, and the method to exert maximal voluntary contraction was undertaken for each participant. Ganshorn spirometer was used to test both the forced spirometry and single breath diffusion. Parameters of forced spirometry and parameters of single breath diffusion were measured pre and post exposure of 12 hours of microgravity. The mean values of all parameters were measured. The results were collated and analyzed using paired t-test.

**Results:** Shapiro-Wilks statistic was carried out to test the normality of the data. Student's paired T-Test was used to analyze and compare means of all parameters which were normally distributed and Wilcoxon test was used to analyze and compare the means of parameters which were not normally distributed between pre and post exposure to microgravity. There is statistically significant increase in both DLCO and KCO when compared to pre-exposure values. There were changes in parameters of forced spirometry and other parameters of single breath diffusion when compared to pre and post values; however, the changes were not statistically significant.

**Interpretation & Conclusion:** 12 hours of exposure of an individual to dry supine immersion causes an individual to lose body fluids, thus reducing his weight and also changes in the lung volumes, capacities and diffusion rates through the respiratory membrane. Probable reason for increase in values of DLCO and KCO was nullification of zone distribution of lungs as the ventilation and perfusion were optimised throughout lungs. Recruitment of blood vessels in the alveolo-capillary membrane might be one of the factors for the increase in the diffusion capacity. This might be due to the nullification of the zones in the lungs due to microgravity and optimisation of the ventilation and perfusion and also due to the recruitment of blood vessels in the alveolo-capillary membrane. There were no significant changes in the forced spirometry and the other parameters of the Single breath diffusion noted in the study.

## **Unexplained Physiological Event In A Modern Fighter Aircraft: A Case Report**

*Iyer Srihari, Sarkar Ranjan*

**Background:** A Physiological Event (PE) occurs when an aircrew experiences physiological symptoms in the aircraft which can be attributed to a known or suspected aircraft and/or aircrew systems malfunction. PEs can occur in-flight, on deck, or manifest post-flight with a delayed onset of aircrew symptoms. These symptoms include cognitive impairment, numbness, tingling, light-headedness, behavioral changes, and fatigue that may be life-threatening. In the recent past, PEs have drawn significant attention especially in aircrew flying advanced fighter aircraft. Investigation into PEs are at several instances unexplained and hence have been called “Unexplained Physiological Events” (UPE). This case report presents one such manifestation of an UPE in flight in a fourth-generation fighter aircraft.

**Case Report:** A 36-year-old pilot flying a fourth generation fighter aircraft heard an alarm indicating cabin depressurization when he ascended above 41,500ft. He noticed that the noise level in the cockpit increased and communication with the Weapon Systems Operator (WSO) was also difficult. He started descent when he experienced the smell of smoke in cockpit, severe pain in his joints and muscles, inability to read instruments properly due to the watering in his eyes, creeps and misinterpreted the cabin depressurization light as warning light for the left engine, switched off the left engine and executed safe single engine landing. He continued to experience the symptoms for 15-20 mins post landing. The WSO, however, reported no symptoms.

**Discussion:** Investigation into this Unexplained Physiological Event remains inconclusive. This case report discusses approach to investigation of an UPE wherein there was a suspicion of altitude decompression sickness.

## **Outbreak Of Food Poisoning At Military Establishment**

*Aniket Kulkarni, Harpreet Singh, Manohar Dutt*

**Background:** An outbreak of food poisoning was reported from a Military establishment between the period 15 to 17 Oct 22 when 70 cases of food poisoning reported sick over the span of few hours.

**Methods:** It was retrospective-prospective study in which data regarding the chronology of events, symptomatology profile, history of food items consumed and their preparation was collected. A detailed inspection of the mess premises regarding its hygiene and sanitary status, cooking and storage procedures, water points including the overhead tanks was conducted. Food and water samples for the past 24 hrs were ceased and sent for analysis at public health lab. Patients’ stool samples were sent to military hospital for analysis.

**Results:** A total of 70 cases of food poisoning occurred between period 15 to 17 Oct 22. These cases had symptoms of diarrhea (79%) fever (50%), abdominal discomfort (46%), headache (22%) and vomiting (7%). All individuals were treated at military set

up and recovered fully without any sequel. Epidemiological investigation was carried out which incriminated Groundnut & Coconut Chutney served during breakfast on 15 Oct 22 as the food item responsible for outbreak prior to arrival of lab reports. Lab investigation revealed growth of E Coli (EPEC) from chutney, water sample from the cook house tap and the stool samples from the patients.

**Conclusion:** The food poisoning incident occurred due to consumption of common breakfast food (Chutney) which was contaminated during its processing by use of contaminated water from a cook house tap.

### **Android Phone Based Audiometry For Screening Of Hearing Loss**

*Sunil Mathews, Angshuman Dutta*

**Introduction:** Hearing loss can have severe effects on the individual. In order to intervene and rehabilitate, early identification of hearing loss is essential. There is a need to adopt newer methods of screening which can provide easy access for patients. Self-assisted mobile audiometry can be useful for regular hearing health assessment of a large number of people. The aim of this study was to evaluate the use of android application-based hearing audiometry as a screening tool in comparison to pure tone audiometry.

**Material & Methods:** A study of hearing assessment in 100 ears was carried out at a tertiary care centre. All underwent android based app based audiometry called 'hearing test' which was self administered and the results were compared with conventional pure tone audiometry which is the gold standard.

**Results:** Paired t-test was conducted to determine difference between mean air conduction thresholds on Hearing App compared to audiometry. Android based hearing audiometry was found to be 69.3% sensitive and 100% specific in detecting hearing loss > 25 dB HL and 90% sensitive and 100% specific at > 40 dB HL.

**Discussion:** Android based hearing audiometry is a feasible option for screening of hearing loss where pure tone audiometry is not available as in remote peripheral locations of Armed Forces deployments. Although specificity is low to diagnose mild hearing loss, it is highly specific in diagnosing hearing loss more than 40 dB HL.

**Conclusion:** The application can be used for screening of hearing loss in peripheral areas as well as for self screening by anyone without visiting an ENT setup.

### **KAP Of Armed Forces Personnel In An Air Force Station Regarding Obesity**

*Anubha Shukla, Deepa KR*

**Introduction.** Obesity and overweight are conditions involving excess deposition of fat which impair health. They have the propensity to increase the burden of various other non communicable diseases like hypertension, diabetes etc. A basic understanding of overweight/ obesity is an essential element to curb the fat in high risk individuals. This study aims to assess the knowledge attitude and practices of already overweight individuals regarding obesity.



**Materials and Methods.** A cross-sectional survey was undertaken at an Air Force station wherein the individuals enrolled for lifestyle modification clinic were included as study subjects. A total of 92 subjects were enrolled and data was collected by using a pre-validated, self administered questionnaire. Variables like weight, height, BMI, WHR and KAP scores were obtained. Descriptive statistics were used to depict age group and overweight status and chi-square test was used to assess associations between categorical variables.

**Results.** The results show that more than majority (43.5%) of the participants belonged to the age group between 36 to 45 years and 55.4% belonged to overweight-II. 32% of the participants have good knowledge, followed by 65% of them having a positive attitude, however the knowledge and attitude did not translate into optimal practices. Knowledge and attitude, however, showed significant association.

**Conclusions.** The study concludes that the participants did have good knowledge and attitude towards obesity but the same did not manifest into practice of controlling their weight gain and reverting towards standard weight. Repeated efforts and reinforcements are essential in creating awareness regarding weight management methods which are feasible and acceptable to the population.

## Poster Session V

### Adult Onset Myopia – A Case Study Of Flight Cadets In Indian Air Force

*Sourav Gain, Namita Choudhry*

Myopia or short-sightedness is a type of refractive error in which parallel rays of light coming from infinity are focused anterior to the retina when accommodation is at rest. It is one of the common refractive errors worldwide. While myopia often starts and progresses during childhood and adolescence, the refractive changes associated with myopia can continue into adulthood. Manifestation of myopia during adulthood is referred to as Adult-Onset Myopia. These individuals are emmetropic during their childhood and adolescence but later on become myopic in subsequent years. Aeromedical consideration will include progression of myopia and its complications like retinal detachment, open angle glaucoma and degeneration of retina. Spectacles and contact lenses enhance susceptibility to spatial disorientation, displacement when subjected to increased G forces and loss during ejection which has led to preparation and implementation of policies to safeguard aerospace safety. This paper presents 02 cases of Myopia in which the applicants were emmetropic during their initial/special medical board while entry in National Defence Academy and Air Force Academy but later on became myopic post attainment of adult age which was detected during medical examination prior to commencement of flying in one case and after few initial flying sorties in the second. Both these cases were referred to the Institute of Aerospace Medicine for comprehensive evaluation by ophthalmologist and aeromedical disposal.

## A Case Of Guillian Barre Syndrome In A Fighter Pilot: Aeromedical Decision Making

*Shireen Deepthi S, Karthikeyan, Devdeep Ghosh*

**Introduction:** Guillian-Barre syndrome (GB), also known as Guillain–Barré–Strohl syndrome, Landry's paralysis, postinfectious polyneuritis is an autoimmune attack on peripheral nerves mediated by antibodies produced in response to an antecedent infection. Characterised by weakness and tingling sensation in the lower extremities which gradually ascends to upper torso and to face. In some cases, the weakness might progress to paralysis and can result in breathlessness due to paralysis of respiratory muscles. Cause is not fully understood but it does hold the involvement of viral or bacterial infection. The antecedent infection could be a gastrointestinal disturbance or a simple flu. Diagnosis is made by raised CSF protein levels and Nerve conduction studies. Outcome of an aircrew with GB syndrome makes him/her unsuitable for flight safety. Diagnosis includes CSF analysis and Nerve conduction studies. Prompt diagnosis at right time, initiating treatment at early phase can hasten patient's recover.

**Case Report:** A 35-year-old fighter pilot with 1050 flying hrs. Had no co-morbidities reported with complaints of tingling sensation over feet followed by hands, associated with gradually progressive weakness in both lower limbs. There was a history of loose stools 14 days back. He was evaluated and found to have flaccid quadriplegia with areflexia. He was admitted in ICU for paresthesia investigation by neurologist. His CSF analysis revealed Albumino-Cytological Dissociation and Nerve conduction studies were suggestive of GB syndrome. He was managed with IVIG and supervised with physiotherapy, leading to favorable response. He was observed in the non-flying category for 9 months and gradually upgraded to full flying category after obtaining opinion from Neurologist and complementary in-flight assessment on his flying performance in his type aircraft.

**Discussion:** The prevalence of GB syndrome in India is 1.55/100,000. However, similar case studies in aviators have not been done yet. The significance of this syndrome in aviators is that it interferes with the cockpit worthiness. The emergency ingress and egress along with the actuation of aircraft controls is challenging. It has aerospace safety implications. An effort has been made on detailed evaluation, aeromedical concerns, and disposal of GB syndrome to assess the aircrew safely back to flying without compromising safety aspect in this paper.

## Psoriatic Arthritis In Military Flying: Aeromedical Concerns And Disposal

*Biswajit Bhowmick, Gaurab Ghosh*

Psoriasis is a relapsing inflammatory skin disease that occurs in 1–3% of the world's population. PsA affects 0.1%–1% of the general population and ~20% of patients with psoriasis. Psoriatic arthritis (PsA) is a chronic inflammatory joint disease which can develop in patients with psoriasis. Etiology of the disease is still unclear but a number of genetic associations have been identified. Inheritance of the disease is multilevel and the role of environmental factors is emphasized. Destructive changes in bones usually appear after a few months from the onset of clinical symptoms median time from psoriasis to psoriatic arthritis is 36 months (1.0 - 153.4 months). Typically, PsA involves joints of the axial skeleton with asymmetrical pattern of involvement. Imaging plays an important role in the diagnosis of PsA and X-ray is used as initial modality to check for PsA, there are newer imaging modalities, such as ultrasonography (US), computed tomography (CT) and magnetic resonance (MR), have been developed are important diagnostic tools for evaluation of rheumatoid diseases. They enable the assessment and monitoring of early inflammatory changes. Aeromedical Considerations include the disease sequelae like persistent clinical symptoms like the psoriatic lesion can cause difficulty in using flying clothing's as humidity and heat can aggravate the symptoms of psoriasis, restriction of movement making actuation of switches, emergency egress from aircraft difficult and Side effects of the disease modifying drugs like recurrent infection like URTI, nausea, vomiting making flying difficult. Further, many DMARDs are not compatible with flying as it can cause in-flight incapacitation which can compromise flight safety. This paper presents a case of Psoriatic arthritis in a military aircrew and its disposal in aviation.

## Telemental Health Care: An Effective Alternative Way To Psychological Well-Being For Aircrew In Iaf

*Akansha Gautam*

**Background:** Mental health has been stigmatized and underrated in Military aviation and civil aviation as well. Pilots may feel that visiting counsellor/ psychologist may affect their flying career. However, there have been initiatives by the authorities to lessen the stigma attached to obtaining mental health treatment and to motivate pilots to speak out about their psychological disturbance.

**Objectives:** The aim of this research is to promote telemental health care system for IAF aircrew. Furthermore, it is to provide an insight regarding telemental health and its benefits for IAF aircrew.

**Method & Sample:** A comprehensive review of the telemental health literature was conducted for the period of 2003 to 2023. A small questionnaire was developed to determine whether telemental health care systems are needed by the aircrew in

IAF. The authors reviewed the published literature to synthesize information on what is and what is not effective related to telemental health.

**Findings:** Telemental health is effective for diagnosis and assessment across many populations. Telemental health is helpful and increases access to care. Telemental health can help reduce the stigma often associated with seeking mental health services

**Implications:** Telemental health care can provide effective and adaptable solutions to the care for aircrew who are struggling with poor mental Health. It is beneficial for all aircrew irrespective of any stream, experience, rank, and age. Telemental health is the most appropriate mode of care for their specific needs and circumstances.

## **SMO's Conference: Guest Lecture**

### **HONEST (Healthcare Online Near Miss and Sentinel Events Tracker)**

*S Souche*

**Introduction.** Ensuring safety of patients during their management is a most vital consideration as any accident during such care can seriously impact the outcome. Accidents occur due to active and latent errors. Learning from such errors helps us prevent/ mitigate their future recurrence. CHAFB is the nodal centre for patient safety in IAF. A software-based system named "HONEST" was conceived and developed as an incident reporting and Learning system to capture adverse events in healthcare and analyse them and make appropriate rec across the entire Med services in IAF.

**Material & Methods.** The requirement for an incident reporting system were analysed. Maintaining anonymity of the reporter and feedback on rec to him/ her was defined as an indisputable criterion. The software was designed on AFNET platform using HTML, CSS, ASP, Javascript / JQuery & Visual Studio.Net Frontend and MySQL backend. Separate modules were made for reporting and analysis. **Results.** An online reporting system has been created for reporting and analysis of near-miss and sentinel events pertaining to patient care across entire IAF. Anonymity of reporter is ensured. Structured feedback allows for lucid root-cause analysis of the report. Recommendations made on the report will be available to the reporter. **Discussion.** Lessons learnt from each event will be disseminated pan IAF to avoid their repetition in every unit. Thus, patient care will become safer all over IAF.

## **CME Session: Indian Space Mission – A Step Forward!**

### **Development of Real-Time Psychomotor Function Evaluation Test for a Space Mission**

*Abhishek Jha, Imtiaz Ali Khan, Ch N Sowghandi, Stuti Mishra*

A trained and vigilant crew capable of executing the tasks as well as handling any off-nominal scenario is a vital asset for any manned space mission. Spaceflight is associated with its unique set of stressors to the crew such as isolation and confinement, periods of monotony and high workload, sleep deprivation due to disturbed circadian rhythm, etc. It may lead to neurocognitive changes, fatigue and increased likelihood of errors compromising the mission. Therefore, there is need for deployment of a tool for assessment of the neurocognitive state of the onboard crew. Few space agencies such as NASA have deployed computerized versions of Psychomotor Vigilance Task (PVT) to assess the impact of sleep loss and circadian misalignment on the crew's abilities in long duration mission assignments on the International Space Station (ISS). This paper discusses the development of a software tool based on short duration Real Time Self-Assessment which can help in assessing various aspects of Crew's neurobehavioral state such as sustained attention, visuo-spatial organization and memory. This tool is envisaged to be a check-point to evaluate the awareness of the crew before any critical spaceflight operations during the mission as well as assess the impact of any-nominal event (physical injury, hypoxia, toxic exposure etc).

### **A Roadmap to Astronauts' Water Survival Training & Strategic Rescue Post Splashdown**

*Ghosh G, Mishra S, Sannigrahi P, Prusty P, Chandrawanshi S*

Planet Earth offers two elements on which a spacecraft can carry out landing – land (touchdown) and water (splashdown). This means that the recovery techniques would have to be divided and therefore training to survive both on different terrain conditions and in water would also have to be imparted to the astronauts. Where the Russian Cosmonauts traditionally have been carrying out touchdown with their Soyuz MS space vehicle on the terrains of Kazakhstan border, the American counterparts have resumed splashdown re-entry with the latest partially reusable SpaceX Dragon Crew Capsule. Astronauts' water survival training has been a major component of mission preparation. It encompasses both nominal and off-nominal situations that the crew may encounter during their return. This paper highlights various past and present water survival and crew rescue training procedures followed by international space agencies, and also attempts to come up with recommendations for water survival training and rescue plan for Indian astronauts-to-be in preparation towards Gaganyaan Mission.



## **Post-Flight Rehabilitation of an Astronaut after Long Duration Mission in Space: through the Eyes of a Flight Surgeon**

*Sannigrahi P, Ghosh G, Mishra S, Renjhen P*

Dwelling in the microgravity environment of space results in various physiological adaptations in the form of Cardiovascular deconditioning, Neurovestibular changes, loss of bone and muscle mass, etc. which effects the physiological functioning of the human body on return to earth. Hence, post-flight reconditioning programs are implemented by the International Space Agencies with an aim of returning the Astronauts to their pre-flight physical condition. This paper deals with the post-flight rehabilitation of an Astronaut conducted by a foreign Astronaut Training Centre, after his long duration mission of six months on-board International Space Station. The Rehabilitation program consisted of Post-flight Medical Evaluation and Post-flight Physical Reconditioning. With the advent of Human Spaceflight Programme, the lessons learnt in this rehabilitation program would be helpful in formulating post-flight rehabilitation protocol of Indian Astronauts after India's maiden Human Spaceflight mission as well as serve as a template for future exploration missions.

## **Conceptual Design of Extrication Device for Crew Rescue for Human Spaceflight Missions**

*Abhishek Jha, B Nagaraju, Satyam Malhotra, Sneha Dinakaran, Stuti Mishra*

Identifying potential safety risks to the crew and devising suitable mitigation strategy is integral to human spaceflight mission planning and execution, considering paramount importance to crew safety. One such scenario which has to be catered is the off-nominal landing where extrication of a potentially injured crew is a possibility. This requires design of a specialized device to extricate a potentially injured crew from the Crew Module for further medical intervention. The design of the extrication device has to factor the limited space within crew module to the rescue team. One of the major design requirements for extricating a potentially injured crew is to prevent secondary mechanical spinal injuries during the extrication process. This requires implementation of mechanical design solution for immobilization of the spine. Ease of deployment and operational usage during a rescue scenario with minimum number of personnel as well as extrication path should also be considered in view of the limited space availability within the crew module. The paper discusses some of these design requirements for the extrication device and presents an engineering design solution which can not only be deployed in space missions but also in similar scenarios in trauma injuries in road as well as aviation related accidents.

## **Analysis of Deep Learning Algorithms for Crew Health Monitoring Applications in Human Spaceflight Missions**

*Abhishek Jha, Imtiaz Ali Khan, Vishal Shukla, Anurag Kumar Sinha, Stuti Mishra, Punyashlok Biswal*

The effect of spaceflight on cardiovascular, neuro-vestibular, musculoskeletal system etc. has been a subject of study in previous as well as current human spaceflight missions. For missions in low earth orbit (LEO), near-real time communication and medical decision support from ground-based experts is possible. However, this requires continuous analysis of voluminous crew health data which is difficult even for trained ground expert. Real time medical support from Mission Control Centre for future human exploration missions to Moon, Mars and beyond will not be possible due to communication latency. Hence, there is a requirement for deploying a robust crew health monitoring and decision support systems for space missions. Artificial intelligence (AI) has emerged as a promising tool in this area. Deep learning is a subset of AI algorithms which is used to model complex data and comprises of multiple neural network layers. The objective of the current study is to review Deep Neural Network (DNN) based models for predicting cardiovascular anomalies using ECG data. Automated ECG analysis is a classification problem and, in this paper, two such DNN based models such as Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) are used to study ECG data and their respective capabilities in prediction of cardiac anomalies such as Arrhythmia are discussed.





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