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Critical Care Air Transport in Northern India: A Retrospective Analysis

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Introduction- Critical care medicine has developed and progressed by leaps and bounds in the recent past which resulted in better outcomes of critical patients.(1) Military operations along with natural or manmade disasters are two scenarios where critical patients are left in austere environment or the environment is made austere. Providing advanced life support facilities in the austere environment may not prove to be economical or sustainable, hence the need arose for mobile ICU or the CCATT (Critical Care Air Transport Team) for immediate and faster transport of critical patients to advanced ICU centers. Firstly, by doing this the critical patient is not denied the best available post resuscitation care and secondly the burden on medical resources at the periphery is reduced and they can concentrate on managing the less critical patients. Military medical concept of 'stay and stabilize' over the time, changed to 'scoop and scoot' with 'in transit stabilization'. Aero medical transport has its own challenges and constraints.(2) This requires proper planning and prior training of the CCATT. Although protocols are not formulated, endeavour is to integrate initial resuscitation of critical causalities at the peripheral medical set up with optimal post resuscitation care at advanced ICUs. CCATTs are tasked to simultaneously manage multiple high-severity casualties, and each team is trained to manage multisystem trauma, burns, shock, respiratory failure, and other serious illnesses and injuries.

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Critical Care Air Transport in Northern India: A Retrospective Analysis

M N Vijai [α], P R Ravi [σ] & Abhishek Patania [ρ]

I. Introduction

Critical care medicine has developed and progressed by leaps and bounds in the recent past which resulted in better outcomes of critical patients.(1) Military operations along with natural or manmade disasters are two scenarios where critical patients are left in austere environment or the environment is made austere. Providing advanced life support facilities in the austere environment may not prove to be economical or sustainable, hence the need arose for mobile ICU or the CCATT (Critical Care Air Transport Team) for immediate and faster transport of critical patients to advanced ICU centers. Firstly, by doing this the critical patient is not denied the best available post resuscitation care and secondly the burden on medical resources at the periphery is reduced and they can concentrate on managing the less critical patients. Military medical concept of 'stay and stabilize' over the time, changed to 'scoop and scoot' with 'in transit stabilization'. Aero medical transport has its own challenges and constraints.(2) This requires proper planning and prior training of the CCATT. Although protocols are not formulated, endeavour is to integrate initial resuscitation of critical causalities at the peripheral medical set up with optimal post resuscitation care at advanced ICUs. CCATTs are tasked to simultaneously manage multiple high-severity casualties, and each team is trained to manage multisystem trauma, burns, shock, respiratory failure, and other serious illnesses and injuries. CCATTs are a high-demand, low-density resource, designed for utilization within a full spectrum of operations, including disaster response, small-scale contingencies, homeland security, and war.

The concept of CCATT was first started in the US air Force and the CCATT in US consists of three persons including one physician specializing in critical care, pulmonology, or surgery, a critical care nurse and a respiratory technician. (3,4) In the Indian Air Force, CCAT team and its PTU developed a bit later and consists of an anesthetist and four operating room assistants trained in critical care and emergency procedures.(5)PTU is self-sustainable in terms of power and oxygen supplies for about 3.5 hours. This suits Indian conditions as the flying time is not more than 3 hours duration. For evacuation and transport of longer duration, suitable aircrafts having the facility for onboard charging of electro medical equipment and oxygen facility are utilized. Military aircrafts generally used are both fixed wing and rotary aircrafts based on the place from where medical evacuation has to be carried out. In the recent past, CCATT have been set up in North Eastern and Northern parts of India and evacuations are being carried out from areas in peace, counter insurgency areas and natural disasters like floods and earthquakes.

Limited studies exist regarding the epidemiology of patients transported by CCATTs internationally and almost nil in the Indian scenario. This study is intended to gain insight on the kind of critical patients encountered specially in a high altitude stressful physical environment (in northern India) which can prove to be helpful in deployment of suitable manpower and also in training of the CCAT team. Further we will discuss experiences and lessons learnt from CCAT missions.

II. Methods

This is a report of all the air evacuations done in the northern region of India from Dec 2015 to Dec 2016. During this period, a CCAT team was always at standby at Air Force Station; Hindan and CCAT missions were undertaken when required. Details of all the transfers were maintained in a standardized format. The current paper presents a descriptive analysis of these CCAT missions. Data was entered and analyzed using Microsoft Excel 2017.

III. Results

A total of 53 persons were evacuated/ transferred by air between Dec 2015 and Dec2016 with Air Force Station, Hindan (Ghaziabad) as its Nodal Centre. All the transfers were undertaken by missions dedicated for transfer of patients only.

Out of the tri-services, most transfers were for the Indian Army, 92.5% (49/53) and 7.5% (4/53) for the Indian Air Force personnel.

Just two (3.8%) transfers were for the dependents of serving personnel while 51 (96.2%) transfers were of the serving personnel.

The age of patients evacuated ranged from 20 years to 57 years old. Mean age of the people transferred was 35.7 years with a standard deviation of

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8.9. Median age was 35.0 years and 35.0 years was the mode too. Thus, it was a fairly normal distribution.

The flight time of missions ranged from 30 minutes to 210 minutes. The mean duration of flight time was 82.8 minutes with a standard deviation of 37.2. Thirty out of 53 transfers took 75 to 105 minutes.

Fixed wing aircrafts were used for all missions, while in one mission a helicopter was used too.

Transfers due to battle injuries were 14 (22.6%), whereas 41(77.4%) of the transfers were due to diseases/emergencies of non-battle origin.

Looking at the causes of transfers, 58.5% were from causes which can be classified as surgical, while 41.5% were by medical causes.

Table 1: Provisional diagnosis/cause leading to immediate transfer

Sr. No.	Type of disease	Frequency
1.	Cerebrovascular accident, CNS pathology	9
2.	Burns	6
3.	Abdominal Disease (UGI bleed, Ac. Pancreatitis, abdominal tumours, hepatic failure abdominal trauma)	8
4.	Respiratory Pathology	5
5.	Cardiac Event	5
6.	Gunshot/ Splinter injuries	12
7.	Snake bite	2
8.	Trauma to extremities (# femur, spine, head injury)	4
9.	Hypothermia	1
10.	Cellulitis/Sepsis	1

As seen in table 1, gunshot or splinter injuries were the most common cause leading to immediate transfer. Three gunshot injuries were in chest and abdomen each, one involved both chest and abdomen, two lead to fracture of femur, one was in neck and one in the head.

In flight interventions like intubation, anesthetic or analgesic medications, vasopressors were used in 42 (79.2%) of the transfers. A secure IV line was maintained before flight in all evacuations and around 80% patients were transferred with infusion of normal saline or ringers lactate.

Analgesic medications were used in 47.2% patients.

Oxygen either by a mask or endotracheal tube was administered in 60.5% of patients.

Around one fourth of the transfers were done along with a ventilator support.

Table 2: In flight interventions done in patients transferred by CCAT team

Sr. No.	On board Intervention	No. of patients administered
1.	Ionotropic support	8
2.	Anaesthetic drugs	6
3.	Urinary catheterization	2
4.	Intubation	1
5.	Bag and mask ventilation	1
6.	Amiodarone	1
7.	Pressure bandage	1
8.	Morphine	1

Patients were given priority for air evacuation based on severity of illness and requirement of air evacuation with priority 1 requiring immediate transfer to an intensive care facility. (5) One third of the patients transferred were in Priority 1. Around half of the patients were in Priority 2, while the rest one sixth were in Priority 3.

There were a few complications during some missions but there was no onboard death in any of the air evacuations. The complications sometimes encountered were bleeding from nose, broad complex tachycardia, delay due to bad weather.

Follow up data of 40 patients could be obtained. Thirty two (80%) of these patients recovered and were discharged or transferred back. One fifth of the patients died in the hospital.

IV. Discussion

CCATT in IAF took off in the year 2007 in the North Eastern region with Jorhat (Assam) as the nodal centre from where CCAT missions were managed. Subsequently, CCAT teams were also formulated at Hindon (near Delhi), since the last 2 years, to cater to the needs of the units in the Northern region of India. At Hindon, CCAT missions gained momentum and 53 evacuations of critical patients were undertaken from areas in peace, mostly due to very harsh environmental conditions and in anti-terror operations hostilities during a period of one year. The problems of the northern sector are different than the north eastern sector in terms of both environmental stresses as well as enemy hostilities. Most of the air evacuations in North India were for the Indian Army mostly from high altitude or areas where counter insurgency operations are undergoing. In these parts, air evacuations not only save life or limb, but also play a vital role in boosting the morale of the troops. If we look at the demography of patients, most of them are serving soldiers in the productive years of life. Around three fourths of the transfers are due to non-battle reasons, showing the importance of CCAT even in the times of peace.

The reason for transport of a patient can give us information about the requirement of equipment and training needs of member of CCATT. Our results show

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that traumatic injuries lead to around half of all air evacuations undertaken in North India and out of these the most frequent morbidity were gunshot wounds. This can be compared to the report by Mason et al (6) in the year 2006 on 133 patients transported from Balad Air Base, Iraq, over a period of on year. They also reported trauma to be the most common factor among patients undergoing air evacuation, but most common finding was burns as compared to gunshot wounds in the present observation. Medical causes like cardiovascular and respiratory diseases and hypothermia constituted about two-fifths of the patient transfers, which highlight the importance of availability of drugs, oxygen and ventilator support for the patients in the transport aircraft. Around one fourth of the patients transferred, were on ventilator emphasizing the training of CCAT team members in critical care and emergency procedures like endotracheal intubation and resuscitation. The average travel time seen in our study shows that the CCAT teams should be prepared to work in the closed environment of aircraft for around two hours, which may extend in some special cases. The two main restrictions faced in the aircraft are that of lack of space and aircraft noise that makes it difficult to pass instructions. Therefore, each member has to know his role and should be familiar to the working environment in an aircraft. In around 80 percent of the patients, some intervention had to be made. Mostly medicines or anesthesia drugs needed to be administered. A good practice therefore, done in all the patients was ensuring a secure IV before the transfer of patient to the aircraft.

In 2009, Bridges and Evers(7) performed the largest retrospective epidemiologic analysis of CCATT patients to date, reporting on 1,418 patients from Operation Iraqi Freedom/ Operation Enduring Freedom. This analysis revealed a high prevalence of traumatic brain injuries, soft tissue trauma, and burns. Because of this analysis, several troop surges have occurred, and mortality and morbidity rates have changed. The epidemiology reported in these studies suggests different injury patterns compared to previous wars. This is likely due to the changing nature of contemporary warfare, but may also be because of sampling during different stages in an ongoing armed conflict.

We can conclude that transport of critically ill patients has been successfully carried out in the Indian Air Force, but it is still in the developing phase and many possibilities are yet to be explored. The use of aero medical evacuations in the civil set up in India is almost negligible in India and can use experiences gained by the Indian Air Force. Although CCAT have not been deployed in disaster relief in India, there is a scope of application of CCAT teams in civil disasters and a model for this was described by Sariego J. (8)

This is the first analysis of its kind in India and therefore can act as a stepping stone for future research and evolution of CCAT in India. As it is a retrospective analysis, it lacked planning and collection of information actively. The information obtained was limited and a planned, goal oriented study is proposed with due consideration for follow-up of patients. Another limitation is the sample size, which was beyond the control of investigators for such type of analyses, but it has to be kept in mind that these missions are not so common and getting a big sample size will prolong the duration of observation. These studies suggest that a robust epidemiological analysis is required and the outcomes be disseminated regarding the type of patients generally encountered during CCAT missions. This also facilitates requirement of appropriate medical training for the personnel involved in CCAT and the equipment required. Air transport of critically ill patients is expected to rise in the future and research and innovations in this new field are advocated.

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