Evaluation of Patients with Liver Injuries Treated by Perihepatic Gauze Packing

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Abstract

Background: The liver is one of the most common organs injured after blunt abdominal trauma. The control of severe hemorrhage remains a problem.

Methods: One-hundred thirty-eight patients diagnosed as liver injury between 09/2003 and 08/2006 had been evaluated prospectively in Al- Kindy Teaching Hospital.

A distinction was made between hemodynamically stable and unstable patients. Different modalities of surgical procedures were done concentrating on perihepatic gauze packing.

Results: (60 out of 138) patients included in the study were clinically evaluated as hemodynamically stable. The average abbreviated injury severity score (ISS) was 25. Twenty patients underwent abdominal surgery. In 12 of them additional liver treatment was performed. The mortality was three, all were non-liver related.

Seventy eight patients were considered to be hemodynamically unstable, and had an average ISS of 38. All of them needed abdominal surgery.

Gauze packing was used as initial therapy for bleeding control from injured liver in 34 patients of both hemodynamically stable and unstable groups with a mortality of 11 patients (32.7%).

Conclusion: perihepatic gauze packing is considered as a life saving and a quick method for controlling ongoing hemorrhage in the treatment of liver injuries before undertaking definitive repair under controlled conditions.

Key words: surgery, liver injury, and gauze packing.

Introduction

The liver is the most solid intra-abdominal organ involved by blunt trauma, as it can't yield to impact by elastic deformation [1]. The death rate from hepatic trauma improved over the past 25 years due to decreased death from hemorrhage, improved resuscitations, recent technological advances in the field of computerized scanning and better surgical techniques[-4]

The treatment and outcome of liver injuries had been changed dramatically in the last 25 years. Multiple modes of therapy are available for hemorrhage control such as aggressive surgery [5], conservative therapy e.g. packing [6] and non-surgical treatment [7, 8,] which had dramatically improved the outcome.

Pringle first described temporary occlusion of porta hepatis as an adjunct to packing[9]. The Pringles' maneuver was used through out World War I and II with liver related mortality of 60%[10]. After World War II the liver related mortality dropped due to increased experience in primary repair of liver injuries. This led to avoidance of packing because packing at that time was associated with a high incidence of late sepsis, and re-bleeding on pack removal [11].

Since the late 1970s packing has regained its popularity, being reported as life saving in highly selected patients [2, 13]

The present study evaluates the outcome of perihepatic gauze packing in the anagement of patients with hepatic trauma.

Methods

A prospective study was done on 138 patients who were admitted to Al-Kindy teaching hospital between 09/2003 and 08/2006, with liver trauma.

The diagnosis of liver trauma had been made by clinical examination, ultrasound, CT scan or at laparotomy. All patients were classified as hemodynamically stable or unstable by clinical evaluation (systolic blood pressure, pulse rate, respiratory rate, urine output and mental status) in the emergency unit. Data collected from all patients included in this study concentrating on the grade of liver injury **(Table-I)** [14], ISS, abdominal surgery, morbidity and mortality.

Surgical procedures used for liver injury were perihepatic packing with gauze, suture of liver parenchyma and vessels and liver resection.

Packing had been performed against the natural contour of the diaphragm by application from below, large abdominal packs had been used to ease their removal and the abdomen had been closed to facilitate compression of the parenchyma. Re-exploration after 48 hours has been done for pack removal when the patients are hemodynamically stable.

Suture of liver parenchyma was done by interrupted sutures placed 2 cm from the wound margins, using (0) chromic catgut suture swayed onto a 2-inch blunt-tipped liver needle.

Liver resection was done by resectional debridment using the lines of injury as boundaries of resection. The margins of resectional debridment 2-cm beyond the point of injury. The bleeding during debridment is controlled by digital parenchymal compression. The liver parenchyma is separated bluntly by finger fracture, vessels and bile ducts are secured by individual suture ligation.

A statistical analysis was done by using SPSS program version II. Chi square test (X^2) was used. A p value of less than 0.05 is considered statistically significant.

Results

Sixty out of 138 patients (43.5%) were considered to be hemodynamically stable by clinical evaluation .Their ISS varied from 16-34 with a mean of 25. Twenty out of 60 (33%) hemodynamically stable patients needed to go to the operating room for explorative laparotomy, due to evidence of ongoing blood loss despite correction of any underlying coagulopathy and the development of signs of generalized peritonitis.

Twelve out of 20 patients (60%) the injured liver was treated by means of gauze packing (5 patients 41.7%), suturing of liver parenchyma (5 patients 41.7%), suturing o f vena cava (2 patients 16.6%).

Eight out of 20 patients (40%) needed no surgical mean for their liver injury as the bleeding already stopped at abdominal surgery. Nine out of 20 patients (45%) had both hepatic and other abdominal injuries requiring surgery **Table-2**.

Forty out of 60 hemodynamically stable patients did not need any surgical intervention for liver injury or any associated injuries and were treated conservatively as they remained stable by clinical evaluation and imaging procedures (ultrasound and contrast enhanced CT scan). Three out of the 60-hemodynamically stable patients (5%) died from sepsis (two patients) and from severe neurological trauma (one patient), There was no direct liver related mortality in this group.

In the other group, 78 patients had been evaluated as hemodynamically unstable (56.5%), and had an ISS ranging from 16-60 with a mean of 38, all needed laparotomy for intra-abdominal bleeding. In 40 patients, liver injury was not the only intra abdominal injury.

On laparotomy, 12 out of 78 patients (15.4%) did not require any specific treatment of the liver injuries as the bleeding stopped already at operation. Nine of them had other abdominal injuries requiring surgery. Different surgical techniques were used in 66 out of 78 patients (84.6%) with liver injures including gauze packing 29 patients (43.9%) i.e. grade of liver injury IV, V, VI , suturing of liver parenchyma 25 patients (37.9%) i.e. grade of liver injury III , hepatic resection 12 patients (18.2%) i.e. grade of liver injury IV ,V.

The mortality was 34 out of 78 patients (43.5%). Liver related mortality was 13 patients (38%). This was due to either to liver failure or to liver exsanguinations or to coagulopathy. The characteristics of the 78 hemodynamically unstable patients are shown in table III. Overall mortality in both groups were 37 patients (27%).

Gauze packing had been used in 34 out of 138 patients (24.6%).

In 16 patients, the bleeding was successfully controlled by pack tamponade and they underwent uneventful laparotomy to remove the gauze pack after 48 hours.

Three of them died at a later date from non liver related causes.

In 9 patients, second packing was needed to control ongoing bleeding. Three of them died at a later date, 2 from liver failure and one from non-liver related problem.

In 4 patients, additional surgical procedures during second laparotomy were needed (hepatic resection). Two of them died , one at the fourth post-operative day because of uncontrolled hepatic bleeding and the other at the sixth postoperative day due to liver insufficiency.

In 5 patients they did not have re-laparotomy because of death within 24 hours after the first operation, liver exsanguination was the only cause of death in three of them and the other two died due to uncontrolled bleeding from pelvic fractures **Figure-1**.

The mortality rate among the 34 patients treated by perihepatic gauze packing was 32.7%(11 out 34 patients).

A statistical analysis was done to find any significant differences between mortality rate among perihepatic gauze packing on one hand and those who underwent liver resection on the other hand. A p value of 0.016 was found in our study, which is considered statistically significant as a p value less than 0.05 is statistically significant.

Perihepatic abscesses occurred in 5 out of 34 patients who underwent perihepatic gauze packing (14.7%).

An abdominal compartment syndrome (ACS) was found in 2 out of 34 patients who underwent perihepatic gauze packing (3%).

Discussion

Multiple reports found that bleeding from injured liver had already stopped at surgery and therefore outlined the efficacy of non-surgical treatment and its relative safety in hemodynamically stable patients [7,8]. In the present study, this can be demonstrated in 8 and 12 patients in the hemodynamically stable and unstable groups respectively.

In hemodynamically unstable patients, the priority is to stop the bleeding from the liver.

Review of the literatures indicates that minimal intervention should be the policy [6,15]. Gauze packing of the liver is one of these policies as it is a life saving maneuver. The high complication rate associated with liver packing in the middle of the twentieth century had led to its abandonment in the treatment of complex liver trauma [16,17].

Subsequent multiple reports from the mid 1980s and on demonstrated the value of perihepatic gauze packing as life saving in highly selected patients suffering from hypotension, hypothermia, coagulopathy and acidosis, and this modality became an important part of the

armamentarium in the management of major hepatic injuries [18-21].

Packing of the liver stabilizes patients during transferring to trauma centers [13], moreover; its effectiveness has been reported during definitive surgery because it provides time for correction of coagulopathy and hypothermia [22,23]. After the reintroduction of gauze packing, more articles have been published favoring non-resectional management of major hepatic trauma by means of perihepatic gauze packing [6, 23-25].

In the present study 34 patients were treated by perihepatic gauze packing, 30 patients treated by mere gauze packing. Additional surgical procedures during a second laparotomy were necessary in 4 patients (hepatic resection).

Perihepatic sepsis was reported in 20-30% of cases as a complication of perihepatic gauze packing in the literature. [26,27] but early pack removal along with evacuation of intraperitoneal clots and debridment of necrotic hepatic tissue had lessen the incidence of this problem, as some authors did not report any abscess formation as long as the packs were removed timely and adequate antibiotics were given.[22, 28]

In the present study the rate of perihepatic abscess formation was 14.7% (5 patients) as the packs were removed timely and adequate antibiotics were given.

The abscess was drained in 3 patients by ultrasonic guided drainage, and in the other 2 patients it had to be drained operatively with good results.

Other complication is ACS due to increased abdominal pressure [21].Two patients in our study developed ACS one of them died because of multi organ failure.

The death rate associated with packing significantly decreased in the last years. This fact is supported by other studies (Carrison JR etal [20], Feliciano *etal*[26])

In the present study the death rate was found to be 32.7% in patients who were treated by perihepatic gauze packing which is comparable with the study of J. David Richardson 34.5% [15], and lower than the study which was reported in the University Medical Center of Utrecht in the Netherlands (42.1%) [29].

The postoperative mortality was eleven patients, liver related was five patients.

Liver resection was performed in 16 patients (11.5%), twelve of them at first laparotomy, nine died; six of them due to liver related causes and four patients underwent liver resection during a second operation following gauze-packing removal, two died due to liver related causes.

Our data show a mortality rate of 68.75% (11 out of 16) in-patients with liver resection while over all mortality rate among perihepatic gauze packing was 32.7%. (11 out of 34). A difference in the mortality rate between patients with packing only on one hand and liver resection on the other hand was observed, with p=0.016, as shown in **Table- 4**

Conclusion

Liver resection should be avoided whenever possible and simple gauze packing has to be performed when appropriate.

Perihepatic packing is an effective, life saving and fast method for the control of severe hemorrhage in liver injuries.

(Table -1)
Grading of Liver Trauma [14]

Grade	Injury	Description
I	Hematoma	Sub capsular, less than 10% surface area
	Laceration	Capsular tear, less than 1 cm parenchymal depth
II	Hematoma	Sub capsular, 10-50% surface area intraparenchymal less than 10cm in diameter
	Laceration	1-3 cm parenchymal depth, less than 10 cm in length
		Sub capsular more than 50% surface area or expanding
III	Hematoma	Ruptured sub capsular or parenchymal hematoma intraparenchymal more than 10cm or expanding.
	Laceration	More than 3 cm parenchymal depth
IV	Laceration	Parenchymal disruption involving 25-75% of hepatic lobe or 1-3 contained segments within a single lobe
V	Laceration	Parenchymal disruption involving more than 75% of hepatic lobe or more than 3 contained segments within a single lobe.
	Vascular	Juxtahepatic venous injuries i.e. retro hepatic cava/ central major hepatic veins.
VI	Vascular	Hepatic avulsion

(Table -2)
Characteristics of 20 patients treated surgically of hemodynamically stable patients

Patients no.	Grade of liver trauma	ISS	Additional abdominal trauma	Treatment of the liver	Treatment of other abdominal injuries
1	1	18	-	-	-
1	2	22	-	-	-
1	2	34	Spleen	Packing	Splenectomy
1	1	28	Intestine , mesentery	-	Resection of part of small bowel
1	3	20	-	Packing	-
1	3	30	Pancreas ,duodenum	Suturing of vena Cava	Suturing of duodenum, drainage
1	2	24	-	Suture of liver	-
1	1	22	Diaphragm	-	Suture of diaphragm, chest tube
1	3	20	-	Packing	-
1	2	25	-	Suture of liver	-
1	3	27	Colon	Packing	Colostomy
1	2	22	Kidney	Suture of liver	Nephrectomy
1	3	30	Stomach	Suture of vena cava	Suture of stomach
1	1	22	Intestine	-	Suture of bowel
1	3	24	-	Packing	-
1	2	20	-	Suture of liver	-
1	1	16	-	-	-
1	1	32	Spleen	-	Splenectomy
1	3	20	-	Suture of liver	-
1	2	18	-	-	-

(Table-3)
The characteristics of hemodynamically unstable patients treated surgically.

| Grade	no. of pat.	ISS	Treatment of liver injury at laparotomy				Other abdominal injury	Mortality	L.R.M.
			No Tr.	G.P.	L. R.	L.SU.			
I	5	16-28	5	-----	-----	-------	3	1	----
II	7	16-30	7	-----	------	------	6	3	----
III	25	20-60	-------	------	------	25	10	8	-------
IV	14	35-55	------	10	4	------	8	8	3
V	26	18-57	-------	18	8	-------	12	13	9
VI	1	60	-----	1	-----	------	1	1	1

No Tr.= no treatment, G.P. =gauze packing, L.R. = liver resection. L.Su. = liver suture , L.R.M. =liver related mortality

(Table- 4)
The comparison between perihepatic gauze packing and liver resection

Procedure	No. of patients	No. of deaths	LRM
Perihepatic gauze packing	34	11	5
Liver resection	16	11	8

* LRM = Liver related mortality
$X^2=5.85$, $dF=1$, $p=0.016$

(Figure -1):
Perihepatic Gauze Packing
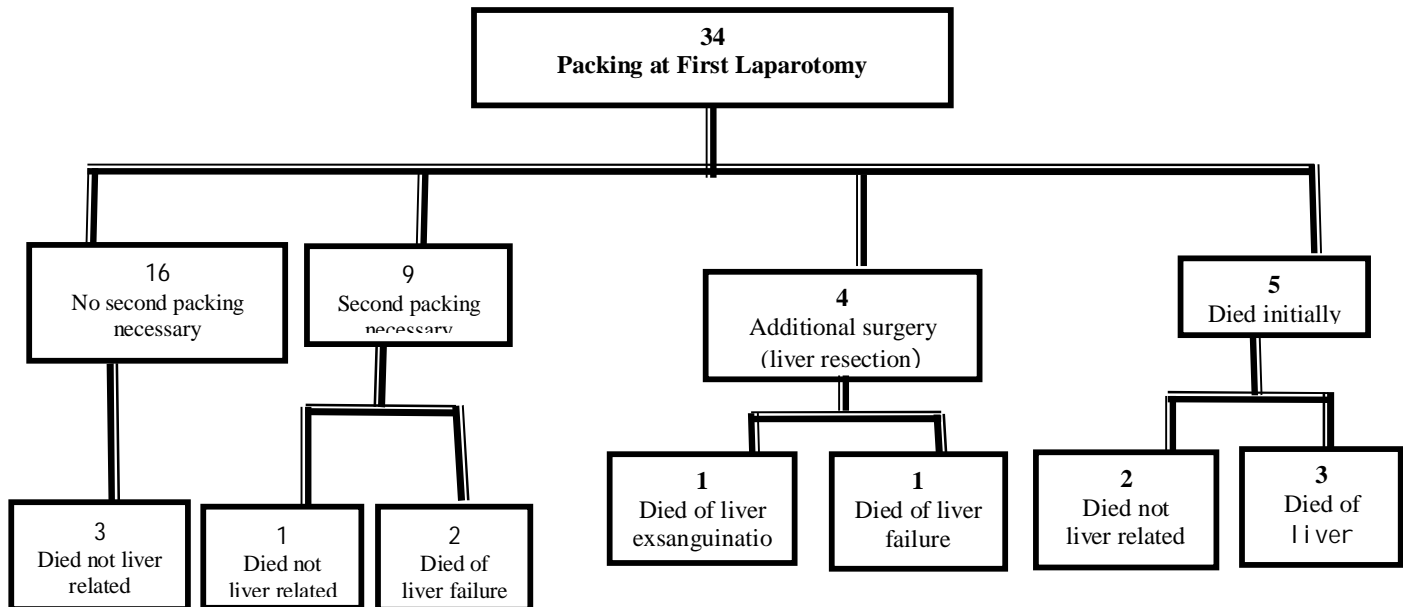
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