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A prospective and retrospective study on conservative management of hepatic and splenic injury following blunt abdominal trauma

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ABSTRACT

Background: worldwide road traffic accidents accounts as the leading cause of death of young people. For a very long time most of the intra-abdominal injuries following blunt abdominal trauma were managed operatively. Conservative management is becoming more acceptable and effective management option for blunt abdominal trauma during the last few decades.

Methods: This study was conducted in Government Medical College, Kottayam during September 2007 to December 2008. All conservatively managed blunt abdominal trauma patients during the study period were included in the

Results: Out of 22 patients, 4 patients failed conservative management. Success rate was 81%. Most commonly injured solid organ in the study group was liver (77%). Maximum cases were of age group 10 to 20 (31.81%) years. 81% of patients were males. Motor vehicle accident was the most common cause of trauma (77%). Mean stay in intensive care unit was 4.2 days and mean hospital stay was 15.7 days. Mean systolic blood pressure was 110 mmHg ranging from 70 to 130 mmHg. 50% of patients had moderate hemoperitoneum and non-had massive hemoperitoneum.

Conclusions: Non operative management is safe and effective approach in blunt spleen and liver injuries. Non operative management should be treatment of choice for all hemodynamically stable patients with blunt liver and splenic trauma.

Keywords: Blunt abdominal trauma, Conservative management, Liver injury, Splenic injury, Road traffic accidents, Hemodynamic stability

INTRODUCTION

Approximately 1.35 million people die each year as a result of rode traffic accidents. Road traffic injuries are the leading cause of death for children and young adults aged 5-29 years and it costs most countries 3% of their gross domestic product. 93% of the worlds fatalities occur in low- and middle-income countries. As a developing country India is no exception. After extremity and head injury abdomen is the third most common system affected by major trauma. Majority of blunt abdominal traumas are due to motor vehicle accidents and to a lesser extent due to direct blow to abdomen from various causes.

Surgery was considered as gold standard treatment for blunt abdominal trauma especially with splenic injuries.² universally believed that non-operative management carried a high mortality of 90 to 100%. The possibility of non-operative management was first recognised by paediatric surgeons in children with splenic trauma. Non operative management has proved to

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be valuable therapeutic option and its application is progressively increasing due to higher confidence level that surgeons build through experience and the use of advancing technology that ensures continuous and reliable monitoring.³ Aim of this study is to find out the outcome and safety of blunt abdominal trauma

METHODS

A prospective and retrospective study on twenty-two cases of sustained blunt abdominal trauma, admitted to Government Medical College, Kottayam with contrast tomography (CT) scan evidence of splenic or liver injury,

which were managed nonoperatively between 2007 September to 2008 December, were included in the study.

Patients with clinical suspension of blunt abdominal trauma (BAT) were first evaluated in the emergency department and hemodynamically stable patients and those became stable after initial resuscitation underwent CT scan of abdomen. CT scan of abdomen was taken after administration of IV contrast. Hepatic and splenic injuries were graded based on the appearance of CT scan according to the organ injury scale adopted by American association for surgery of trauma (AAST) (Table 1 and 2).^{4,5}

Table 1: AAST grading for liver injury scale.4

Grade	Liver injury scale (2018 revision)
I	Sub capsular hematoma <10% surface area.
	Parenchymal laceration <1 cm depth.
II	Sub capsular hematoma (10-50) % surface area; intraparenchymal hematoma <10 cm in diameter.
	Laceration (1-3) cm in depth and ≤10 cm length
III	Sub capsular hematoma >50% surface area; ruptured sub capsular or parenchyma hematoma.
	Intraparenchymal laceration >10 cm, laceration >3 cm depth.
	Any injury in the presence of a liver vascular injury or active bleeding contained within liver parenchyma.
IV	Parenchymal disruption involving (25-75%) of a hepatic lobe.
	Active bleeding extending beyond the liver parenchyma into the peritoneum.
V	Parenchymal disruption >75% of hepatic lobe juxta hepatic venous injury to include retro hepatic vena cava
	and central major hepatic veins.

Table 2: AAST grading for spleen injury scale.⁵

Grade	Spleen injury scale (2018 revision)				
I	Sub capsular hematoma <10% surface area, parenchymal laceration <1 cm depth capsular tear.				
II	Sub capsular hematoma (10-50) % surface area; intraparenchymal hematoma <5 cm, parenchymal laceration (1-3) cm.				
Ш	Sub capsular hematoma >50% surface area; ruptured sub capsular or intraparenchymal hematoma ≥5 cm.				
	Parenchymal laceration >3 cm depth.				
IV	Any injury in the presence of a splenic vascular injury or active bleeding confined within splenic capsule.				
	Parenchymal laceration involving segmental or hilar vessels producing >25% devascularisation.				
V	Parenchymal disruption >75% of hepatic lobe, juxta hepatic venous injury to include retro-hepatic vena cava				
	and central major hepatic veins.				

Hemodynamically stable patients and those who became stable after initial resuscitation with evidence of hepatic or splenic injury and who had no signs of peritonitis clinically were considered for nonoperative management. All patients underwent routine radiological evaluation of cervical spine, chest and pelvis. CT head was taken for all patients with clinical suspicion of head injury.

Blood samples of those patients were analysed for routine haemogram, serum biochemistry, blood typing etc. All patients were observed in intensive care unit (ICU) and close monitoring of clinical and laboratory parameters were done. Hourly pulse rate and BP monitoring were maintained. Haemoglobin and PCV were monitored 4th hourly. Repeated clinical examination were performed on regular intervals for developing abdominal signs of

peritonitis. All patients were managed with nothing by mouth, nasogastric tube decompression, intravenous fluids. Patients with contaminated external injuries received IV antibiotics.

Blood transfusion was given for those patients with a fall in haemoglobin below 10 gm%. All patients were monitored in ICU for a minimum period of 48 hours after which they were shifted to general ward. Radiological reassessment of each patient of each patient was done with ultrasound scanning on third and seventh days of admission and also just before discharge from the hospital.

Patients who develop hemodynamic instability, persistent drop in haemoglobin or developing signs of peritonitis were taken for laparotomy and were considered as failure of non-operative management. Data analysis was performed using SPSS software.

RESULTS

Twenty-two patients who underwent conservative management in Government Medical College, Kottayam during the study period of September 2007 to December 2008 were included in the study. Out of 22 cases 18 were male and 4 were females.

According to the mechanism of injury 17 of the patients (77%) had motor vehicle accident, 2 (9%) had fall from height, 2 (9%) had heavy object falling on abdomen and 1 (5%) had assault (Figure 1).

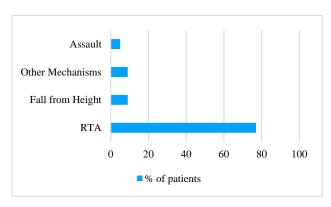


Figure 1: Mechanisms of injury in study participants.

Most common organ injured was liver. Seventeen (86%) patients had liver injury. Five (22%) patients had splenic injury. Two of them had both splenic and liver injury (Table 3). 14 (63%) had associated injuries other than liver or spleen. Most common associate injury was lower rib fractures (45%).

Mean duration in hospital was 15.7 days. One patient had prolonged hospital stay of 68 days. Excluding that patient mean hospital stay was 13 days. Mean ICU stay was 4.2 days. 6 out of 22 patients had an initial Hb of <10 gm%. Average blood transfusion was 1.5 units. A maximum transfusion requirement was 6 units for a patient who subsequently needed laparotomy.

Table 3: Organ specific injury.

Organ	No. of patients
Liver trauma	17
Splenic trauma	5
Both spleen and liver	2

Among the liver injuries segment VI, VII, VIII were most commonly injured. Of the five splenic injuries one had laceration, two had subcapsular hematoma and two had laceration and hematoma (Table 4). 10 patients had minimal hemoperitoneum 11 of them had moderate hemoperitoneum and one patient didn't have free fluid in

the abdomen. None of them had massive hemoperitoneum.

Table 4: CT grading according to association for surgery of trauma organ injury scale.

Grades	I	III	Ш	IV	
Liver	5	8	4	3	
Spleen	-	3	2	-	

Success rate

Out of 22 patients 4 patients failed conservative management and one patient expired at day eight because of causes other than liver or splenic trauma (massive pulmonary contusion leading to respiratory failure ventilator associated pneumonia and septicemia). That patient is excluded from calculating success rate.

Table 5: Organ specific success rate.

Variables	Total no. of patients	No. of failures	Success rate in %
Liver	19	2	89
Spleen	5	2	60

Overall success rate for conservative management of hepatic and splenic trauma following blunt abdominal trauma in this study was 81% (Figure 2).

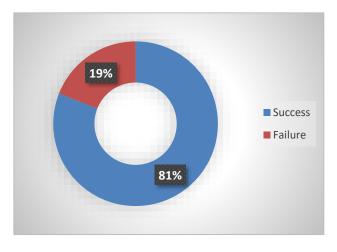


Figure 2: Overall success rate.

DISCUSSION

Liver and spleen are the most commonly injured intraabdominal organs in blunt abdominal trauma.⁶ Laparotomy was considered as the treatment of choice for past decades. The risk of developing overwhelming post splenectomy infection first described by King and Shumaker was the initial impetus behind the thinking towards a possible conservative management in spleen in pediatric patients.⁷ As early in 1908 Pringle suggested that minor liver injuries will heal without operative intervention.⁸ Fortunately, majority of blunt liver injuries are not severed and most of these injuries stopped bleeding at the time of laparotomy. Management of solid organ injuries have changed throughout the years with primary goal being reducing morbidity and mortality from hemorrhagic shock and sepsis.

More than half of earlier reported studies were limited to pediatric population, more recent studies have demonstrated successful application of conservative or non-operative management (NOM) in adults. Currently NOM is the treatment of choice for patients with blunt injury to liver and spleen and who are hemodynamically stable. There are numerous studies regarding the NOM of abdominal trauma. Success rate of NOM for blunt trauma varies in a wide range.

The most important modality of investigation that allowed successful non-operative management of abdominal trauma (NOMAT) is CT abdomen. Initial evaluations with the use of CT in guiding non-surgical management of abdominal trauma was described by Meyer et al and Federle et al. 10,11 They concluded that non-operative management should be considered if hemoperitoneum is less than 250 ml provided patient is hemodynamically stable.

Initial studies non-operative approach was limited to minor grades of injury (I and II) and in certain instances extended to grade (III and IV). Later on the concept that haemodynamic stability rather than grade of injury is more important determinant for the management of blunt abdominal trauma was put forwarded by many experts in the field of trauma. This concept was supported by studies of Croce et al where grade IV-V injuries were managed by NOMAT. On literature review majority of patients belong to grade II and III and the chance of failure increases with higher grades of injury. In our study 17 patients were having grade II or III injuries and only 2 patients were having grade IV injury.

Presence of contrast extravasation (contrast blush) is considered ass a contraindication for NOMAT. ¹⁵ In our series none of the patients had contras blush. In his study Federico concluded that amount of free fluid in the abdomen did not predict failure of treatment and was supported by other studies. ¹⁶ In our series 50% of patients were having moderate amount of free fluid in abdomen. Out of the 4 failed cases only one patient was having moderate to large amount of hemoperitoneum. So, presence of moderate to massive hemoperitoneum is no longer considered as a prediction for failure.

Another important concern in NOMAT is chance of a missed hollow viscous injury. Fischer et al cautioned that GI disruption occurs in 15% of BAT. ¹⁷ In his series conducted in 1988 he concluded that routine NOM in adults is not warranted due to high incidence of missed hollow viscous injury. But numerous studies followed in later years proved undoubtedly that dedicate serial

clinical examinations along with quality radiological assessment can pick up most of hollow viscous injuries.¹⁸ But clinical examination in patients with high spinal cord injury can be misleading because they may not develop classical abdominal signs and there may be a delay in diagnosis up to 4 days.¹⁹ CT findings of hollow viscous injury includes, pneumoperitoneum, free fluid without solid organ injury thickened small intestine, small intestinal dilatation.^{20,21}

In our series one patient was taken up for laparotomy suspecting bowel injury but no injury was found. It should be kept in mind that blind trust in radiological imaging can result in dangerous consequences. Decision to whether go for laparotomy or a diagnostic laparoscopy for a suspected visceral injury in the absence of radiological finding can be difficult. In such situation we can't emphasis more about repeated clinical examination preferably by the same surgeon.

Another concern when determining the benefit of NOMAT is the increased chance of blood borne diseases through blood transfusions.^{22,23} In this study average blood transfusion requirement was 1.5 units.

There is no consensus regarding the length of observation needed for this group of patients. Although lots of studies support that there is no added benefit in observing the patient more than 5 days because 95% of the cases who fail NOMAT do so with in first 3 days.

Non operative management has revolutionized the treatment of patients with blunt abdominal trauma. Reported success rate for non-operative management varies widely. One probable reason for this variation may be due to institutional variation in surgical practice. Success rate of NOMAT is undoubtedly a consequence of how often it is attempted.²⁴ If one operates for most of the blunt abdominal trauma and advice NOMAT for a very selected group of patients with lower grade injuries success rate is likely to be high and vice versa.

CONCLUSION

Conservative management for blunt abdominal trauma is safe and effective in a majority of patients who sustained blunt trauma with solid organ injury. The most important determinant in successful management of blunt abdominal trauma is hemodynamic stability. Repeated clinical examination is also an essential part of management in order to detect missed hollow viscous injuries. Unstable patients should not undergo NOMAT. Success rate of this study was comparable with other similar studies in the literature.

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Institutional Ethics Committee

REFERENCES

- 1. Road traffic injuries, WHO. Available at: https://www.who.int/health-topics/road-safety#tab=tab_1. Accessed on 3 December 2019.
- Cimbanassi S, Chiara O, Leppaniemi A, Henry S, Scalea TM, Shanmuganathan K, et al. Nonoperative management of abdominal solid-organ injuries following blunt trauma in adults: Results from an International Consensus Conference. J Trauma Acute Care Surg. 2018;84(3):517-31.
- 3. Raza M, Abbas Y, Devi V, Prasad KV, Rizk KN, Nair PP. Non operative management of abdominal trauma a 10 years review. World J Emerg Surg. 2013;8:14.
- Liver Injury Scale. Injury Scoring Scale. A
 Resource for Trauma Care Professionals. Available
 at: https://www.aast.org/library/traumatools/injuryscoringscales.aspx#liver. Accessed on 3 December
 2019.
- Spleen Injury Scale. Injury Scoring Scale. A
 Resource for Trauma Care Professionals. Available
 at: https://www.aast.org/library/traumatools/injury
 scoringscales.aspx#spleen. Accessed on 3 December
 2019.
- Fransvea P, Costa G, Massa G, Frezza B, Mercantini P, Balducci G. Non-operative management of blunt splenic injury: is it really so extensively feasible: a critical appraisal of a singlecenter experience. Pan Afr Med J. 2019;32:52.
- 7. King H, Shumacker HB. Splenic studies In Susceptibility to infection after splenectomy performed in infancy. Ann Surg. 1952;136(2):239-42.
- 8. Pringle JHV. Notes on the Arrest of Hepatic Hemorrhage Due to Trauma. Ann Surg. 1908;48(4):541-9.
- Upadhyaya P. Conservative management of splenic trauma: history and current trends. Ped Surgery Int. 2003;19:617-27.
- 10. Meyer DM, Thal ER, Coln D, Weigelt JA. Computed tomography in the evaluation of children with blunt abdominal trauma. Ann Surg. 1993;217(3):272-6.
- 11. Federle MP, Griffiths B, Minagi H, Jeffrey RB. Splenic trauma: evaluation with CT. Radiology. 1987;162(1-1):69-71.
- 12. Pachter HL, Knudson MM, Esrig B, Ross S, Hoyt D, Cogbill T, et al. Status of nonoperative management of blunt hepatic injuries in 1995: a multicenter experience with 404 patients. J Trauma. 1996;40(1):31-8.
- 13. Pachter HL, Spencer FC, Hofstetter SR, Liang HG, Coppa GF. Significant trends in the treatment of

- hepatic trauma. Experience with 411 injuries. Ann Surg. 1992;215(5):492-500.
- Croce MA, Fabian TC, Menke PG, Smith WL, Minard G, Kudsk KA, et al. Nonoperative management of blunt hepatic trauma is the treatment of choice for hemodynamically stable patients. Results of a prospective trial. Ann Surg. 1995;221(6):744-53.
- 15. Schurr MJ, Fabian TC, Gavant M, Croce MA, Kudsk KA, Minard G, et al. Management of blunt splenic trauma: computed tomographic contrast blush predicts failure of nonoperative management. J Trauma. 1995;39(3):507-12.
- 16. Federico JA, Horner WR, Clark DE, Isler RJ. Blunt hepatic trauma. Nonoperative management in adults. Arch Surg. 1990;125(7):905-8.
- 17. Fischer RP, Crotchett MP, Reed RL. Gastrointestinal disruption: the hazard of nonoperative management in adults with blunt abdominal injury. J Trauma. 1988;28(10):1445-9.
- 18. Parreira JG, Oliari CB, Malpaga JM, Perlingeiro JA, Solda SC, Assef JC. Severity and treatment of 'occult' intra-abdominal injuries in blunt trauma victims. Injury. 2016;47(1):89-93.
- 19. On BZ, Ohry A. The acute abdomen in spinal cord injury individuals. Paraplegia. 1995;33(12):704-6.
- 20. Sherck J, Shatney C, Sensaki K, Selivanov V. The accuracy of computed tomography in the diagnosis of blunt small-bowel perforation. Am J Surg. 1994;168(6):670-5.
- 21. Jha NK, Yadav SK, Sharma R. Characteristics of Hollow Viscus Injury following Blunt Abdominal Trauma; a Single Centre Experience from Eastern India. Bull Emerg Trauma. 2014;2(4):156-60.
- 22. Afifi I, Abayazeed S, Menyar EA, Abdelrahman H, Peralta R, Thani AH. Blunt liver trauma: a descriptive analysis from a level I trauma center. BMC Surg. 2018;18(1):42.
- 23. Umali E, Andrews HG, White JJ. A critical analysis of blood transfusion requirements in children with blunt abdominal trauma. Am Surg. 1992;58(12):736-9.
- 24. Stawicki SP. Trends in nonoperative management of traumatic injuries a synopsis. Int J Crit Illn Inj Sci. 2017;7(1):38-57.

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