Liver injuries in children: The role of selective non-operative management

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Le rôle du traitement non-opératoire dans la prise en charge des traumatismes du foie chez l'enfant

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RÉSUMÉ

Prérequis : Dans la population pédiatrique le traumatisme reste la première cause de mortalité. Les lésions hépatiques surviennent généralement suite à un traumatisme abdominal.
But : Evaluer la place du traitement non-opératoire dans la prise en charge des traumatismes du foie chez l'enfant.
Méthodes : Etude rétrospective, sur une période de 14 ans allant de Janvier 1996 à Décembre 2009, portant sur 51 patients hospitalisés dans le service de chirurgie pédiatrique à l'hôpital d'enfants de Tunis pour traumatisme du foie.
Résultats : Trente garçons et 21 filles, avec un âge moyen de 7 ans, ont été hospitalisés pour traumatisme du foie. Les accidents de la voie publique représentent l'étiologie la plus fréquente. Les traumatismes crâniens sont les lésions associées les plus fréquentes. Quarante neuf patients (96%) ont bénéficié d'un traitement non opératoire sans complications. La durée moyenne d'hospitalisation était de 10 jours. La régression totale des lésions hépatiques a été observée à l'échographie entre 3 et 6 mois. Deux patients ont nécessité d'emblée une laparotomie pour instabilité hémodynamique. Le taux de mortalité était de 0,2%.
Conclusion : Le traitement des traumatismes du foie chez l'enfant repose sur le traitement non-opératoire qui nécessite une surveillance clinique rapprochée dans une unité de réanimation et un accès facile aux explorations radiologiques et au bloc opératoire. Le challenge est d'identifier précocement les malades qui nécessitent une transfusion sanguine ou une laparotomie en urgence.

Mots-clés
Enfant- Traumatisme- Foie

SUMMARY

Background: Trauma remains the leading cause of mortality in the pediatric population. Liver injuries occur commonly in blunt abdominal trauma.
Aim: To assess the selective non-operative management of liver injuries in children.
Methods: A retrospective review of 51patients with a discharge diagnosis of traumatic liver injuries at Tunis Children's Hospital, over a 14-year period from 1996 to 2009.
Results: We identified 51 patients with liver trauma. The median age was 7 years. Boys accounted for 58% (n= 30), and the most common cause was traffic accident. Head injuries were the most common associated injuries. Forty-nine patients (96%) required non-operative management without complications. The mean in-hospital stay was 10 days in this group. The ultrasound demonstrated complete resolution and healing after 3-6 months. Two patients underwent surgery for hemodynamic instablity. The mortality rate was 0.2 %
Conclusion: Safe, non-operative management involves careful serial examination, a CT scanning facility and close monitoring of the patient in a fully equipped high-dependency unit with trained staff to run it. Even though most patients can be treated non-operatively the challenge is to identify the severely injured child early and institute aggressive resuscitation and expedite laparotomy.

Key-words
Children, Liver trauma

Trauma remains the leading cause of mortality in the pediatric population (1, 2). Liver injuries occur commonly in blunt abdominal trauma. During the last 100 years the management and approach to blunt liver and other solid visceral injuries has fluctuated from surgical caution at the turn of the century as advocated by Beckman's ''intelligent conservatism'' in the 1920s followed by aggressive surgical intervention throughout most of the century, and finally a move back towards an initial non-operative approach for most (1, 2).
This study set out to describe the causes and the role of selective non-operative management of liver injuries in children.

MATERIAL AND METHODS

The records of all children presenting to Tunis Children's Hospital with traumatic liver injuries, over the 14-year period (January 1996 to December 2009) were reviewed. Information was gathered about the clinical presentation, associated injuries, grade of injury, transfusion requirements and hemodynamic stability. Those patients who remained hemodynamically unstable after initial resuscitation underwent laparotomy, the remainder were treated non-operatively in a high care setting. The outcome of both the operative and non-operative groups has been reviewed with resultant complications.
Liver injuries were graded according to the American Association for the Surgery of Trauma (AAST) (Table 1) (2).

Table 1 : Liver injury scale classification

GRADE	INJURY DESCRIPTION
I	Hematoma subcapsular, nonexpanding, < 10% of surface area
	Laceration capsular tear, non bleeding, with <1cm deep parenchymal disruption
II	Hematoma subcapsular, nonexpanding, hematoma 10-15%, intraparenchymal, intraparenchymal, nonexpanding < 2cm in diameter
	Laceration <3 cm of parenchymal depth, <10 cm in length
III	Hematoma subcapsular, >50% of surface area or expanding; ruptured subcapsular hematoma with active bleeding; intraparenchymal hematoma >2 cm
	Laceration > 3cm of parenchymal depth
IV	Hematoma ruptured central hematoma
	Laceration parenchymal destruction >75% of hepatic lobe
V	Laceration Parenchymal destruction>75% of hepatic lobe
	Vascular juxtahepatic venous injuries (retrohepatic cava/major hepatic veins)
VI	Hepatic avulsion

Computed tomography scanning has been available at our hospital as the investigation of choice in diagnosing blunt liver trauma since 2006, after which 18 patients underwent CT scans and subsequent grading. Prior to this the diagnosis was confirmed by abdominal ultrasound. Unfortunately, no grading system was devised for liver ultrasound but our results suggested that a high proportion of small contusions and lacerations of the liver and spleen are more likely to be demonstrated by liver ultrasound than by CT, however, direct comparisons regarding specificity, sensitivity and accuracy have been few. The decision to operate was based on the following criteria; hemodynamic instability following volume and blood resuscitation, symptoms and signs of ongoing haemorrhage or associated intra-abdominal injuries requiring surgery (hollow viscus and diaphragmatic injuries and selected cases of renal vascular injuries). The decision remained a clinical one, not significantly influenced by radiological findings. Those children presenting with massive hemorrhage (requiring >40 ml/kg blood) not responding to adequate intravenous resuscitation and transfusion were taken for emergency laparotomy. Those who responded to initial resuscitative measures and remained hemodynamically stable were taken for a liver ultrasound or CT scan. Once the diagnosis was confirmed the patients were closely monitored in a high care or intensive care unit. Non-operative management of these patients included close monitoring of hemodynamic status, serial hemoglobin, electrolytes, liver function tests, serum lactate and transfusion requirements. Those patients who subsequently became hemodynamically unstable, indicating a secondary or ongoing hemorrhage were taken for laparotomy. The group that remained clinically stable were discharged after about 1 week of in-hospital observations. Ultrasound imaging was chiefly reserved for follow-up monitoring.

RESULTS

There were 51patients admitted with liver injuries during the fourteen year period reviewed: 30 boys and 21girls with a sex ratio of 1, 4. The median age was 7 years (range 1–13). There was a wide spectrum of liver injury's causes. The most frequent causes were traffic accident (50%) represented essentially by pedestrian injuries. The other causes were home accident (39%), especially bicycle accidents, farm accident (6%), and scholar accident (5%) (table 2).

Table 2 : Mechanism of injury

Mechanism of injury	Number of children	Frequency
traffic accident	26	50%
home accident	20	39%
farm accident	3	6%
scholar accident	2	5%

The major symptom in the emergency room was abdominal pain. 31 patients were stable and only 5 children were in an hemodynamic choc. The mean level of hemoglobin was 10, 8 g/dl. At admission it was low in 13 patients, and among the 25 patients with initial normal level, four patients showed a deglobulisation 48 hours later. Blood transfusions were given to

9 of these 51patients, usually in moderate amounts (mean, 14mL/kg; maximum, 25 mL/kg). The values of transaminase were undergone for 16 patients on admission. It was elevated in 14 patients (Five times the normal value or higher). Abdominal ultrasonography was made for all patients. It showed an hepatic contusion in 84% of patients, an hepatic fracture in 5%, a laceration in 3% and in 8%, it showed other anomalies such as: hematoma and biloma . Abdominal tomography was made for only 18 patients. Seventeen patients were found to have grade ß injuries, twenty three grade ¶, height grade ßßß, two grade ßV, and one grade VI (table 3).

Table 3 : liver injury scores and number of children

GRADE	Number of children	Frequency	Number of death	Number of patients who underwent surgery
I	17	34%	0	0
II	23	45%	0	1
III	8	15%	0	0
IV	2	4%	0	0
V	0	0	0	0
VI	1	2%	1	1

Of the total number of cases, ten had an isolated hepatic injury and three had polytrauma. There were fifteen head injuries, twelve thoracic injuries, eleven fractures, two spleen injuries and two kidney injuries (table 4).

Table 4 : Associated injuries

Associated injuries	Number
Head injury	15
Thoracic injury	13
Fractures	11
Spleen injuries	2
Kidney injuries	2
Isolated hepatic injury	10

Forty nine patients (96%) required non-operative management without complications.

The mean in-hospital stay was 22 days in this group. The ultrasound demonstrated complete resolution and healing after 3-6 months.

Only two patients underwent surgery. The decision to operate was based on the hemodynamic instability following volume and blood resuscitation. For the first one we found a 2 cm laceration of the right liver. For the second one we found an hepatic avulsion which necessitate the packing technique of the bleeding with laparotomy pads; unfortunately he died after four days of an uncontrollable bleeding.

DISCUSSION

Worldwide, trauma is the leading cause of death and disability in children (3, 4, 5). Blunt liver trauma is uncommon, but it is associated with significant morbidity and mortality. Although blunt liver trauma accounts for 15-20% of abdominal injuries, it is responsible for more than 50% of deaths resulting from blunt abdominal trauma (6). In keeping with other centers the majority of our patients sustained their injuries as pedestrian (related motor vehicle accidents) (7, 8).

The management protocol for blunt hepatic trauma at our hospital changed 20 years ago from an early operative approach to the more conservative non-operative management outlined in this study. Improved pediatric resuscitative measures in a dedicated pediatric trauma unit together with better imaging and intensive care facilities have facilitated non-operative measures.

Over the last 14 years, 96% of our patients with confirmed blunt liver trauma were successfully managed non-operatively and only 4% underwent liver related laparotomy. The vast majority (96%) of these patients therefore do not require surgery despite in many cases a severe injury as demonstrated by various imaging techniques.

The decision about whether to operate was thus a clinical one based on hemodynamic stability, signs of ongoing hemorrhage or evidence of hollow viscus injury. Most patients presented with multiple injuries. Head injuries were the most common associated injuries (9, 10).

The radiological investigation of choice in the hemodynamically stable patient is AAST graded computer tomography. This exam was performed for only 18 of our patients, as it was indicated if abdominal ultrasonography showed an hepatic injury. And in fact our study had shown high utility of abdominal ultrasonography as CT scanning has confirmed the results found in this exam. However, far too much emphasis has been placed on the CT-grade in the literature as a prognostic predictor. CT confirmed the diagnosis of a blunt liver injury but we and others have shown poor correlation between liver grade injury and clinical outcome, (11) including the need for blood transfusion and/or laparotomy. (12) The CT findings alone should therefore not influence the decision on whether or not to operate. Ultrasound imaging was chiefly reserved for follow-up monitoring (13). Some studies proposed other protocol. It meant to homogenize care and limit the financial costs associated with a prolonged hospitalization. It says that management of blunt spleen/liver injury in children requires a number of days of bed rest equal to the grade of injury plus 1 (18). We didn't use this protocol in our study. The bed rest in our study was patient-dependent. And the mean in-hospital stay was 22 days in this group (3 days - 441 days). The patients hospitalized for 441 days presented severe neurological injury causing his long stay in hospital. His liver injury disappeared after 30 days.

For those patients who require operative intervention, control of the hemorrhage is the priority. In inexperienced hands correct

peri-hepatic packing would be the preferred approach (14). This technique is generally simple and effective and should be employed before transfer of the patient for definitive procedure. However, frequently the injuries are complex (as our patient who died) requiring more technically difficult procedures to gain vascular control (15), presenting a challenge to even the most experienced surgeon. Some complications may occur: we can notice a continued bleeding from an intrahepatic hematoma. It may be detected by a pooling of contrast medium in the hematoma demonstrated by CT scan (16). This complication may need an angiography with embolization (16, 15). Bile collection or biloma is a common complication of the non-operative management of hepatic injuries. The treatment consists on a percutaneous drainage (16). Some authors reported others complications such as: wound infection: immediate and late hemobilia, liver abscess, fever and sepsis requiring prolonged hospitalization (17, 16, 13). Fortunately, none of our patients presented any of these complications.

CONCLUSION

The decision to institute the non-operative management of blunt liver trauma in children has been successfully borne out by our experience in the subsequent 14 years. Ninety-six percent of patients were successfully treated non-operatively, with only 4% liver related laparotomies with no complications and the duration of in-hospital stay shorter. Safe, non-operative management involves careful serial examination, a CT scanning facility and close monitoring of the patient in a fully equipped high-dependency unit with trained staff to run it. Even though most patients can be treated non-operatively the challenge is to identify the severely injured child early and institute aggressive resuscitation and expedite

Références

1. Moore F, Cogbill TH, Jurkovits GJ, et al. Organ injury scaling: Spleen and liver. J Trauma 1995;38: 323-4.
2. Gaines BA, Ford HR. Abdominal and pelvic trauma in children. Crit Care Med 2002;30: 5416-23.
3. Gratz RR. Accidental injury in childhood: a literature review on pediatric trauma. J Trauma 1979;19: 551-5.
4. Meyer AA. Death and disability from injury: a global challenge. J Trauma Inj Infect Crit Care 1998;44: 1-12.
5. Rivera FP. Epidemiology of childhood injuries. I. Review of current research and presentation of a conceptual framework. Am J Dis Child 1982;136: 399- 405.
6. Richard S, Dennis L, Gary F, The Spectrum of Liver and Spleen Injuries in Children: Failure of the Pediatric Trauma Score and Clinical Signs to Predict Isolated Injuries: Ann Emerg Med 1991;6: 20-6
7. Cooper A, Barlow B, DiScala C, String D. Mortality and truncal injury: the pediatric perspective. J Pediatr Surg 1994;29: 33-8.
8. Parks RW, Chrysos E, Diamond T. Management of liver trauma. Br J Surg 1999;86: 1121-35.
9. Kumar R, Holland AJA, Shi E, Cass DT. Isolated and multisystem hepatic trauma in children: the true role of nonoperative management. Pediatr Surg Int 2002;18: 98-03.
10. Petre R, Mentha G, Huber O, et al. Hepatic trauma: risk factors influencing outcome. Br J Surg 1988;75: 520-4.
11. Ruess L, Sivit CJ, Eichelberger MR, et al. Blunt hepatic and splenic trauma in children: correlation of a CT injury severity scale with clinical outcome. Pediatr Radiol 1995; 25: 321-5.
12. Hackman J, Potoka D, Meza M, et al. Utility of radiographic hepatic injury grade in predicting outcome of children after blunt abdominal trauma. J Pediatr Surg 2002; 37: 386-9.
13. Landau A, van As AB, Numanoglu A, et al. Liver injuries in children: The role of selective non-operative management. Injury 2006;37: 66-71.
14. Feliciano DV, Mattox KL, Burch JM, et al. Packing for control of hepatic haemorrhage. J Trauma 1986; 26: 738-43.
15. Coln D, Crighton J, Schorn L. Successful management of hepatic vein injury from blunt trauma in children. Am J Surg 1980;140: 858-64.
16. Chadin Tharavej, Boonchoo Sirichindakul, Sathaporn Chiamananthapong. A multidisciplinary approach in the management of hepatic injuries. Injury 2002; 309: 315-33.
17. Francesca Berton, Giampiero Perrino, et al. Isolated Blunt Liver Trauma: Is Nonoperative Treatment Justified? J Pediatr Surg 1992; 466: 466-27
18. George W. Holcomb III, Daniel J. Ostlie. Justification for an abbreviated protocol in the management of blunt spleen and liver injury in children. J Pediatr Surg 2008 ; 191:194- 43