MILITANCY TRAUMA : ANAESTHESIA AND CRITICAL CARE MANAGEMENT

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ABSTRACT

At a Base Hospital, 2151 patients of militancy trauma were managed from Jan 1990 to 31 May 1993. It involved military, paramilitary, ex-servicemen, civilians, foreigners and antinational elements. The nature of trauma was either gun shot wounds (1333) or blast injuries (818). Polytrauma (multiple injury to soft tissue, bone, parenchyma with shock or injury to more than one body region) was seen in 862 patients. Standard protocol was evolved for initial management in ICU/acute surgical ward. Time taken for initial evaluation of injury, resuscitation, respiratory care and oxygen therapy, analgesics, blood group cross matching, antibiotics and preparation of the part before surgery was usually 45 min. Anaesthesia was induced with ketamine 2 mg/kg or thiopentone 3 mg/kg based on haemodynamic response and maintained with N₂O : O₂ (50 : 50 ratio), relaxant controlled ventilation. Mortality was 3.8% including 4 deaths on operation table.

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KEY WORDS : Trauma; Anaesthesia and critical care; Trauma anesthesia

Introduction

Militancy has become a global phenomenon, similarly, it has gripped Kashmir, Punjab and Assam in India. Aim of militancy is usually to cause terrorism. Contrary to actual hostilities, militancy attacks have the characteristics of surprise (time and place), shoot and run, volume of burst ammunition rather than accuracy, and indiscrete targets. Epidemiology and pattern of casualties may be different than the state of war which will need proper medical organisation for the care of these critically injured patients. Here we share our experience with militancy trauma in 2151 patients from 01 Jan 90 to 31 May 93 at Base Hospital. The aim is to give profile of injuries in militancy operations and to high-light importance of trauma anesthesia in critical care of these patients. Protocol for resuscitation of these critically sick patients has been evolved which may be different from the planned medical set up during actual hostilities.

Material and Methods

Militancy violence started in Jammu and Kashmir State in Dec 1989. Evacuation strategy was planned with identification of pockets of violence.

Planned strategy functioned only during organised paramilitary operations, otherwise casualties were brought directly to the regional trauma centre, more so, to intensive

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care unit. Reception staff completed the documentation in the ICU/acute surgical ward while the patients were resuscitated and prepared for surgery. Time interval from the initial evaluation, resuscitation and preparation of the patient to the time of surgery was usually 45 min. Initial evaluation and extent of injury was based on revised trauma score [1] and factors suggestive of seriousness of the trauma [2]. Emergency resuscitation at the site of accident could not be rendered to the injured due to surprise attack, non-availability of trained medical staff and panic state rush of the casualty to the medical centre, except in organised cordon and search operations by the military and paramilitary forces. Intravenous fluids, crystalloids, colloids or whole blood was administered as rapidly as possible with the help of large bore venous cannulae into the large veins or internal jugular. The crystalloids, colloids and blood were given in the proportion of 4:2:1. Bleeding from the wound was controlled with pressure bandages. As a principle, pressure bandage if already applied at the primary treatment centre was opened in the operation theater prior to surgery to prevent the loss of blood during the resuscitation period. Militancy trauma mass casualties due to bomb blast were managed successfully on the principle of triage [2]. All casualties were managed in intensive care unit or acute surgical ward with standard protocol based on management priorities.

Priority I Management

Primary treatment and resuscitation.

- (i) Airway/oxygenation
- (ii) Fluids: Ringer's lactate 2000 ml + Haemaccel 500 ml.
- (iii) Tetanus toxoid, ampicillin 500 mg IV, analgesics
- (iv) Blood grouping, cross matching.
- (v) Life saving intervention - intercostal chest drain.
- (vi) Radiological investigations.
- (vii) Preparation of the part for surgery.
- (viii) Informed consent for surgery.

Priority II Management

- (i) History of associated medical disease (diabetes, hypertension, IHD, COPD) and drug therapy.
- (ii) Complete general and systemic examination
- (iii) Establish monitoring lines.
 - (a) ECG (Oscillography)
 - (b) Blood pressure (Dinamap)
 - (c) Central venous pressure - internal jugular or long venous line
 - (d) Radial artery cannulation - blood gases
 - (e) Oesophageal thermoprobe - core temperature

Priority III management

Further diagnostic evaluation and surgery based upon clinical findings. Trauma operation theater was kept ready all the time to receive the patient for surgery.

Standard Drill

- (i) Standard instrument trolley laid out.
- (ii) Anaesthesia machine, drugs and endotracheal intubation tray were placed functional.
- (iii) Intravenous fluids kept hanging from the stand.
- (iv) Intravenous longlines, angiocaths and internal jugular caths kept readily available for use.

Anaesthesia Management : Patients were induced with either ketamine 2mg/kg or small increment of thiopentone 3mg/kg based on their haemodynamics (Table 1).

TABLE 1
Techniques of anaesthesia based on haemodynamics

Blood pressure systolic (mm Hg)	Induction of anaesthesia
< 90	Morphine 0.2 mg/kg + diazepam 0.1 mg/kg intravenously with continued resuscitation dopamine infusion (if necessary)
90-100	Ketamine 2 mg/kg
> 100	Thiopentone (3mg/kg) small increment doses

Rapid endotracheal intubation was accomplished with suxamethonium 1.5 mg/kg neuromuscular blockade considering all patients as potential candidates for pulmonary aspiration. Anaesthesia was maintained with 50% nitrous oxide in oxygen. Ventilation was manually controlled with nondepolarising muscle relaxants (pancuronium or vecuronium and chandonium iodide) inhalational anaesthetics were avoided to prevent further deterioration in haemodynamics, prolonged recovery and post-operative sickness. Those patients who were likely to suffer compromised airway post-operatively (maxillo-facial injuries, airway trauma with emphysema, laryngeal and oral cavity oedema) were managed with endotracheal tube in situ with spontaneous breathing connected to T-piece for O₂ supplement. Residual effect of neuromuscular block was reversed with atropine 20 µg/kg, neostigmine 60 µg/kg mixture. Patients were shifted to the ICU/surgical ward ensuring spontaneous breathing with adequate tidal volume. Post-operative intensive care, monitoring and therapy was continued till declared out of danger.

Results

Two thousand one hundred and fifty one patients sustained injuries during militancy operations from 01 Jan 90 to 31st May 93. Out of these 1715 (79.7%) were operated upon. The nature of trauma was either gun shot wound (1333) or blast injuries (818). Majority of casualties belonged to Army - 718 (33.4%) followed by BSF - 683 (31.7%) and CRRF - 447 (20.8%). Other categories involved were Air Force - 13 (0.6%), ITBP - 11 (0.5%), JKP - 34 (1.5%), NSG - 02 (0.1%), Assam Rifles - 13 (0.6%), Rashtriya Rifles - 33 (1.5%), Ex-servicemen-12 (0.6%), civilians - 83 (3.9%) and antinational elements (ANE) - 102 (4.7%). Year wise breakdown (Table 2) reveals a significant increase in the rate and severity of injuries over the years. Militant action was responsible for 83.6% of injuries (Table 3). Site of injury and surgical procedures performed are shown in Tables 4 and 5. Polytrauma associated with shock was seen

in 862 patients (Table 4). Initial management of mass casualties in ICU/acute surgical ward proved to be successful with low mortality and morbidity (Table 6). Of the 59 (2.7%) deaths, 38 had sustained gun shot wound and 21 had sustained bomb blast injury. Three patients died at the operation table.

TABLE 2

Militancy trauma (01 Jan to 31 May 93): Casualty rate break-down 1990-1993 (n = 2151).

	1990	1991	1992	1993 (upto 31 May 93)
Casualties received	516	652	740	243
Casualties surgically operated	361	449	671	234

TABLE 3

Militancy trauma (01 Jan 90 to 31 May 93) : Mode of injury (n = 2151)

Mode of Injury	Number of patients	%
Militant action	1799	83.6
Enemy firing (infiltration)	148	6.9
Accidental	91	4.2
Self inflicted	10	0.5
Homicidal	01	-
Security Forces (ANEs fired upon by security forces)	102	4.7

TABLE 4

Militancy trauma (01 Jan 90 to 31 May 93) : Site of injury (n = 2151)

Site of injury	Number of patients	% of total patients
Head and neck (maxillofacial - 48, penetrating eye injuries - 54)	300	13.9
Chest	280	13.0
Back	85	4.0
Abdomen	196	9.1
Monoparesis	15	0.7
Paraplegia	08	0.4
Extremities		
Lower limb soft tissue	1219	56.7
Lower limb bones	257	11.9
Upper limb soft tissue	533	24.8
Upper limb bones	160	7.4
Both limbs soft tissue	415	19.3
Both limbs bones	65	3.0
Polytrauma (multiple sites)	862	40.1

TABLE 5
Militancy trauma (01 Jan 90 to 31 May 93) : Surgical procedures performed in patients (n = 2151)

Surgical Procedures	Number	% of total patients
Abdominal	240	11.2
Laparotomies	190	8.8
Repair of gut perforations	130	6.0
Repair of hepatic tear	44	2.0
Splenectomy	12	0.6
Nephrectomy	14	0.7
Diaphragmatic repair	08	0.4
Repair of blood vessels	25	1.2
Diagnostic minilaparotomies	24	1.1
Chest injuries	145	6.7
Thoracostomy with ICD	115	5.3
Thoracostomy with ICD and thoracotomy	30	1.4
Lung contusion	23	1.1
Cardiac perforation	02	0.1
Lobectomy	05	0.2
Pericardiotomy	03	0.1
Head Injuries	64	3.0
Burr hole decompression	30	1.4
Conservative	34	1.6
Long term ventilation (> 8 hours)	16	0.7
Amputation (AK/BK)	78	3.6
Other amputations	71	3.3
Orthopaedic surgery	61	2.8
Internal fixation	18	0.8
Wound debridement	1752	81.4
Skin graft	78	3.6

ICD = Intercostal drain.

TABLE 6
Militancy trauma management (01 Jan 90 - 31 May 93) : Post operative complications and cause of death

Complications	Number of patients
<i>Post operative complication (n=1715)</i>	
Septicaemia	6
Jaubdice	3
Faecal fistula	3
Pneumonitis	4
Pyothorax	3
Collapse lung	2
Burst abdomen	2
Parotid fistula	1
<i>Cause of Death (n=2151)</i>	
Septicemia	10
Shock	31
Renal failure	1
Head injury	9
Fat embolism	4
Pulmonary aspiration	1
Unexpected cardiac arrest	1
Unknown	2

Discussion

The concept of trauma anaesthesia (TA) had evolved as a new subspeciality (traumatology and emergency medicine) of anaesthesiology [3]. It needs individual expertise in advanced resuscitation, physiological stabilisation skills, airway and mechanical ventilation management and monitoring of vital organs in addition to the techniques and skills of the art of anaesthesiology. Trauma anaesthetist as resuscitation specialist, as a part of mobile resuscitation team [4] or critically ill transportation team [3] will ensure optimal clinical state of the patient on his arrival to trauma centre. Those trauma patients who reach the hospital alive without irreversible damage to a vital organ usually survive when managed by the experienced trauma medical team [5]. This highlights the role of resuscitation on the scene of accident, during transportation and pre-operative period. Sometimes, patients may have to be taken up for surgery with continued resuscitation during pre, intra and post-operative period. Trauma management systems have reduced the mortality rate.

Intensive care units in the peripheral zonal hospitals may be multidisciplinary. These ICUs may have the additional responsibility for the care of polytrauma critically ill. Most of these patients will need some form of life support either respiratory, cardiac or renal. Anaesthesiologists may be the ideal choice [7,8] for the subspeciality of TA with their expertise in airway control, mechanical ventilation; patients monitoring; applied pharmacology; and management of electrolyte, metabolic and fluid balance.

Polytrauma, multiple injuries to soft tissue, bone or parenchyma with shock or injury to more than one body region, the criteria as used by us may be deceptive. Sometimes, apparently a small splinter injury over the abdomen may cause severe damage to the internal organs. Trauma care centre, as our hospital, ensured reception, resuscitation, investigations and management of casualties irrespective of extent and severity of the

injury. Besides, round the clock medical paramedical and nursing staff, the hospital was supported with helicopter service for specific neurosurgical, cardio-thoracic and vascular surgery expertise. Low mortality and morbidity in this study, may be as result of the availability of modern facilities in material (rapid infusion therapy, cardiac monitors, respiratory therapy and volume cycle ventilators) and manpower (experienced surgical team/nursing staff). Serious casualties from far off regions were evacuated to our centre by helicopters. Low priority patients used ambulance cars which could be moved during fixed timings of convoy protection. During militancy, evacuation plan of trauma victims may not be feasible. Casualties are not predictable in time, number and place. Military vehicles may have to be used for transportation of the patients. Civil medical services may not be helpful.

Hypovolaemia, when it fails to respond to initial resuscitation, may indicate continued blood loss or failure to appreciate the full extent of pre-admission fluids loss. Haemorrhage into the body cavities, splenic, liver or mesenteric injury and retroperitoneal bleed were the common causes of the failure of the IV fluids to improve the haemodynamics. These patients were managed with rapid infusion of crystalloid, colloid and blood (4:2:1 ratio) and, sometimes, dopamine infusion. Surgical team was called upon to accept the risk of urgent surgical exploration [9,10].

Anaesthetist working in a military service hospital treating militancy trauma/battle casualties assumes the responsibilities relating to triage, immediate resuscitation, airway respiratory therapy, monitoring, administration of anaesthetics and post-operative intensive care [11]. Morton [12] administered diethyl to war wounded soldiers. Ketamine [13] is advantageous in pre-existing hypovolaemia and shock. General anaesthesia [14] with muscle relaxants and IPPV may be essential for abdominal and chest injuries. Results of pre-operative resuscitation on haemodynamics will decide the use of drugs for anaesthesia.

Several rating scores (15-18) are used exclusively in trauma management. They were developed to quantify the extent of injury which is useful in anticipating the prognosis of acutely injured patients [19]. Revised trauma score (TS) may be calculated from physiological parameters, such as respiratory rate, respiratory effort, systolic blood pressure, capillary refill and neurological status (Glasgow coma scale). Trauma patients with TS < 13 will need care at trauma centre [1]. Injury severity score, a combination of TS with anatomical details of the extent of the injury may be used to predict the outcome. During airways management of trauma patients, one should maintain a high index of suspicion for the possibility of both head and spinal cord injuries. Polytrauma patients may be confused and obtunded on admission. This could be due to CNS injuries with raised intracranial pressure, hypoxia with inadequate respiratory exchange, ingestion of sedative drugs or a combination of these factors. The adequacy of ventilation should be evaluated by arterial blood gas analysis. The measured arterial oxygen tension (P_{aO_2}) should be compared with the expected P_{aO_2} , utilising the ratio of P_{aO_2} to alveolar oxygen partial pressure (PAO_2). The normal P_{aO_2}/PAO_2 ratio is > 0.75. Low values suggest increased right to left pulmonary shunting of blood or venous admixture. Significant venous admixture is common after trauma and is best treated by oxygenation, intubation and mechanical ventilation [19]. Several indices have been used to compare actual P_{aO_2} with expected P_{aO_2} . The P_{aO_2}/FIO_2 ratio is simple to calculate, a value < 200 is consistent with an elevated pulmonary shunt. The alveolar to arterial difference of the partial pressure of oxygen ($A-aDO_2$) is increased with elevated venous admixture. However, the ratio of arterial to alveolar PO_2 (PsO_2/PAO_2) is more sensitive indicator of pulmonary dysfunction and can be used to predict the FIO_2 needed to maintain the desired P_{aO_2} because it remains constant with different levels of FIO_2 unlike the $A-aDO_2$ and the P_{aO_2}/FIO_2 [20].

To conclude, militancy trauma is compa-

rable with battle field casualties but evacuation, resuscitation and initial management may be different than the actual hostilities. The role of anaesthetist as resuscitation specialist, administration of anaesthetics and critical care has been highlighted. Young anaesthesiologist may be called upon to accept the challenges of trauma anaesthesia, to develop individual expertise in advance resuscitation, stabilisation skills, pulmonary therapy and mechanical ventilation, monitoring techniques of vital organs and the art of the administration of anaesthesia in emergency situations. Polytrauma critical care by experienced medical team may be essential to prevent vital organ(s) damage and save the life of the victims.

REFERENCES

1. Trankey DD, Siegel J, Baker SP, Gennaralli TA. Current status of trauma severity indices. *J Trauma* 1983; 23 : 185-201.
2. Champion HR, Sacco WI, Trauma scoring. In : Mattox KL, Moore EE, Feliciano DV, eds. *Trauma*. Norwalk : Appleton and Lange 1988; 63-77.
3. Grande CM, Stene JK, Bernhard WN, Barton CR. Trauma anaesthesia and critical care, the concept and rationale for a new subspeciality. *Crit Care Clin* 1989; 6(i) : 1-11.
4. Campbell D. Immediate hospital care of the injured. *Brit J Anaesth* 1977; 49 : 673-9.
5. Wolfson LJ. The anaesthetist's management of the injured patient. *Brit J Anaesth* 1966; 38 : 274-87.
6. Grande CM. Critical care transport : a trauma perspective. *Crit Care Clin* 1989; (i) : 165-83.
7. Telfer AB. Use of anaesthesia : Intensive care. *Brit Med J* 1980; 280 : 1593-5.
8. Stene JK, Christopher MG. Formalised training programme of trauma anaesthesia. In : Stene JK, Grande CM (Eds). *Trauma Anaesthesia*. Baltimore : Williams and Wilkins 1991; 28-9.
9. Render JW, Lundy JS. Anaesthesia in war surgery. *War Med* 1942; 2 : 193-212.
10. Donchin Y, Wiener M, Grande CM, Cotev S. Military medicine : trauma anaesthesia and critical care on the battle field. *Crit Care Clin* 1989; 6(i) : 185-202.
11. Cole WHJ. The anaesthetist in modern warfare : Experience in the first Australian field hospital in South Vietnam. *Anaesthesia* 1973; 28 : 113-7.
12. Morton WTG. The first use of ether as an anaesthetic at the battle of the wilderness in the civil war. *JAMA* 1904; 42 : 1068-73.
13. Carmichel MR. Anaesthesia under civil war conditions. *Anaesthesia* 1981; 36 : 1077-88.
14. Wandless JG. Emergency anaesthesia. *Brit J Hosp Med* 1978; 19 : 437-43.
15. Copes WS, Lawrick CH. A comparison of abbreviated injury scale, 1980 and 1985 versions. *J Trauma* 1988; 28 : 78-83.
16. Baker SP, O'Neil B, Hadden W. The injury severity score. A method for describing patients with multiple injuries and evaluating emergency care. *J Trauma* 1974; 14 : 187-96.
17. Champion HR, Sacco WJ, Copes WS. A revision of the trauma score. *J Trauma* 1989; 29 : 623-29.
18. Champion HR, Sacco WJ, Hunt TK. Trauma severity scoring to predict mortality. *World J Surg* 1983; 7 : 4-11.
19. Peters RM. Fluid resuscitation and oxygen exchange in hypovolaemia. In: Siegel JH (ed), *Trauma : Emergency surgery and critical care*. New York : Churchill Livingstone 1987; 157-79.
20. Gilbert R, Reighley JF. The arterial alveolar oxygen ratio, an index of gas exchange applicable to varying inspired oxygen concentrations. *Am Rev Resp Dis* 1974; 109 : 142-5.