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Effectiveness of Trauma Team in Management of Abdominal Trauma: A Retrospective Audit

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Abstract

Introduction: Trauma represents a major cause of death in patients presenting in emergency department. Abdomen represents a commonly injured region which may often by missed in cases of blunt trauma particularly when compounded with other obvious musculoskeletal injuries. The role of trauma team is to assess, resuscitate and manage all poly-trauma patients in a systematic manner to avoid missing intra-abdominal injuries and manage such patients aggressively.

Materials and methods: This retrospective study was conducted in Liaquat National Hospital, Karachi which is a level 2 trauma centre. All the data was obtained from the hospital's registry for the period of 1 year from January 2014 to December 2014. Trauma victims who fulfilled trauma team activation criteria were included in study with criteria like patients with abdominal trauma with obvious penetrating injury either in the form of gunshot injury, stab wound or any object penetrating the abdomen with or without an exit wound; patients with blunt trauma with ultrasound Fast/CT scan showing free fluid, hemoperitoneum or visceral injury; adult patients more than 18 years of age; poly trauma patients with associated abdominal injury. Patients excluded from study were trauma patients less than 18 years of age; poly trauma patients who had no abdominal injury; patients who expired with 10 minutes of presentation within emergency department or brought dead.

Results: A total of 150 trauma calls were generated during the year 2014. Out of these 150 trauma calls, 25 (16.6%) patients met the inclusion criteria of having intra-abdominal injury. Male to female ratio was 24:1. Among the patients who sustained abdominal injuries, 9 (26%) patients had blunt trauma to abdomen while 16 (64%) patients had penetrating abdominal injuries. In penetrating injuries, 15 (60%) cases were due to gunshot injuries while 1 (4%) was due to an assault. Sixteen (64%) patients required immediate laparotomy. Fifteen of these patients had penetrating injuries and 1 had blunt trauma, 8 patients were managed conservatively and 1 patient underwent angio-embolization of splenic artery. Time required to shift patient from ER to OT was variable between 36 minutes to 69 minutes with a mean value of 50 minutes. Patients who were managed conservatively had an ED stay time varying from 40 minutes to 160 minutes with mean value of 130 minutes. Of 25 patients who had abdominal injuries, 21 (84%) patients survived and 4 (16%) patients expired. Among the patients who went immediate surgical intervention, 3 patients expired and 1 patient who underwent angio-embolization of splenic artery expired.

Conclusion: Because of the concealed nature of intra-abdominal hemorrhage, one is likely to miss abdomen as a potential source of bleeding until patient decompensates to unresuscitable state of shock. Thus, appropriate management of severe trauma patients can only be achieved by a systematic evaluation by Trauma team according to ATLS guidelines. Our study concluded that the time factor for activation of trauma team and shifting of patient was not the major factor among patients who expired. Although the shifting time was fairly long for patients who were managed conservatively, it was not identified as a cause of death.

Keywords: Abdominal trauma; Penetrating abdominal injuries; Trauma team

Abbreviations: CT: Computerized Tomography; ATLS: Advanced Trauma Life Support, ARDS: Acute Respiratory Distress Syndrome; ED: Emergency Department; ICU: Intensive Care Unit; OT: Operation Theatre

Introduction

Trauma represents a major cause of death in patients presenting in emergency department and is currently the fourth leading cause of death in western countries [1]. Worldwide approximately 11.9 million people die annually as a result of trauma and thousands more are temporarily or permanently disabled [2]. The World Health Organization estimates that, by 2020, trauma will be the first or second leading cause of years of productive life lost for the entire world population. A wide array of simple principles including ATLS training has been introduced in many tertiary care facilities to manage trauma patients more effectively, but despite all these measures, significant variability exists in patient management between institution to institution. For example in 2007, a report by the UK National Confidential Enquiry into Patient Outcomes and Death [1] found that trauma teams were only available in 20% of hospitals for management of poly-trauma patients. The report strongly recommended that hospitals in the UK ensure that a trauma team is available twenty four hours a day, seven days a week. The basic objective is early recognition of the severity of injury and timely management, thus emphasizing the importance of golden hour. Abdomen represents

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a commonly injured region which may often by missed in cases of blunt trauma particularly when compounded with other obvious musculoskeletal injuries. The major cause of mortality in a poly trauma victim is hemorrhage. Hemorrhage can be visible or concealed. While visible bleeding promptly alerts the treating surgeon regarding the serious nature of the sustained injuries, concealed hemorrhage is often overlooked terminating in a fatal outcome for the patient. Hence, abdominal injuries are often overlooked in a setting of poly trauma which is often compounded by the unavailability of ultrasound to detect such intra-abdominal injuries. Spleen and liver are the most commonly injured organs in blunt trauma. However, in cases of gunshot injuries to abdomen, multiple viscera can be damaged and such injuries often lead to diversion from associated head, spine and extremity injuries.

Working in a tertiary care hospital in a third world country has its own challenges. Of particular importance is the lack of availability of appropriate services in peripheral clinics and poor referral system that often results in significant delay in presentation. The trauma team usually comprises a multidisciplinary group of individuals drawn from the specialties of anesthesia, emergency medicine, surgery, nursing and support staff, each of whom provide simultaneous inputs into the assessment and management of the trauma patient, their actions being coordinated by a team leader. The primary objective is to rapidly resuscitate, stabilize and assess the severity of injury and subsequently transport to site of definitive care either within or outside hospital.

The objective of this study is to assess the effectiveness of trauma team in management of abdominal injuries occurring either as a sole entity or as a component of poly trauma patients in terms of patient outcome as mortality or survival, response time of trauma team and time requires to shift patient from ED to site of definitive care.

Methods

This retrospective study was conducted in Liaquat National Hospital, Karachi which is a level 2 trauma centre. The hospital is situated in the middle of city which caters to the needs of many patients. It is a 750 bedded hospital with 50 ICU beds availability with ventilator support. The emergency department is well equipped with all lifesaving modalities and 3 ventilators. Trauma team workup is done according to ATLS guidelines [3]. Radiologic imaging consists of routine chest, pelvis X-rays and ultrasound with selective CT scanning. All the data was obtained from the hospital's registry for the period of 1 year from January 2014 to December 2014 after taking ethical committee's approval. Patients included in the trauma registry were enrolled based on classification as a trauma patient who met trauma team activation criteria. The hospital's trauma team activation criteria are made according to the guidelines developed by Texas EMS Trauma and Acute Care Foundation Trauma Division. This is as follows and in Table 1:

Physiologic criteria for adults

1. Systolic BP<90
2. Respiratory rate <10 or >29
3. GCS <13
4. Pulse<60/min or >130/min
5. Unresponsive patient

Anatomic criteria for adults and pediatric

1. Penetrating injuries to head, neck, torso and extremities proximal to elbow and knee
2. High energy blunt trauma to head, neck, torso or groin
3. Flail chest
4. Combination of trauma with burns
5. Two or more proximal long bone fractures
6. Suspected pelvic fractures
7. Open or depressed skull fractures
8. Paralysis secondary to recent trauma
9. Amputation proximal to ankle or wrist.

Mechanism of injury

1. Ejection from vehicle
2. Fall>20 feet adult or >10 feet children
3. Death of a victim in same passenger compartment of vehicle
4. Extrication time>20 minutes
5. Roll over motor vehicle crash with unrestrained patients
6. High speed vehicle crash with major auto deformity
7. Intrusion into passenger compartment>12 inches
8. Pedestrian thrown or run over
9. Significant force blunt trauma to head or torso from large animal.

The hospital's trauma team consists of following members, trauma team leader (ATLS Certified), neurosurgeon, orthopedic surgeon, anesthetist, plastic surgeon, emergency consultant, general surgeon, supporting staff and nurses. Among the patients who fulfilled trauma team activation criteria. Patients included in this study were those with abdominal trauma with obvious penetrating injury either in the form of gunshot injury, stab wound or any object penetrating the abdomen with or without an exit wound; patients with blunt trauma with ultrasound Fast/CT scan showing free fluid, hemoperitoneum or visceral injury; adult patients more than 18 years of age; poly trauma patients with associated abdominal injury. Patients excluded from study were trauma patients less than 18 years of age; poly trauma patients who had no abdominal injury; patients who expired with 10 minutes of presentation within Emergency Department or brought dead. The data recorded was response time of trauma team, time required for patient to shift from ED to site of definitive care (ICU or operation theatre), management of patient either conservative or surgical, patient outcome as survival or mortality, cause of mortality, pattern of abdominal injuries, associated injuries of patients with abdominal trauma, and morbidity. Data was analyzed using SPSS version 16.

Results

A total of 150 trauma calls were generated during the year 2014. Out of these 150 trauma calls, 25 (16.6%) patients met the inclusion criteria of having intra-abdominal injury. The demographics of patients were as such that among 25 patients, only 1 (4%) was female while the remaining 24 (96%) patients were male. Majority of patients were aged between 20 to 50 years with mean age of 32 years. This included 21 patients representing 84% of study group, while the remaining 4 (16%) patients were aged more than 50 years (Figure 1).

Table I: Physiologic criteria for pediatric.

Age< or =3 years	Age>3 years old
Respiratory Distress	Respiratory Distress
Respiratory Rate<20 or>50 /min	Respiratory Rate 16 or>40 /min
Loss or peripheral pulse	Loss of peripheral Pulse
HR<80 or >180	HR<60 or>160
	Systolic BP<70
Behavior not appropriate for age	Behavior not appropriate for age

The trauma team response time was an average 7.5 minutes (mean) which was less than the declared time of 10 minutes. Among the patients who sustained abdominal injuries, 9 patients had blunt trauma to abdomen while 16 patients had penetrating abdominal injuries. It is worth noticing that among those 16 patients who sustained penetrating abdominal injuries, 15 cases were due to gunshot injuries while 1 was due to an assault. The mechanism of injury is shown in Figure 2. Fifteen patients had gunshot injuries, 6 patients had road traffic accidents, 1 patient had crush injury, 1 patient was a victim of assault and 2 patients had history of fall from height.

Only 8 patients had isolated abdominal injuries while remaining 17 patients had associated injuries. Among those 17 patients, 11 patients had extremity and pelvic injuries, 4 patients had head injuries, 1 patient had flail chest with multiple rib fractures and 1 had vascular injury involving femoral artery laceration and left ureteric injury. All these patients were managed aggressively by trauma team in ED and all associated injuries were addressed and stabilized before transporting to definitive care area. Extremity injuries were stabilized with back-slabs, pelvic injuries were addressed with application of pelvic binders, flail chest was managed by passing chest tube drain and head injuries were managed conservatively as none of the cases (based on GCS and CT scan findings) required urgent craniotomy.

Regarding patient management, 16 patients required immediate laparotomy. Fifteen of these patients had penetrating injuries and 1 had blunt trauma. Eight patients were managed conservatively and 1 patient underwent angio-embolization of splenic artery (Figure 3). One patient with gunshot injury had a superficial wound confined to abdominal wall that was managed by dressings and therefore, did not require surgery (Table II). Among the patients managed surgically, operative findings were recorded as shown in Table III.

Time required to shift patients to site of definitive care was a bit variable. Since, it was dependent upon hospital bed availability status, this occasionally led to some delay in shifting of patient from ED but eventually all patients were admitted and none of the patients were referred out of facility. Among the 16 patients with penetrating abdominal injuries, 15 patients (14 gunshot and 1 assault) required immediate surgical intervention (Table IV). All these patients were resuscitated aggressively in ER according to ATLS protocols and subsequently shifted to operation theatre. In case of non-availability of ICU bed, no delays were made and post-operatively patient was kept in OT recovery on ventilator support under care of an anesthetist until ICU bed was made available and patient subsequently shifted there.

In-case of patients who were decided to be managed conservatively, they were kept in ED monitoring bay until ICU bed was made available. Therefore the time required to shift patient from ED to OT was variable between 36 minutes to 69 minutes with a mean value of 50 minutes (Table V). However patients who were managed conservatively had an ED stay time varying from 40 minutes to 160 minutes with mean value of 130 minutes (Table VI).

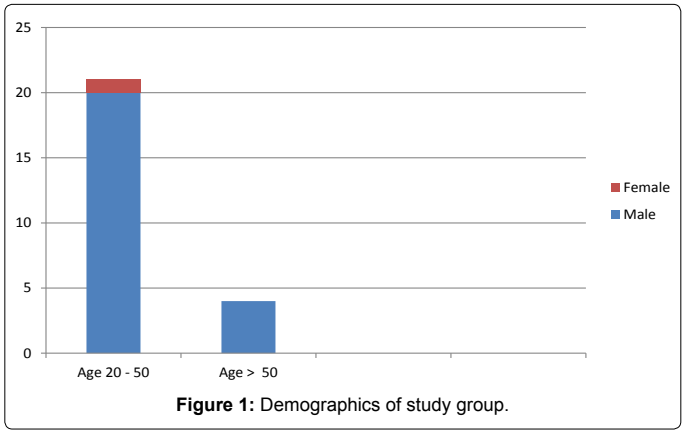

Figure 1: Demographics of study group.

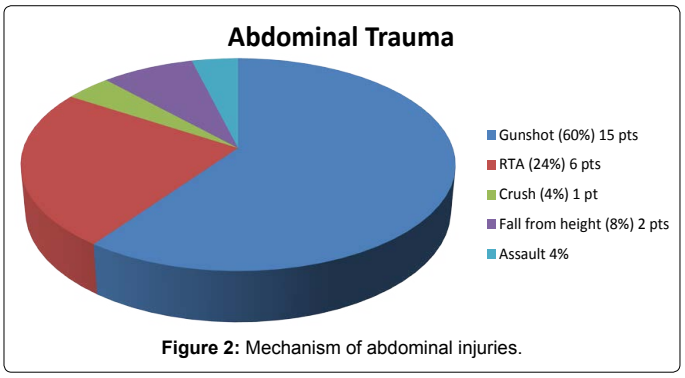

Figure 2: Mechanism of abdominal injuries.

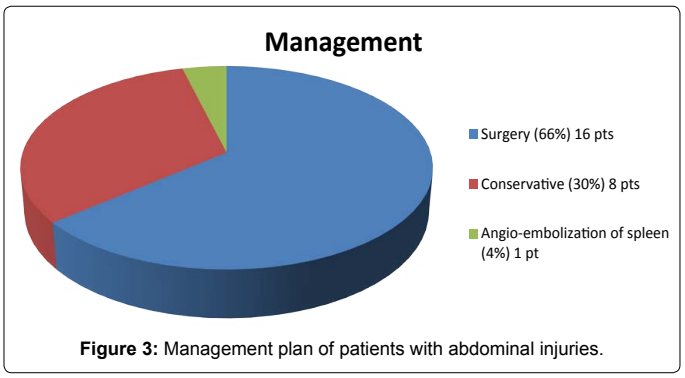

Figure 3: Management plan of patients with abdominal injuries.

Table II: Mechanism of Injuries in relation to type of abdominal injury.

Mechanism	Blunt	Penetrating	Total
RTA	6	0	24%
Gunshot	0	15	60%
Assault	0	1	4%
Fall from Height	2	0	8%
Crush	1	0	4%

Table III: Abdominal operative findings in relation to the type of abdominal injury (16 patients).

	Blunt	Penetrating
Bowel Repair	0	11
Splenectomy	1	1
Femoral Artery Ureter Repair		1
Liver laceration repair		1
Retroperitoneal packing		1

Table IV: Abdominal injuries in patients managed conservatively.

	Blunt	Penetrating
Spleen	4	0
Liver	3	0
Superficial skin	0	1
Angioembolization of splenic artery	1	0

Table V: Time taken for shifting of patients (time in minutes).

	Time (n-25)	Mean	P Value
ED to OT	36-69	50	0.04
ED to ICU	40-160	130	0.04

Of 25 patients who had abdominal injuries, 21 (84%) patients survived and 4 (16%) patients expired. Among the patients who went immediate surgical intervention, 3 patients expired and 1 patient who underwent angio-embolization of splenic artery expired (Table VII).

Table VI: Patients treatment outcome in relation to length of hospital stay.

Treatment Outcome	Up to 7 days	Up to 2 weeks	More than 2 weeks	Total	P Value
Recovered satisfactorily	8	12	1	21	0.05
Expired	3	0	1	4	0.05

Table VII: Outcome in relation to trauma team response time and shifting time to OT/ER (time in minutes) expressed as mean.

	Total (n-25)	Trauma team response time (mean)	Shifting Time (mean)	P Value
Surgical (Survived)	13	7.3	52	0.05
Surgical (Expired)	3	7.1	48	0.05
Conservative (Survived)	7	7.8	135	0.05
Conservative (Expired)	1	7.4	128	0.05
Angiomembolization of splenic artery (Expired)	1	7.9	131	0.05

The cause of expiry in surgical patients was identified as severe hemorrhage and other patient with splenic trauma who underwent angio-embolization expired due to ARDS secondary to pulmonary contusions. Among the survivors, only 1 patient developed paraplegia due to spinal cord transection indicating the only permanent morbidity in study sample.

Discussion

Trauma management continues to be a challenge, particularly when significant time is lost in the pre-hospital phase due to poor referral system. The premise underlying the development of trauma system is that an organized system of trauma care would ensure that critically injured patients are appropriately triaged, transferred to high-quality definitive care, or both, without delay. Abdominal trauma still goes unrecognized in many centers due to inconsistent clinical findings and unavailability of ultrasound facilities. Introduction of trauma team and ATLS principles has led to significant improvement in poly trauma patient management and better identification of abdominal injuries.

From the given data, it is fairly obvious that majority of the victims of injuries were males. And most of them were in middle age group representing the active working class. This leads to significant impact to economy of a developing nation particularly when the bread earners are lost in accidents. The data also highlights that gunshot injuries are fairly common and need to be managed aggressively. Although 3 patients expired despite of aggressive resuscitation and surgery. The remaining all survived due to timely management and early surgical intervention. The type of surgery performed varied depending upon the injury, this included bowel resection and anastomosis, creating diverting colostomies, splenectomy and liver laceration repair.

Time required for recruitment of trauma team was documented from the initiation of call until the arrival of all involved members. All concerned individuals reported within the given time limit policy of 10 minutes. The above results showed that there was no significant difference in trauma team response time among patients who survived or expired. Although the shifting time was significantly longer for those who were managed conservatively, but again, the difference between those who survived and expired does not show any profound differences. The outcome was largely dependent on the nature and severity of injury with 3 surgical patients dying due to sequela of hemorrhage and 1 patient who required angiographic embolization of spleen succumbing to injuries due to onset of ARDS.

Commonest intra-abdominal injury in blunt trauma was splenic injury followed by liver injury. Commonest hollow organ injury was small bowel perforation. Most common bowel injured was ileum. These results were consistent with other studies.

In blunt trauma surgeon's main concern is control of hemorrhage, but how it can be best done with safety and less morbidity, depends on grade, severity and site of injury. In our study, majority of splenic and liver injuries were managed conservatively. This method was employed only in patients who were heamodynamically stable. CT scan was also done to assess the grade of injury. However one patient had a gradual decline in hemoglobin over 2 days after admission requiring daily 2 pack cell blood transfusion. Due to hemodynamic stability, this patient was subjected to angiographic embolization of splenic artery. Post procedure his hemoglobin remained static but eventually patient expired due to ARDS. All heamodynamically stable patients were followed with series physical examinations; ultrasonography or CT scans thus avoiding unnecessary laparotomy.

As mentioned before, hemorrhage is the most common cause of death in patients with penetrating injuries to abdomen peaking within first 24 hours of admission [4]. Hence this emphasizes the role of aggressive resuscitation and control of hemorrhage while simultaneously dealing with all associated injuries according to ATLS guidelines. As mentioned in another article, deaths caused by severe chest or abdominal trauma peaked at 1 to 6 hours after admission and are largely attributed to profound hemorrhage [5]. According to a study, among all trauma related patient deaths, 5.9% were considered preventable or potentially preventable. The most common single error across all phases of care was failure to appropriately evaluate the abdomen [6]. And inability to control ongoing intra-abdominal hemorrhage is an important error leading to a preventable cause of mortality [7]. The severity of head injury correlates well with GCS, hence the severity of head injury can be classified easily and appropriate measures taken. Musculoskeletal injuries are fairly obvious and bleeding can usually be controlled by tourniquet application. But abdomen can be a potential source of bleeding without obvious clinical signs. Early diagnosis can decrease mortality by 50% [8-10]. This necessitates the importance of good clinical techniques and radiographic imaging to rule out intra-abdominal pathologies.

Limitations

The study had limitations of a retrospective study. The sample size was small and the assessment of trauma team was done only in patients of abdominal trauma.

Conclusion

The role of trauma team in management of poly trauma patients remained vital. Because of the concealed nature of intra-abdominal hemorrhage, one is likely to miss abdomen as a potential source of bleeding until patient decompensates to unresuscitable state of shock. Thus, appropriate management of severe trauma patients can only be achieved by a systematic evaluation by Trauma team according to ATLS guidelines. Our study concluded that the time factor for activation of trauma team and shifting of patient was not the major factor among patients who expired. Although the shifting time was fairly long for patients who were managed conservatively, it was not identified as a cause of death. Hence trauma team played a significant role on survival of 21 patients (86%) with severe abdominal injuries. This study also provides the basis to evaluate the outcome of all patients who present with severe trauma.

References

1. https://www.ncepod.org.uk/2007t.html
2. World Health Organization. The Global burden of disease. WHO, Geneva. 2004.
3. https://www.facs.org/quality-programs/trauma/atls
4. Acosta J, Yang J, Winchell R, Simons R, Fortlage D, et al. (1998) Lethal injuries and time to death in a level I trauma center. J Am Coll Surg 186: 528-533.
5. Demetriades D, Murray J, Charalambides K, Alo K, Velmahos G, et al. (2004) Trauma fatalities: time and location of hospital deaths. J Am Coll Surg 198: 20-26.
6. Davis JW, Hoyt DB, McArdle MS, Mackersie RC, Eastman AB, et al. (1992) An analysis of errors causing morbidity and mortality in a trauma system: a guide for quality improvement. J Trauma 32: 660-665.
7. Gruen R, Jurkovich G, McIntyre L, Foy H, Maier R (2006) Patterns of errors Contributing to Trauma Mortality. Ann Surg 244: 371-380.
8. Davis J, Cohn I, Nance F (1996) Diagnosis and management of blunt abdominal trauma. Ann Surg 183: 672-678.
9. Morton J, Hinshaw R (1957) Blunt trauma to the abdomen. Ann Surg 145: 699-710.
10. Shojaee M, Faridaalaee G, Yousefifard M, Yaseri M, Arhami Dolatabadi A, et al. (2014) New scoring system for intra-abdominal injury diagnosis after blunt trauma. Chin J Traumatol 17: 19-24.