EXPERIENCES OF THE CRITICAL CARE AIR TRANSPORT TEAMS (CCATT) DURING OPERATION JOINT ENDEAVOR

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SUMMARY

For the past year, Critical Care Air Transport Teams (CCATT’s) from Keesler Medical Center, Keesler AFB, Mississippi and Wilford Hall Medical Center, Lackland AFB, Texas have been deployed to support Operation JOINT ENDEAVOR (OJE), the NATO peace effort in Bosnia. This is the largest operation involving the use of the CCATT’s to date. A CCATT consists of a physician specializing in intensive care medicine, a critical care nurse, and a cardipulmonary technician. The CCATT uses transport monitors, ventilators, portable blood analyzers and other medical equipment commonly used in our medical centers' intensive care units. The CCATT augments the standard aeromedical evacuation aircrew so that critically ill or injured patients may be evacuated from forward areas to definitive care hospitals. Otherwise, field hospitals in forward areas would have to provide care for these patients until they were stable enough to travel unaccompanied, creating huge logistical demands, or provide a physician to accompany the patient during evacuation, leaving forward field hospitals understaffed. Providing increased clinical capabilities aboard patient evacuation flights is not new. Several other nations' military medical services have extensive experience using enroute care providers to manage critically ill or injured patients during evacuation. During one year of the OJE deployment, the CCATT’s moved 44 patients in 42 missions. Of these patients, 22 required mechanical ventilation during the flight. Eight missions were transatlantic flights to return patients to treatment facilities in the United States. CCATT’s also redeployed to support the evacuation of foreign nationals from Liberia and rescue operations after the Khobar Towers Bombing in Dhahran. With the end of the "Cold War", a shift in military medical planning now calls for a reduced medical presence in areas of conflict and a subsequent increased reliance on patient movements out of theater for definitive medical and surgical care. The CCATT concept is an effective solution that fills the need for long range critical care air evacuation and easily integrates into the current aeromedical evacuation system.

INTRODUCTION

Casualty management today is marked by relatively dramatic changes from casualty management twenty to thirty years ago (Ref 1). There is limited air lift available. Combat forces today are smaller although more heavily equipped for more intensive battles. The time for build up of both combat as well as medical forces is limited as battles and engagements occur with relatively little warning. Because of the diverse locations and widely geographically spread areas of involvement, in-theater beds will be limited, especially in the first few days of combat. This is due to a multitude of reasons which include the disappearance of most permanent fixture overseas hospitals which can no longer be funded. Because of the multiple numbers of potential sites of battle, prepositioned medical assets are difficult to be placed in appropriate locations worldwide. Frequently, the nearest definitive care hospital may be in the continental US (CONUS). To increase survivability of casualties and also because of the higher intensity and larger number of critically injured patients with today's battles, we must be able to stabilize and evacuate critically ill casualties as soon as possible. This has led to the concept of continual en-route care so that from the initial intervention to definitive care there will be some surgical capability as well as en route critical care available. This concept is not a new one. It has been espoused for civilian trauma care (Ref 2) and by other military air evacuation services (Ref 3). Our current air evacuation system was originally designed for stable patients. Patients were required
to be in their convalescent stage, and require relatively minimal in flight care. More critically ill patients would have required medical attendants which would usually have been provided from the fixed base facility that was sending the patient. This system worked well for large numbers of patients that required relatively low level amounts of care. For these reasons, air evacuation personnel usually were not required to be current in critical care experience and this system was difficult on small field hospitals which frequently had to temporarily lose critical medical personnel for significantly long periods of time as medical attendants to accompany their sicker patients into the system. One solution to fix the ability to transport critically ill patients and not weaken field hospitals by taking medical personnel was a critical care air transport team. This system would upgrade the critical care capability of the air evacuation system and provide a critical care medicine capability wherever the air evacuation system goes. It would augment the air evacuation personnel and not replace them. It would allow evacuation of stabilized patients as early as combat day or C day. By augmenting air evacuation personnel, field hospitals would not have to give up their medical personnel and they would be preserved and remain in the field where they belong. These CCAT teams needed to be small, rapidly deployable, be relatively self sufficient and provide their own supplies and critical care capability. To maintain their critical care skills, preferably they should be medical center-based so they would have an ongoing daily experience with the critically ill patient. The personnel that would man the CCAT teams would be a critical care physician which in tertiary care hospitals is a critical care trained surgeon or a board certified emergency room physician. A critical care nurse should also augment the team and this can be a medical, surgical or emergency room nurse. Additionally, because of the difficulties with respiratory circuit configuration in multiple different kinds of aircraft, an experienced respiratory therapy technician is essential to the team. The CCAT team concept was developed several years before Operation Joint Endeavor (OJE); however, OJE provided the first opportunity for an extensive real world test.

DEPLOYMENT PHASE OF CCATT

Three OJE CCAT teams were deployed; two from Wilford Hall Medical Center, one from Keesler AFB Mississippi. One team went to Ramstein Air Force Base, Germany and the two team went to Taszar, Hungary. The last team was deployed to Tuzla Airbase in Bosnia-Herzegovina. The plan was to rotate the CCATTs monthly for them to get experience at all three locations. OJE served as a prototype regarding the appropriate method of deploying the CCAT team in a major operation. During the ramp up phase there was a CCAT team in physical proximity to the mobile air staging facility (MASF) at both Taszar and Tuzla which would provide tactical evacuation back to Landstuhl Army Regional Medical Center where a reserve CCAT team was prepared to rotate in as the down range CCAT team brought critically ill casualties out. Also, the CCAT team at Landstuhl; if necessary, could provide strategic air evacuation for critically ill casualties to go back to CONUS sites. During the sustainment phase, since there was initially a relatively low number of casualties down range, two CCAT teams were placed back at Landstuhl but were ready to deploy at approximately one hour's notice to go down range to either Tuzla or Taszar to provide air evacuation from the mobile air staging facility of either Taszar or Tuzla back to Landstuhl. Also, based on the clinical need of the patient, could provide strategic air evacuation back to CONUS. The goals of this mission were to support the medical needs of the patients in OJE. Additionally, goals were to define the role of the CCAT teams and how to utilize them best during air evacuation missions in contingencies, and develop command and control relationships with field hospitals and regional medical centers. Also, it would help to define their long term role in theater. These initial CCAT teams were also to provide for a smooth transition for later replacement teams. Regarding command and control issues, the initial method of implementation was to interrelate with the 86th Air Evacuation Squadron from Ramstein AB, Germany since they had extensive air evacuation experience. The CCAT team would augment the air evacuation units and provide critical care capability on the flight with the air evacuation crews providing the air medical safety role on the flight. The point of initiating a request for the CCAT teams would be either by the air evacuation liaison team (AEILT) or the air evacuation combat control (AECC) officers. Decisions to use the CCATT would preferably be made jointly by the combat control as well as the downrange officer in command (OIC) of the MASF who could either coordinate with the air evacuation squadron flight surgeons or in consultation directly with the CCATT physicians back at the 86th Air Evacuation Squadron.

PATIENT MOVEMENT BY CCATT IN OJE

To summarize, the patient movement during OJE by the CCAT teams included a total of 44 patients moved from December of 1995 to December of 1996. This constituted a small minority of approximately 10% of the overall patient missions during OJE and slightly less than 5% of all patients by the air evacuation system. The majority of CCATT missions were tactical missions of less than four hours duration. All 44 patient moves were greater than 2 hours air transport time, and a total of 12 were greater than 8 hours air transport time. The missions greater than 8 hours were strategic missions going back to CONUS. As a measure of the intensity or severity of illness, approximately 22 of the patients required mechanical ventilation for respiratory failure. Four of the patients had chest tubes and required either a Heimlich valve or pleuravac drainage. Eight of the patients...
utilized in-flight point of care testing (POCT) for evaluation of serum chemistries or arterial blood gases. Five patients were on an intravenous continuous paralysis sedation medical regimen. Fourteen were on some form of intravenous vasopressor or vasodilator therapy and fourteen patients required invasive hemodynamic monitoring with either arterial and/or Swan-Ganz catheters. There were no in-transit deaths in air evacuating critically ill patients by the CCAT teams during OJE.

LONGEST CCATT MISSION

To illustrate the capabilities of the CCAT one of the longest non-stop OJE CCATT patient moves was for a nineteen year old patient that was electrocuted in the Czech Republic. He had 40% body surface area burns (BSA), and 25% BSA burns were full thickness. He also had a closed head injury with a skull fracture and a cerebral spinal fluid leak. He had a right pneumothorax requiring chest tube drainage and was intubated requiring mechanical ventilation. He also had possible anoxic brain injury from a brief period of asystole immediately after his electrocution injury. He was briefly treated in a local civilian hospital and air evacuated via Army helicopter to Landstuhl Army Regional Medical Center (LARMC). He was then air evacuated via C-141 from Ramstein Air Force Base, Germany to the Brooke Army Burn Center in San Antonio, Texas. His flight was a 14 hour flight that required a mid-Atlantic mid-air refueling.

CCATT MISSION WITH COMPREHENSIVE MONITORING

The second illustrative CCATT mission is one utilizing the most comprehensive monitoring of the patient moves for OJE by the CCAT teams. This was a fifty-six year old American tourist who had severe coronary artery disease and severe left ventricular dysfunction. She developed unstable angina with flash pulmonary edema upon arrival on a vacation in Wurzburg, Germany. Because the patient had Medicare eligibility, no German hospital was willing to offer coronary artery bypass surgery. The only option for the patient was to be transferred back to the United States or be treated with medical therapy only. Medical management alone was felt to be inappropriate for the severity of coronary disease the patient had. She was initially air evacuated by helicopter to LARMC and stabilized with intubation, mechanical ventilation, intravenous sedation, nitroglycerin, heparin and morphine and invasive monitoring with arterial and Swan-Ganz catheters. She was subsequently air evacuated with mechanical ventilation, intravenous sedation, nitroglycerin, heparin, morphine and continuous monitoring with arterial and Swan-Ganz catheters to Fairfax, Virginia. In Fairfax she subsequently underwent an uneventful coronary artery bypass surgery.

LESSONS LEARNED

Important command and control lessons learned during CCATT's participation in OJE is CCAT teams are an air evacuation asset. CCAT teams are under the command and control of the air evacuation units and may work to augment other units critical care medicine capabilities. A CCATT physician may act as a critical care medicine consultant to the air evacuation system as well. The CCAT teams do not replace air evacuation medical teams. In addition to controlling the use of the CCAT teams, the air evacuation system must provide support for the CCAT teams. The air evacuation medical teams continue to be responsible for the safety of the flight and the overall mission completion.

Deployment lessons noted during the ramp up/ramp down phases were that logistics worked best when the CCAT team was deployed with the air evacuation teams. That means being deployed forward to provide an intensive care unit capability down range. Once the field medical unit becomes operational, the CCATT is redundant to the intensive care medical capability that is inherent in most deployed field medical units. During the sustainment phase, after the field medical unit is operational the CCATT can be redeployed to a central regional medical center to be available via the host air evacuation unit for a wider range of missions. By working in a regional medical center, the CCAT1 team members also can be maintaining their critical care skills by working in the medical center.

Patient care lessons noted during participation in OJE were multiple. The capability to analyze blood in flight by point of care testing (POCT) could be an important adjunct, but was only important for longer missions, usually of greater than 2 or 3 hours duration. It was infrequent for short flights that point of care testing really had a role as most patients had an opportunity to have most blood analysis done prior to entering the transportation phase, and the flight itself was relatively short. Although infrequent, when they did occur, we found aircraft-to-aircraft transfers of complex critically-ill patients can be extremely slow and tedious. Important lessons that were learned to simplify such transfers are: 1) it is important to clarify precisely the patient needs between the two care teams so that appropriate equipment is out and ready; 2) the more complex the patient with multiple intravenous lines, arterial lines, nasogastric tubes, foley catheters, chest tubes connected to pleuravacs, and ventilator tubing, the more important to make these sets of tubing on the patient very orderly so that as equipment is disconnected and reconnected, the tubing does not become tangled and become difficult to be separated from equipment; 3) if possible like equipment between care teams should be exchanged instead of being taken down from the patient and then new equipment from the new team of the same type reestablished which is a timely process; 4) if possible only finish the essential intravenous and
mechanical ventilator configurations during ground time as many adjustments and final configuration changes can be made after airborne which allows for a shorter ground time transfer. The future of patient movement items or PMI may simplify these transfers in the future. Pieces of medical equipment, in that concept, should stay with the patient during transfer from team to team.

To reiterate, complex care situations require more pre-planning to make for smooth team-to-team transitions. The most difficult patients to transport are those with the highest ventilatory needs as any brief disconnect can immediately become a life-threatening event.

CONCLUSIONS

Conclusions learned from Operation Joint Endeavor: Long range critical care air evacuation is needed to fill the gap in the current military environment of a small footprint forward of medical assets. Long range critical care air evacuation is fundamentally different than regional air ambulance services. Regional air ambulances operate with the goal "arrive alive" moving the patient from the field to a close tertiary facility. Long range critical care air evacuation must serve as a continuance of critical care during the lengthy transit times. This requires a higher skill and capability intrinsic to the care team to deal with a multitude of care and contingency requirements. The CCAIT concept integrates into the current air evacuation system to fill the need for long range air evacuation of the critically ill patient. In real world contingency operations such as Operation Joint Endeavor, the CCAIT teams provide the necessary skill and inherent capability to expand the range of potential patients that can be safely evacuated on a multitude of airframes. In keeping the team equipment needs small, balancing between providing most types of supplies needed for airway and shock resuscitation yet maintaining stock only for a defined, short period of time (about 24 hours), the team and its equipment can be easily utilized on most aircraft that can carry patients.

REFERENCES

