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Prognostic Factors in Penetrating Abdominal Trauma

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Abstract

:Background

Penetrating injuries to abdomen are common and serious problem in our locality since 2003. These injuries causes far more associated .injuries which accentuate the mortality

:Aim

To evaluate the factors that may affect the morbidity and mortality in patients with penetrating abdominal trauma by application of .(ting Abdominal Trauma Index (PATIPenetra

:Patients and Method

Jumhoori -It is a prospective clinical case series study at Al Teaching Hospital (Mosul) and Baghdad Teaching Hospital Baghdad). The Study period was 16 months from 1/4/2013 to)

cases divided into group A (survived group 145 It involved .2015/2/28 patients) and group B (dead group 21 patients). By application of 124 PATI to assess its sensitivity and specificity in determining the morbidity and mortality in patients with penetrating abdominal ll patients who had a penetrating abdominal trauma from trauma. A both sexes who arrive alive to the ER and underwent exploratory laparotomy were included in this study, while who arrive dead or do .excluded not underwent exploratory laparotomy were

:Results of 145 patients [125 (86.2.%) male, 20(13.8%) A total female] with PAT were included in this study. The average and (36-penetrating abdominal trauma index (PATI) was 11.6 ± 8.7 (0 in group A and group B respectively. The (109-15) 21.3 ± 45.6 female patients was (30%) and in male patients was mortality rate of years and 30 ± (74-The mean age was 30.01 ± 13.9 (14 .(%12) average years in group A and group B consecutively. The (71-15)12.5 and 6.0 (4.5-interval between injury and operation was 2.1 ± 1.0 (0.5 hours in group A and group B respectively. Presence of (11-1) 2.2 ± shock on admission was determined in 25 patients and in 14 patients in group A and group B respectively. The mortality rate in patients with high velocity gunshot presenting shells is 20.6% and in patients .%14 wounds was

abdominal organs was 2 ± 1 -The average number of injured intra in group A and group B (11-and 5 ± 2 mean : (1 (5-mean : (1 .respectively

Mortality rates were 42.9% in great vessels injuries, 38.1% in head .and 19% in major extremity and pelvic injury ،injury

:Conclusion The PATI is of a big value in predicting mortality in patients with penetrating abdominal trauma. Is this study, conditions such resence as, female gender, the long interval between injury and operation, p of shock during admission, presence of great vessels and high PATI were .predicting factors for mortality in penetrating abdominal trauma

:Recommendations Application of the PATI in trauma centers will lity in penetrating abdominal have a considerable value in predicting morta trauma patients

Improvements of conditions such as, rapid transport of major trauma victims, improve resuscitation facilities in ambulances, blood bank services, education of paramedical personnel, and other trauma care s would result in a significant reduction in patient mortality within system .the first hours after injury

:Key Words Penetrating abdominal trauma, PATI, mortality, .exploratory laparotomy

Introduction

health problem. In fact, it is Trauma is recognized as a serious public the leading cause of death and disability in the first four decades of life [(1)] and is the third most common cause of death overall

Trauma is the study of medical problems associated with physical verse effect of a physical force upon a person. injury. The injury is the ad There are a variety of forces that can lead to injury, including physical, thermal, ionizing radiation and chemical. However, the force involve in .[(1)] most injuries is mechanical

ns with the largest surface area when For penetrating trauma, orga viewed from the front are most prone to injury (small bowel, liver, and colon). Additionally, because bullets and knives usually follow straight lines, adjacent structures are commonly injured (e.g., the pancreas and [2] (uodenumd

Penetrating injuries are classified according to the wounding agent i.e., stab wound, gunshot wound, or shrapnel). Gunshot wounds are) velocity injuries, because the speed -and low -subdivided further into high ant than its weight in determining of the bullet is much more import velocity gunshot wounds (bullet speed >2000 ft/s) -kinetic energy. High are infrequent in the civilian setting. Shotgun injuries are divided into range shotgun -range wounds. Close-range (<20 feet) and long-close velocity wounds because the entire -tantamount to high wounds are energy of the load is delivered to a small area, often with devastating range shotgun blasts result in a diffuse pellet -results. In contrast, long ose that do strike are pattern in which many pellets miss the victim, and th [2] .dispersed and of comparatively low energy

operative observation may be reasonable. In obese patients, -CT scan, non is thought to be tangential through the subcutaneous if the gunshot wound tissues, CT scan can delineate the track and exclude peritoneal violation. Laparoscopy is another option to assess peritoneal penetration for afer to explore tangential wounds. If there is doubt, however, it is always s In the scenario of tangential high energy gunshot [2] .the abdomen peritoneal -wounds, however, it is possible to sustain a transmitted intra hollow visceral injury due to a blast insult. Gunshot wounds to the back t to evaluate because of the retroperitoneal or flank are more difficul contrast CT scan can -location of the injured abdominal organs. Triple or delineate the trajectory of the bullet and identify peritoneal violation .injuries retroperitoneal entry, but may not identify the specific

As a rule, minimal evaluation is required before laparotomy for gunshot or shotgun wounds that penetrate the peritoneal cavity, because over 90% uries. Anterior truncal gunshot of patients have significant internal inj wounds between the fourth intercostal space and the pubic symphysis whose trajectory as determined by radiograph or wound location indicates peritoneal penetration should undergo laparotomy. The exception is ma isolated to the right upper quadrant; in penetrating trau by liver the to confined trajectory with patients stable hemodynamically

abdominal wounds may cause occult injury to the -Penetrating thoraco diaphragm. Patients with gunshot or stab wounds to the left lower chest should be evaluated with diagnostic laparoscopy or DPL to exclude L evaluation, laboratory diaphragmatic injury. For patients undergoing DP value cutoffs to rule out diaphragm injury are different from traditional [2] .values formerly used for abdominal stab wounds

Modern day concepts of damage control have been honed in the of 50 percent in severely injured civilian sector resulting in survival rates Damage control as it is currently [3] .patients in hemorrhagic shock practiced is simply defined as the rapid initial control of hemorrhage and contamination with packing and a temporary closure, followed by suscitation in the intensive care unit (ICU), and, subsequent physiologic re exploration and definitive repair once normal physiology has been -re restored. From a military perspective, damage control concepts apply to focused surgery on all body regions, with an emphasis on abbreviated and patients expected to survive, thus conserving resources and allowing [4] .definitive care at the next level of care

Rapidly achieving these objectives in severely injured trauma patients ,sisodica ,aimrehtopyh fo "is crucial to mitigating the trauma "lethal triad The acidosis results from hypovolemic shock and [5] .and coagulopathy inadequate tissue perfusion. Hypothermia results from exsanguination and loss of intrinsic thermoregulation. Coagulopathy results from platelet and clotting factors consumption, and ‹hypothermia, acidemia thus blood loss. Coagulopathy, in turn, causes more hemorrhage and

causes more acidosis and hypothermia; so the "bloody vicious cycle" uniformly fatal continues. Once established this vicious cycle is almost and must be prevented using damage control principles rather than [5] .attempting to treat it once it has occurred

The development of efficient ambulance services, blood banks and f mortality regional trauma centers have contributed to the reduction o Early death secondary to .[6,7,8] from 20.1% to 9.5% in the 1990s exsanguinations hemorrhage has been replaced by delayed death due to [9,10] .infection

The risk factors influencing mortality and morbidity in these civilian [12,13].studied settings have been

hospital time, inadequate supply of blood for -Elsewhere, prolonged pre transfusions and the high rate of colon injury contribute to a relatively [14] .high incidence of postoperative infectious complications and death

PATI score, number of postoperative It was determined that complications per patient and presence of shock on admission were independently significant factor in predicting mortality in patients with [13] .abdominal gunshot wounds

actor of each PATI can be calculated by multiplying the risk f abdominal organ by the factor of the its injury and the summation of all will give the PATI score, for example; a patient was found to have large bleeding liver injury; -intestine injury less than 25% of its wall and a non .[9] be (4x3) + (4x1) =16 his PATI score will

Based on assigning a complication risk * (15) .*et al* Table 1: Calculation of the PATI* from MOORE = factor (x) to each organ system involved and grading each organ injury (1 =minimal, 2 = minor, 3 .(major, 5 = maximum = moderate, 4

Organ injured	Risk factor	scoring
Duodenum	5	1. wall Single 2. wall %25 < 3. wall %25 < 4. blood Duodenal wall and supply 5. Pancreaticoduodenectomy
Pancreas	5	1. Tangential 2. Duct) through-and-Through (Intact 3. distal Major debridement or duct injury 4. injury Proximal duct 5. Pancreaticoduodenectomy
liver	4	1. peripheral Non bleeding 2. minor Bleeding, central, or debridement 3. hepatic Major debridement or artery ligation 4. Lobectomy 5. repair Lobectomy with caval or extensive bilobar debridement
Large intestine	4	1. Serosal 2. wall Single 3. wall %25 < 4. wall %25 < 5. supply Colon wall and blood
Major vascular	4	1. wall %25 < 2. wall %25 < 3. transection Complete 4. or Interposition grafting bypass 5. Ligation
Spleen	3	1. bleeding Non 2. agent Cautery or haemostatic 3. or Minor debridement suturing 4. Resection Partial 5. Splenectomy
kidney	3	1. bleeding Non 2. or Minor debridement suturing 3. debridement Major 4. calyceal Pedicle or major 5. Nephrectomy

Organ injured	Risk factor	scoring
hepatic biliary-Extra	3	1. contusion 2. Cholecystectomy 3. wall common duct %25 < 4. wall common duct %25 < 5. Biliary enteric reconstruction
Small intestine	2	1. wall Single 2. through-and-Through 3. injuries 3-wall or 2 %25 < 4. injuries 5-wall or 4 %25 < 5. or Wall and blood supply injuries 5 <
stomach	2	1. wall Single 2. through-and-Through 3. debridement Minor 4. resection Wedge 5. resection %35 <
ureter	2	1. Contusion 2. Laceration 3. debridement Minor 4. Segmental resection 5. Reconstruction
bladder	2	1. wall Single 2. through-and-Through 3. Debridement 4. resection Wedge 5. Reconstruction
bladder	2	1. wall Single 2. through-and-Through 3. Debridement 4. resection Wedge 5. Reconstruction
bone	1	1. Periosteum 2. Cortex 3. through and-Through 4. articular-Intra 5. loss Major bone
Minor vascular	1	1. small Non bleeding haematoma 2. Non bleeding large haematoma 3. Suturing 4. vessels Ligation of isolated 5. vessels Ligation of named

Aim of the study

To evaluate the factors that may affect the morbidity and mortality in patients with penetrating abdominal trauma by application of penetrating .(abdominal trauma index (PATI

Patients and Methods

ta collection documents, case records of all Using a standardized da of April 2013 to $^{st}1$ patients with penetrating trauma diagnosed between Jumhoori Teaching Hospital in Mosul and from the -of May 2014 at Al $^{st}1$ of February 2015 at Baghdad Teaching thof December 2014 to 28 $^{st}1$ spital in Baghdad (16 months) were reviewed. All patients who had Ho emergency laparotomy after sustaining gunshot wounds, shrapnel and stab wounds were included in the study. Patients characteristics (age and unds/stab wounds), gender), etiology of trauma (shrapnels/gunshot wo interval between injury and operation, presence of shock during abdominal organ injuries, thoracic injury -admission, number of intra pneumothorax and/or pulmonary injury), penetrating cardiac -hemo) minal / thoracic), cranial injury, injury, great vessels injury (intraabdo who major extremity and pelvic injury and PATI were recorded. Patients arrived dead to the emergency department or who doesn't underwent .study exploratory laparotomy were excluded from this

factors and mortality was investigated. The relationship between these Interval between injury and operation was defined as the period between injury and operation and it was calculated according to the information collected from the patient himself or his/her relatives. Shock on sion was defined as systolic pressure of less than 90 mm Hg and admis consuming -heart rate greater than 100 per min. In gunshot wounds, time radiological or laboratory analyses were not carried out in case of ounds, the presence of peritoneal penetration. In case of stab w haemodynamically stable patients and those with no peritoneal findings in the first physical examination, or those suspected of such findings, were candidates for laparotomy after performing some diagnostic ion and abdominal attempts such as local wound explorat .ultrasonography

posterior and lateral views is very -ray, antero -Plain abdominal x helpful, simple and easy way in determining the direction, the possibly injured organs, and weather the bullet or the shell is in or outside the .l cavityabdomina

When there was no contraindication, nasogastric tube and urethral the catheter were performed routinely. While an antibiotic of

cephalosporin group was given for prophylaxis, an antibiotic with anaerobic spectrum (metronidazole) was also included in the treatment. In all patients midline laparotomy was performed. In the thoracic injuries, performed. Bullets, bullet tube drainage were-thoracotomy and/or chest fragments and shells in the operation field were extracted if possible. After the completion of all repairs, peritoneal and wound lavage with copious isotonic saline, the peritoneum, fascia, subcutaneous tissue and -sed. Number of extra abdominal and number of intraskin were clo abdominal injuries were all recorded. The PATI score for each patient Table 1). The Glasgow) [15] *.et al* was calculated as described by MOORE l injury. Coma Scale (GCS) was calculated in the patients who had crania The death in the first 48 hours was considered as early mortality. All epidemiological, clinical and operative features were recorded for probable risk factors for mortality. Findings for risk factors included: age, terval between injury and operation, gender, etiology of trauma, in presence of shock during admission, thoracic injury, penetrating cardiac injury, great vessels injury, cranial injury, major extremity and pelvic .PATI abdominal injuries and-injury, number of intra

Results

A total of 145 patients [125 (86.2%) male, 20 (13.8%) female] with PAT were enrolled in this study. Of 145 patients, 124 (85.5%) were in the group A (survived group), and 21 (14.5%) were in the group B (dead .(group

range from 1 to 58) and 46.24 ±) The average PATI was 11.78 ± 9.44 range from 15 to 119) in group A and group B respectively (p =) 22.18 .(Table 2) (0.000

The overall mortality rate for penetrating abdominal trauma in this died (study was 21 patients (dead group (B) 14.5%). 14 patients (66.7% in the first 48 hours postoperatively due to shock, disseminated intravascular coagulation, adult respiratory distress syndrome and/or day -pulmonary emboli, 7 patients (33.3%) died in the postoperative 30 .failure multiple organ due to sepsis, gastrointestinal fistula and/or

The mortality rate of female patients (30%, 6 patients of 20) and in .(F* male patients (12%, 15 patients of 125) (p = 0.045

(71-years and 30 ± 12.5 (15 (74-The mean age was 30.01 ± 13.9 (14 respectively and there was no statistical years in the group A and group B difference related to age between group A and group B (p = 0.99) (Table .(2

The average interval between injury and operation was 2.1 ± 1.0 hours 1 range from 0.5 hours to 4.5 hours) and 6.0 ± 2.2 hours (range from) .(*hours to 11 hours) in the group A and group B respectively (p = 0.000

During admission, the shock was diagnosed in 25 patients and in 14 .(patients in group A and group B respectively (p = 0.000) (Table 2

lls injury, 50 patients Of all patients, 68 patients (48%) due to she due to high velocity gunshot wounds, 14 patients (9.8%) due to (%35) low velocity gunshot wounds, and 10 patients (7.2%) due to stab wounds .were operated on

The mortality rate was in shrapnel injury 20.6% and in high velocity .ot wounds 14%gunsh

abdominal organ injury was 2 ± 1 (range -The average number of intra from 1 to 5) and 5 ± 2 (range from 1 to 11) in group A and group B .(respectively (p = 0.000

Thoracic injury was determined in 29 (23.4%) patients and in 6 patients in group A and group B respectively (p = 0.608). Of (%28.6) group A 4 patients and 5 patients in group B had underwent thoracotomy .and the remaining patients had chest tube insertion only

in head %38.6 ،Mortality rates were 42.9% in great vessels injuries .(F* injury, and 19% in major extremity and pelvic injury (p = 0.9

The mean GCS of patients who had cranial injury were 12.63 ± 1.88 range from 9 to 15) and 10.28 ± 3.17 (range from 3 to 14) in group A) .(0.015 = and in group B respectively (p

patients in group A and 4 patients in group B had underwent damage 1 .control surgery

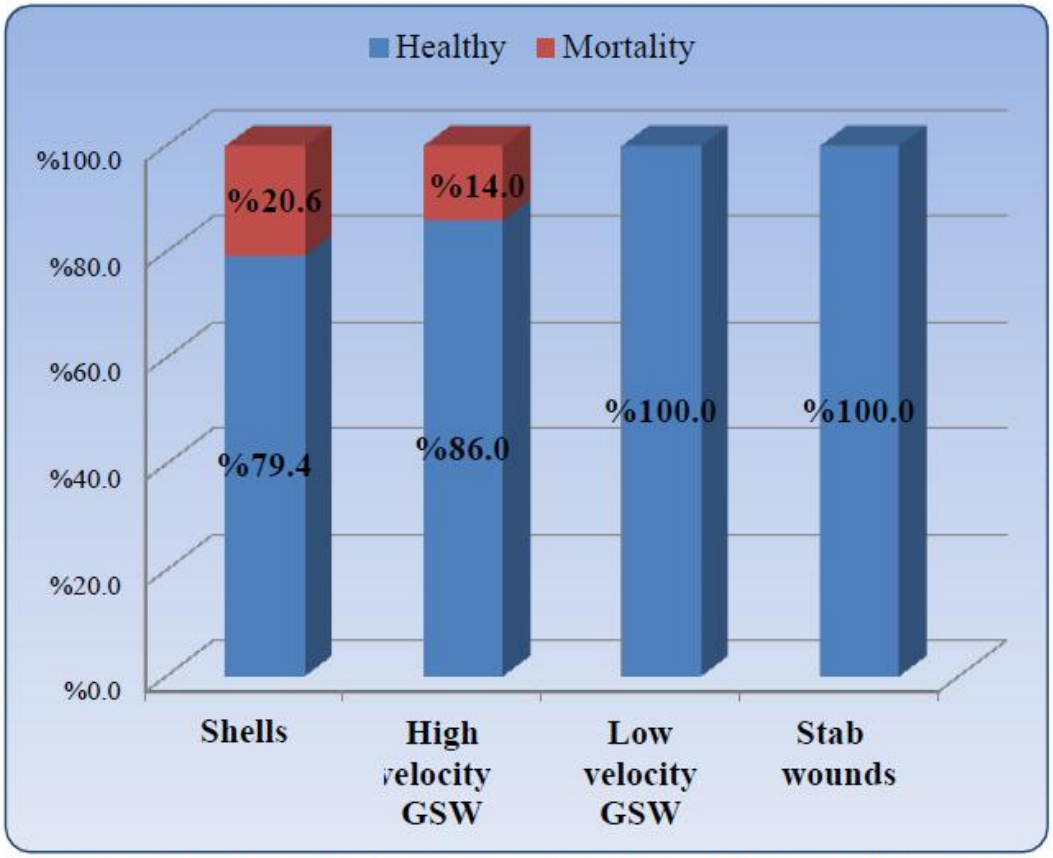
= PAT .PAT to exposed patients in mortality for predictors potential of analysis Univariate :Table2
.significant * ،test exact Fishers =F ،trauma abdominal Penetrating

Parameters	(Survived (A (%) .No	(Dead (B (%) .No	% Mortality	value-p
Gender				
:Female-1	(70) 14	6	%30	F،*0.045
:Male-2	(88) 110	15	%12	
:Type of penetrating injury				
Shrapnel-1	(79.4) 54	14	%20.6	*0.049
High -2 velocity gunshot wounds	(86) 43	7	%14	
Low velocity-3 GSW	(100) 16	0		
Stab wounds-4	(100) 11	0		
Presence of shock during admission	(20.2) 25	14	%66.7	0.000
abdominal organ injured-Extra				
Thoracic	(23.4) 29	6	%28.6	0.608
Cranial injury	(16.1) 20	8	%38.1	F،*0.032
Great vessels injury	(18.5) 23	9	%42.9	F،*0.021
Extremities injury	(20.2) 25	4	%19	F 0.9

between interval ،age ،PATI for value p and deviation standard ± mean the : 3 Table
injury organ abdominal-intra of number and operation and injury

Parameters	Mean ±SD	Mean ±SD	P value
Age	13.9 ± 30.01 (74-14)	12.5 ± 30 (71-15)	0.99
Interval between injury and operation	1.0 ± 2.1 (4.5-0.5)	2.2 ± 6.0 (11-1)	*0.000
-Number of intra abdominal organ injury	1.0 ± 2 (5-1)	2 ± 5 (11-1)	*0.000
PATI	8.7 ± 11.6 (36-1)	21.3 ± 45.6 (109-15)	*0.000

In univariate analyses, age, the long interval between injury and -operation, presence of shock during admission, number of intra PATI and were found significantly abdominal organ injury and high .(3 associated with mortality (Table



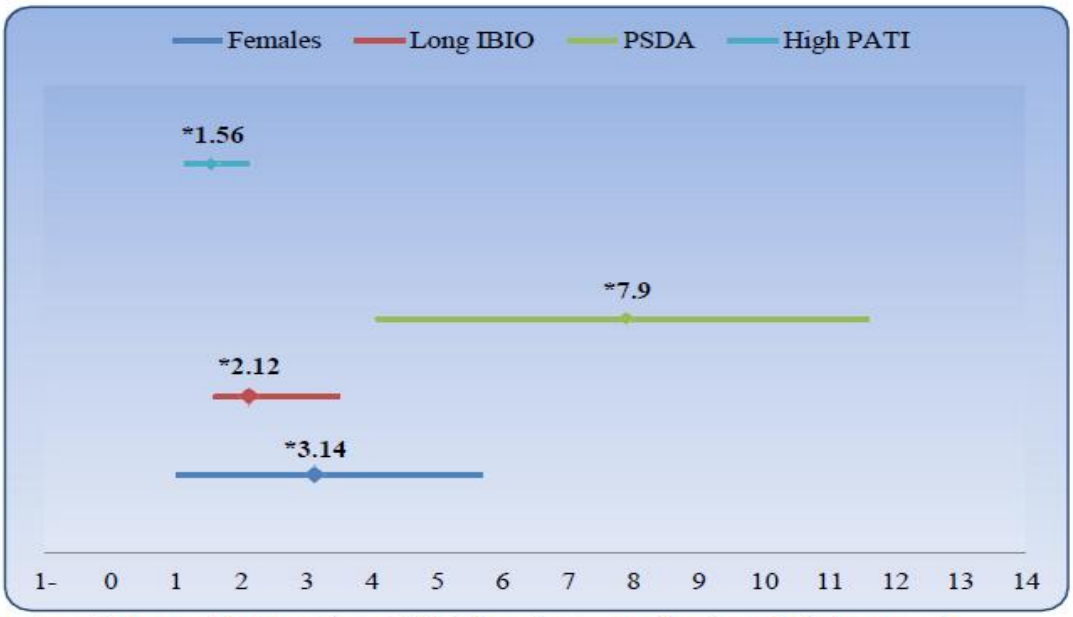
Prevalence of mortality according to the etiology of :**Figure 1**
.PATI, n=145

The highest mortality rate was for the high velocity injury (shrapnel and wounds because of gunshot wounds) while the mortality was zero for stab abdominal injuries from high velocity shrapnel or the variety of intra- .(gunshot wounds as seen in figure (1

Multivariate analysis of potential predictors for mortality in the penetrating :*Table 4*
Penetrating = PATI ، regression logistic (Wald) stepwise wardBack* .trauma abdominal
،index abdominal trauma

Factors	P value	Odds ratio	confidence interval %95 (upper-lower)
The female gender	*0.000	3.14	5.68-1.04
The long interval between injury and operation	*0.000	2.12	3.49-1.62
Presence of shock during admission	*0.000	7.9	11.6-4.1
High PATI	*0.000	1.56	2.11-1.17
Significant at 0.05*			

These variables were entered into the logistic regression model for analyses, female revealing the risk factors for mortality. In multivariate P = 0.000], the long interval between ،5.68-gender (OR = 3.14, CI = 1.04 P = 0.000), presence of ،3,49-injury and operation (OR = 2.12, CI = 1.62 P = 0.000), and high ،11.6-shock during admission (OR = 7.9, CI = 4.1 P = 0.000), were found significantly ،2.11-17.PATI (OR = 1.56, CI = 1 .(important for mortality (Table 3



potential predictors for Multivariate analysis of :**Figure 3**
.mortality in the PAT, n=145

In multivariate analysis show significance of long interval between injury and operation, presence of shock during admission, and high PATI in (predicting mortality. Figure (2

Discussion

Trauma related deaths tend to occur at three traditionally recognized times after injury. About half of all trauma related deaths occur within .seconds or minutes of injury

The second mortality peak occurs within hours following injury and of deaths, half of which are caused by hemorrhage and %30 account for .half by injuries to central nervous system

The PATI score is a more accurate method of quantifying the extent of damage to different organs and therefore is a more valid index of overall .f injuryseverity o

PATI is the most frequently used scoring system to estimate the risk of morbidity and mortality by determination of the severity of trauma in the is [15] *.et al* penetrating injuries. Though this index, defined by MOORE ng the risk of morbidity, it is also used for more important in determini [15] mortality

This study showed that PATI score correlated with mortality in both in group A (36-univariate and multivariate analysis with mean PATI (0 ldemira M. et in group B, p value (0.000) as compared to A (109-and (15 and for the dead (58-where mean PATI for survived group was (0 [19] al .(with P value of (0.000 (119-group (15

In this study, the overall mortality rate for PAT was 14.5%. Of those disseminated ،patients, 66.7% died in the first 48 hours due to shock intravascular coagulation, acute respiratory distress syndrome and/or day due to -pulmonary emboli and 33.3% died in the postoperative 30 .sepsis, gastrointestinal fistula and/or multiple organ dysfunction

l difference related to age between In this study, there was no statistica group A and group B which is similar to M. Aldemira et.al 2004 a study involving 1048 case and was found that age was not significant factor in .[19] determining mortality

significantly higher The mortality rate of female patients (30%) was than that of male patients (12%) in the univariate and multivariate analysis. This may be related to the fact that the number of male patients

was higher than that of female patients, compared to M. Aldemira M. were mortality rate for female was 22.5% and for male was 2004 [19] et.al .%8.6

In this study, mortality was high in shrapnel and gunshot wounds .cases compared with stab wounds cases in univariate analysis

between injury have reported that the interval ،[17] BAKER et al 1996 and treatment is an important factor affecting mortality (p value: 0.000). The longer the interval, the higher is the risk of shock in patients which is similar to this study. Besides, a long interval increases also the severity [17] of shock and duration

In this study, the average interval between injury and operation in group A was significantly lower than that of group B in univariate and multivariate analysis (p value 0.000) which is similar to Aldemeria et al .[18]

reported that shock played a varying role, from [18] BRITT et al. 1996 to 100% in the death cases. In this study, at admittance a %5.5 hypovolemic shock was determined in 66.7% of death cases. We determined in the logistic regression analysis that presence of shock at .sion was a significant predicting factor for mortalityadmis

in group (5-abdominal organ injury was (1-The mean number of intra et al .M in group B P value (0.000) compared to Aldemira (11-A and (1 (7-s (1abdominal organ injuries wa-where the mean number of intra 2004 .[18] in death group (13-in survived group and (1

In this study, injury to the great vessels was the highest mortality rate while in Chambers LW, et al 2005, the highest mortality rates was %42.9 abdominal injuries -raassociated with cranial injuries associated with int .[3] %39.6

abdominal injuries -In this study, prevalence of penetrating thoraco was 23.4% and mortality rate of this injury was 28.6% which was not where the incidence of ،[18] significant and agreed with Aldemira M. et al minal injuries was 11.7%. However, thoracic injury was not abdo-thoraco a predictive factor for mortality. This may be related to a large number of .side stab wounds and wounds to the right

e of one Damage control surgery strategy was helpful in saving the lif critically injured patient out of four for which the strategy was applied for .them

Conclusion

The PATI is of a great value in predicting mortality in patients with female ،penetrating abdominal trauma. Is this study, conditions such as gender, the long interval between injury and operation, presence of shock during admission, presence of great vessels and high PATI were predicting factors for mortality in penetrating abdominal trauma. Damage the life of critically injured patient control strategy was helpful in saving from 4 patients whom underwent damage control surgery so it is of great .value and should be applied

Recommendation

Application of the PATI in trauma centers will have a considerable determining mortality in penetrating abdominal trauma patients value in

Improvements of conditions such as, rapid transport of major trauma victims, improve resuscitation facilities in ambulances, blood bank rauma care services, education of paramedical personnel, and other t systems would result in a significant reduction in patient mortality within .the first hours after injury

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