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High Pati Score is Associated with Increase Mortality in Patients with Penetrating Abdominal Injuries

Authors
Dr Shyam Kiran SM[1], Dr R Ramesh[2], Dr K Ravichandran[3]
[1]Post Graduate, Department of General Surgery, Rajah Muthaih Medical College, Annamalai University, Chidambaram
[2]Professor, Department of General Surgery, Rajah Muthaih Medical College, Annamalai University, Chidambaram
[3]Reader, Department of General Surgery, Rajah Muthaiah Medical College, Annamalai University, Chidambaram

Abstract
Background: *Injuries due to violence is the eighth leading cause of death worldwide. Penetrating abdominal trauma is the third most common area involved. PATI has been used to estimate the severity of abdominal trauma and as a prognostic factor in assessing the mortality rates and commencing the treatment modality regarding repairing the damage and even risk of post-operative complications. The aim of the study is to prove the significance of PATI score (penetrating abdominal trauma index) in assessing the mortality and morbidity in patients with penetrating abdominal injury.*
Objective: *To assess and determine the association of mortality in patients with penetrating abdominal trauma with high PATI score (more than 25).*
Methods and Design: *Case details of all patients (age more than 16 years of age) admitted at Rajah Muthiah Medical College, Annamalai University, Chidambaram with penetrating abdominal injuries from 2008 - 2018 were reviewed retrospectively and prospectively and; adult patients with complete case details were included and patients with missing data were excluded from the study.*
Results: *We included 40 patients in our case study. Stab injuries accounted for about 24 cases followed by bull gore injury[7] (7). Male incidence was 70%. The most common age group affected were between 21 and 30 years.*
Ten patients were treated conservatively who were hemodynamically stable and without signs of peritonism. 30 patients underwent laparotomy and in 5 patients negative laparotomy was encountered. Small bowel was the most commonly injured organ in our study followed by liver and spleen. The mortality rate were 2 among the 30 laparotomised patients. The optimum duration of hospital stay was 10 days. Patients with PATI score of more than 20 were at the risk and were given ICU care. So PATI score is valuable in assessing the mortality and morbidity in patients with penetrating abdominal trauma.
Conclusion: *Stab injuries are responsible for 60% of penetrating abdominal injuries in our study.[15] Management was by emergency laparotomy after clinical assessment, in majority of patients. PATI scoring is of great value in estimating the severity of penetrating abdominal injury and in assessing the mortality rates.*

Introduction Abdomen

The abdomen is a diagnostic black box. Mostly with few exceptions, it is not necessary to assess in the Emergency Department which intra-abdominal organs are injured. Assessment should be based on which patients need exploratory laparotomy and which patient needs to be managed conservatively.[1] Physical examination of the abdomen is unreliable in jumping into a conclusion and drugs, alcohol, and head and spinal cord injuries further complicates clinical evaluation. However, the presence of abdominal guarding and rigidity or hemodynamic instability is an indication for emergency surgical exploration.[3] For the rest of the patients, many diagnostic investigations are used in evaluating abdominal injury. The diagnostic approach varies for penetrating trauma and blunt abdominal trauma. As a dictim, minimal evaluation is required before laparotomy for gunshot or shotgun wounds penetrating the peritoneal cavity, because over 90% of patients have significant organ or viscus injuries.[6] Laparoscopy is another tool in assessing peritoneal penetration and this is followed by exploratory laparotomy to repair injuries. When in doubt, it is always better and safer to explore the abdomen than to equivocate. Penetrating abdominal trauma caused by Stab wounds penetrating the peritoneal cavity are least likely to injure intra-abdominal organs. In Anterior abdominal stab wounds (from costal margin to inguinal ligament and bilateral midaxillary lines) exploration should be done under regional anesthesia in the ED to find out whether the fascia has been violated. Injuries that does not penetrate the peritoneal cavity doesnt not require further evaluation, and the patient can discharged from the Emergency Department and can be managed conservatively. Patients with penetration of the fascia are ought to be evaluated further for intra-abdominal injury, because there are greater chances of requiring a exploratory laparotomy. There seems to be a debate on whether the optimal diagnostic approach is serial examination, diagnostic peritoneal lavage (DPL),[12] or CT scanning. When DPL is carried on, an infraumbilical approach is preferred. A catheter is placed and a 10-mL syringe is connected and the contents are aspirated from the abdomen (termed a *diagnostic peritoneal aspiration*).[13] The aspirate is considered positive if >10mL of blood is aspirated. If <10 mL is withdrawn, usually a liter of normal saline is instilled. The aspirate is withdrawn and sent to the laboratory for RBC count, white blood cell (WBC) count, bilirubin, serum amylase and alkaline phosphatase levels. Penetrating Abdominal stab wounds in three body regions requires a different diagnostic approach: thoraco abdominal region, RUQstab wounds, and back and flank stab wounds. Patients with stab wounds to the RUQ region can undergo CT scanning to find out the extent of the injury and confinement to the liver for potential non operative care. In Patients with stab wounds to the back and flank should a triple-contrast CT should be done in suspicion of any occult retroperitoneal injuries of the duodenum, colon and urinary tract. Penetrating trauma is the most common cause of death in the first four decades of life, and the rate of trauma causing morbidity and mortality seems to peak during war and violence. In trying to minimize the rate of morbidity and mortality associated with penetrating trauma abdomen, factors that affect the morbidity and mortality were evaluated to assess and segregate the patients for whom more intensive care is necessary and transfer them to the suitable ward with better facilities or to refer them to tertiary centers. Study of these predictive factors also gives an idea about the efficacy of surgical team and hospital facilities and help in comparison between different trauma centers.[5] Objectives: The study is aimed to assess and analyze the predictive factors with regards to mortality and morbidity in penetrating abdominal trauma by using penetrating abdominal trauma index (PATI), introduced by moore et al in 1981.[4]

Methods and Design

Case details of all adult patients (age more than 16

years of age) admitted at Rajah Muthaih Medical College, Annamalai University, Chidambaram between 2008 and 2018 are chosen for this study. Resuscitation was done for the patients with fluids, antibiotics and proper wound care was given. Diagnosis of penetrating abdominal injury was obvious in most of the cases, however lower chest injury without obvious exit injury or with delayed or minimal signs of peritonism were the most challenging cases in diagnosis and were investigated using CXR, USG and CT abdomen to the hemodynamically stable patients.

Results

My study showed that Twenty eight Patients (70%) were males, 12 (30%) were females. The age of patients was ranged from 16 to 60 years, with a mean age of 27.9 years ± SD 10.9 years, and the majority being in the age group 21-30 (45%) as tabulated below. The mode of injury was stab injury in 24 patients (60%), bull gore in 8 patients (20%), RTA with penetrating injuries in 7 patients (17.5%) & gunshot wounds in 1 patient as tabulated below. Average time between the accident till the patients reach the hospital was about 2 hours for all patients. Hospital stay period was between 7 to 15 days with a mean of 10 days. Our study showed that the Injured intra-abdominal organs in decreasing frequency were small bowel 10 (33%), liver 6 (20%), omentum 5 (16%), spleen 4 (14%), mesentry 2 (7%) as tabulated below.[9] 30 patients with penetrating abdominal trauma and positive abdominal signs underwent explorative laparotomy. Hepatic injury is managed by different technique according to the severity of injury, the superficial wound without any bleeding was left alone, most of hepatic wounds are managed by suturing using liver needle, when the bleeding continues and the injury is severe packing of the liver is done.

Age in years	Number of patients	Percentage
16-20	3	7.5
21-30	18	45
31-40	12	30
41-50	4	10
>50	3	7.5
Total	40	

Gender	Number of patients	Percentage
Male	28	70
Female	12	30
Total	40	

Mode of injury	Number of patients	Percentage
Stab injury	24	60
Bull gore injury	8	20
Gun shot	1	2.5
RTA with penetrating injury	7	17.5

Plan	Number of patients	Percentage
Operative	30	75
Conservative	10	25
Total	40	100

	Number of patients	Percentage
Therapeutic	25	83
negative	5	17
Total	30	100

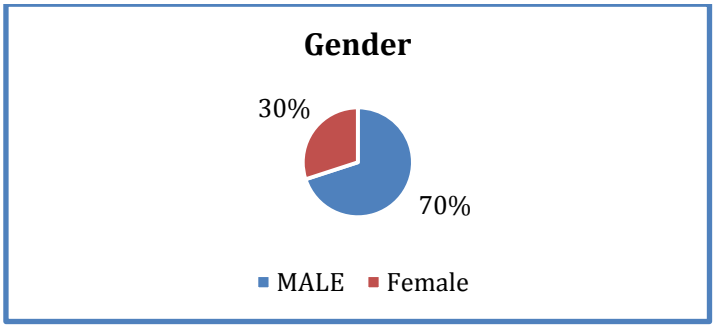
Organ	Number of patients	Percentage
Small bowel	10	33
Stomach	0	0
Liver	6	20
Colon	3	10
Spleen	4	14
Mesentry	2	7
Diaphragm	0	0
Omentum	5	16
Total	30	100

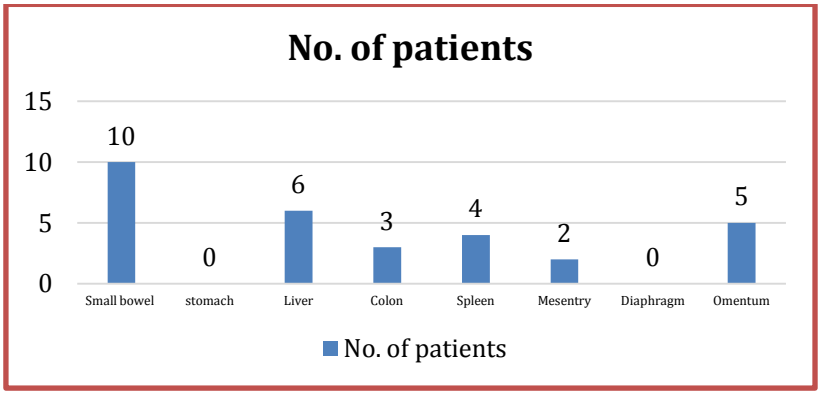
Complications	Number of patients	Percentage
Wound dehiscence	3	21.3
Wound infections	3	21.3
Fecal fistula	1	7
Respiratory complications	4	28
Intra abdominal sepsis	3	21.3
Total	14	100

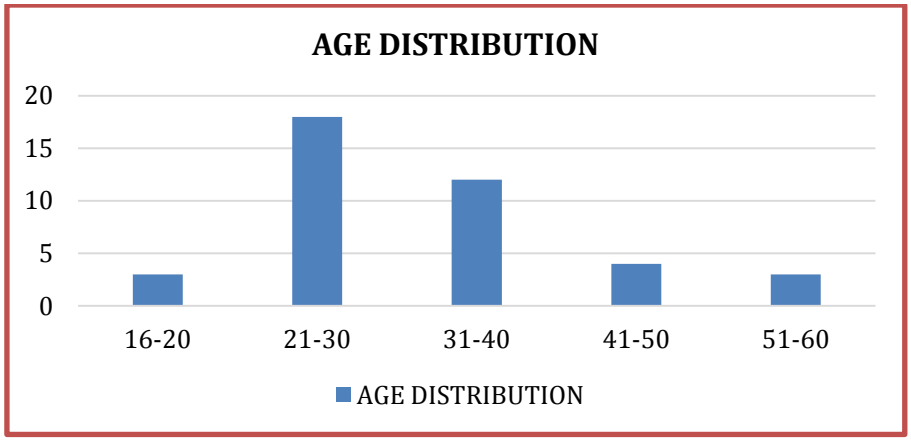
No of days	Number of patients
1- 10	28
11- 20	10
21-30	2

The relationship between PATI and mortality and morbidity

PATI	Number of patient	Percentage	Number of death	Percentage	Number of complication	Percentage
Less than 10	10	25%	0	0	0	0%
11-20	9	22.5%	0	0	2	14%
21-30	14	35%	0	0	5	35%
31-40	5	12.5%	0	0	5	35%
41-50	2	5%	2	5%	2	14%
More than 50	0	0%	0	0	0	0%
Total	40	100%	2	5%	14	35%







Small bowel injury is managed according to the severity of the injury either by two layers suturing or by resection and end to end anastomosis. Colonic injury was treated according to the severity either by colostomy in (60%) of the cases,[16] or primary repair in (40%) of the cases according to the condition of the patient. Splenectomy was done in 4 patients.[8] Post-operatively all patients were either admitted to the surgical postoperative ward or to the ICU when these patients have high level of PATI and associated extra-abdominal injuries. Negative laparotomy was encountered in 5 patients (17%) among 30 operated patients. The extra- abdominal organ injured were chest 34 (35.4%), upper limb 8 (8.3%), lower limb 4 (4.1%), head and neck 4 (4.1%) and spinal cord 2 (2.1 %). The morbidity occurred in 14 patients (35%). Most causes of the morbidity were wound infection in 3 patients (21.3%), wound dehiscence in 3 patients(21.3), respiratory complications in 4 patients(28), fecal fistula in 1 patient(7) and intra abdominal sepsis in 3 patients(21.3). 2 patients died intra operatively or postoperatively. PATI was calculated in all operated patients, the range of PATI was between (0 to 70) with a mean of (21.8 + S.D 10) The study showed that PATI in dead Patients was the highest value while in morbid Patients was more than 25, while Patients with smooth postoperative course was less than 25. Hence by proving that the PATI index is of great value in assessing the outcome of the patients with penetrating abdominal trauma with regards to its mortality and morbidity rates.

Appendix 1:

The Penetrating Abdominal Trauma Index (PATI) can be used to assess the severity of injury in patients with knife, gunshot or other penetrating wounds to the abdomen. The index can be used to compare performance of different emergency care settings.[5]

Patient evaluation

A- 14 organs are examined

B- The risk associated with injury to each organ is graded from 1 to 5. C- The estimated severity of each type of injury is graded from 1 to 5.

Organ injured	Risk Factor	Injury	Injury Estimate
Duodenum	5	single wall	1
		<= 25% wall	2
		> 25% wall	3
		duodenal wall and blood supply	4
		Pancreaticoduodenectomy	5
Pancreas	5	Tangential	1
		through-and-through (duct intact)	2
		major debridement or distal duct injury	3
		proximal duct injury	4
		Pancreaticoduodenectomy	5
Liver	4	nonbleeding peripheral	1

		bleeding central or minor debridement	2
		major debridement or hepatic artery ligation	3
		Lobectomy	4
		lobectomy with caval repair or extensive bilobar debridement	5
Large intestine	4	Serosal	1
		single wall	2
		<= 25% wall	3
		> 25% wall	4
		colon wall and blood supply	5
Major vascular	4	<= 25% wall	1
		> 25% wall	2
		complete transection	3
		interposition grafting or bypass	4
		Ligation	5
Spleen	3	Nonbleeding	1
		cautery or hemostatic agent	2
		minor debridement or suturing	3
		partial resection	4
		Splenectomy	5
Kidney	3	Nonbleeding	1
		minor debridement or suturing	2
		major debridement	3
		pedicle or major calyceal	4
		Nephrectomy	5
Extrahepatic biliary	2	Contusion	1
		Cholecystectomy	2
		<= 25% common duct wall	3
		> 25% common duct wall	4
		biliary enteric reconstruction	5
Small bowel	2	single wall	1
		through-and-through	2
		<= 25% wall or 2-3 injuries	3
		> 25% wall or 4-5 injuries	4
		wall and blood supply or > 5 injuries	5
Stomach	2	single wall	1
		through-and-through	2
		minor debridement	3
		wedge resection	4
		> 35% resection	5
Ureter	2	Contusion	1
		Laceration	2
		minor debridement	3
		segmental resection	4
		Reconstruction	5
Bladder	1	single wall	1
		through-and-through	2
		Debridement	3
		wedge resection	4
		Reconstruction	5
Bone	1	Periosteum	1
		Cortex	2
		through-and-through	3
		intra-articular	4
		major bone loss	5
Minor vascular	1	nonbleeding small hematoma	1
		nonbleeding large hematoma	2
		Suturing	3
		ligation of isolated vessels	4
		ligation of named vessels	5

Discussion

The evaluation in the management of abdominal wounds have been a great advance over the past century. In 1882 Simms emphasized the need of laparotomy in abdominal wound, but the mortality rate remained 72%. After the end of WW1 operative management replaced expectant therapy and reduced the mortality rate to 53%. The mortality rates have been reduced to less than 20% with prompt resuscitation and management. The aim of the study was to find predictive factors to reduce mortality and morbidity in penetrating trauma abdomen by studying circumstances of patients transfer to the hospital, age, sex, mode of injury, PATI, number of intra-abdominal organ injured, associated extra-abdominal injuries and discussing the hospital facilities. From Discussing mortality cases, most of them were injured by stab or penetrating abdominal trauma by road traffic accidents (11 from 13), with PATI of more than 40, and number of intra-abdominal organ injury is more than three, six of them dying either intra-operatively or within 24 hours, which reflect the great association between these predictive factors and development of mortality. But we observe the incidence of mortality was increased with increase in the means of PATI as tabulated. Although the mortality rate increase by increase of the number of intra-abdominal organs injured, but this value does not reflect accurately the severity of injury alone. The morbidity rate also have relation to the increase in PATI. With PATI more than 20 there is an increase in the morbidity rate. The small bowel, liver and spleen have been the most commonly injured organs. The most common complication was respiratory complications (28%) and wound infections with percentage of (21.3%). The PATI is a more accurate method in assessing the extent of damage to different organs and a more valuable index of the overall severity of injury. (O, Neill et al., 2004) In this study, patients with PATI more than 20 developed complications, mortality rate more with patients with PATI is more than 30. We thought that the age of the patient, efficient transport, rapid surgical intervention and use of fresh blood for transfusion is all important factors in minimizing the morbidity and mortality rates. The casualities were managed in a general hospital with the facilities present in our casualty. So our study should not be compared to a study done in a military hospital specialized in treating trauma patients.

Conclusion

Stab injuries are the main cause of penetrating abdominal injury in our study. Penetrating abdominal trauma index score (PATI) is a useful scoring tool in estimating the severity of penetrating abdominal injuries and their outcome. The collective analysis of 40 cases of penetrating abdominal injuries observed for the development of morbidity and mortality showed that PATI is an acceptable prognostic factor. Such approach helps to grade the patient accordingly and start prompt treatment protocol and recognize the possible complication that the patient would encounter intra operatively or postoperatively. So PATI is a useful tool in assessing the mortality and morbidity of patients with penetrating abdominal trauma.

Recommendation

1. Important requirements in reduction of the mortality and morbidity in trauma patients are efficient ambulance services and a regional trauma center.
2. Use of blood products liberally is of great value in management of penetrating abdominal trauma.
3. PATI is a great asset in planning the management of patients with penetrating abdominal trauma.

Conflict of Interest: Declared none.

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