

# Management of Liver Injuries in Paholpolpayuhasena Hospital

THONGCHAI BUDDHABORIWAN, MD\*

## Abstract

This retrospective study of 64 patients undergoing surgery was conducted at Paholpolpayuhasena Hospital from September 1992 to August 2002. Fifty-two patients (81.2%) were male and 12 patients (18.8%) were female. The patients' age range was between 10 to 79 years, and 24 patients (37.5%) were in the age group of 20-29 years. Forty-one patients (64.1%) had blunt abdominal trauma, the most common cause of which was traffic accidents, and the most common associated injury of which was splenic injuries. Twenty-three patients (35.9%) had penetrating abdominal trauma, the most common cause of which was stab wounds, and the most common associated injury of which was ileum injuries. The classification of liver injuries was found to be grade II injury in most patients (20 patients, 31.2%). Hepatorrhaphy with suture ligature of the bleeding points and disrupted bile ducts with drainage was the surgical treatment performed in almost all patients (20 patients, 31.2%). The results of treatment were recovery in 49 patients (76.6%), mortality in 15 patients (23.4%), and complications in 20 patients (31.3%). Most of the therapeutic outcomes were accounted for by patients with blunt abdominal trauma.

**Key word :** Liver Injuries, Management

**BUDDHABORIWAN T**

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It is widely accepted that accidents have continuously increased over the past several years, one of which is abdominal trauma. Abdominal trauma can be categorized into 2 types according to the causes of trauma that are 1) blunt abdominal trauma, and 2)

penetrating abdominal trauma. Any intra-abdominal organ can be affected by that trauma, especially the liver because it is the largest solid organ in the abdomen, thereby presenting high risk of injury. Liver injury is one of the leading causes of death. At the

\* Department of Surgery, Paholpolpayuhasena Hospital, Kanchanaburi 71000, Thailand.

first stage of liver injury, patients generally die from excessive blood loss<sup>(1)</sup> and subsequent infection<sup>(2,3)</sup>. As a result of early diagnosis, prompt and proper treatment as well as correct care, complications and mortality will be decreased. The objective of this retrospective study was to compare and analyze patients with blunt abdominal trauma and those with penetrating abdominal trauma with emphasis on incidence, types and causes of abdominal trauma, associated injuries, classification of liver injuries, complications, mortality, and therapeutic outcomes which might be beneficial for some interested surgeons who manage liver injuries in provincial hospitals.

## MATERIAL AND METHOD

The medical records of 64 patients with liver injury secondary to penetrating and blunt abdominal trauma who were operated on in Paholpolpayuhasena Hospital from September 1992 to August 2002 were reviewed. Data, such as types and causes of abdominal trauma, associated injuries, classification of liver injuries, operative procedures, complications, mortality, and results of treatment are demonstrated in the form of tables.

## RESULTS

Of all 64 patients undergoing operative procedures, 52 patients (81.2%) were male and 12 patients (18.8%) were female. The age range was from 10 to 79 years, and 24 patients (37.5%) were in the age group of 20-29 years. Forty-one patients (64.1%) sustained blunt abdominal trauma, and 23 patients (35.9%) sustained penetrating abdominal trauma.

The most common cause of blunt abdominal trauma was traffic accidents (31 patients, 75.6%), most of which were motorcycle accidents. Meanwhile, stab

wounds accounted for the majority of patients (15 patients, 65.2%) with penetrating abdominal trauma. (Table 1)

The most common associated injury of blunt abdominal trauma was splenic injuries. Ileum injuries were the most leading associated injury of patients with penetrating abdominal trauma. In general, the number of associated injuries of blunt abdominal trauma (66.7%) was more than that of penetrating trauma (33.3%) and among the number of associated injuries of penetrating abdominal trauma, intra-abdominal organs injuries were more than extra-abdominal organs injuries. (Table 2)

Accounting for classification of liver injuries of patients with blunt abdominal trauma, it was found that the majority of liver injuries were grade II (12 patients), grade III (12 patients). On the other hand, among patients with penetrating abdominal trauma the majority of injuries were grade II (8 patients). Grade VI injury was not found in both patients with blunt abdominal trauma and those with penetrating abdominal trauma. Conclusively, the number of patients with grade I injury was equal in both groups, but the number of patients with blunt abdominal trauma representing grade II, grade III, grade IV, and grade V injuries was more than that of patients with penetrating trauma representing the same grade of liver injuries respectively. (Table 3)

The most common operative procedure was hepatorrhaphy with suture ligature of the bleeding points and disrupted bile ducts with drainage (31.2%). (Table 4)

Bile fistula (5 patients) was the most common complication of patients with blunt abdominal trauma. On the other hand, intra-abdominal collection (5 patients) was the most common complication

Table 1. Types and causes of abdominal trauma.

Cause	Blunt trauma		Cause	Penetrating trauma	
	No.	%		No.	%
Traffic accident	31	75.6	Stab wound	15	65.2
Motor cycle	16				
Car	10				
Pedestrian	5				
Fall	6	14.6	Gun shot wound	6	26.1
Assault	4	9.7	Shot gun wound	2	8.7
Total (n = 64)	41	64.1		23	35.9

Table 2. Associated injuries\*.

Associated injury	Blunt trauma (No. of injuries)	Penetrating trauma (No. of injuries)	Total
Splenic injury	14	-	14
Ileum injury	3	10	13
Colon injury	2	5	7
Stomach injury	-	6	6
Diaphragm injury	-	4	4
Chest injury	6	-	6
Head injury	10	-	10
Renal injury	3	2	5
Maxillofacial injury	6	-	6
Extremities injury	8	-	8
Pelvic injury	2	-	2
Total	54	27	81
%	66.7	33.3	

\* Some patients may have more than one associated injury.

Table 3. Classification of liver injuries.

Grade	Blunt trauma (No. of patients)	Penetrating trauma (No. of patients)	Total	%
I	5	5	10	15.6
II	12	8	20	31.2
III	12	4	16	25
IV	8	4	12	18.8
V	4	2	6	9.4
VI	-	-	-	-
Total	41	23	64	100

of patients with penetrating abdominal trauma. The leading cause of death of patients with blunt abdominal trauma was irreversible shock (5 patients) due to excessive blood loss. For those with penetrating abdominal trauma, the leading cause of death was intraabdominal sepsis (2 patients). In general, the number of complications and mortality of patients with blunt abdominal trauma was more than that of patients with penetrating abdominal trauma. (Table 5)

Therapeutic outcomes were full recovery in 49 patients (76.6%), mortality in 15 patients (23.4%), and complications in 20 patients (31.2%). Patients with blunt abdominal trauma accounted for the majority of patients in each of the three types of therapeutic outcomes. (Table 6)

## DISCUSSION

Dependent upon causes and mechanisms of injuries, associated injuries of intra and extra-abdo-

minal organs frequently coexist with liver injury, stressing the need for treatment prioritization. Initially, patency of airway and respiration must be thoroughly examined and promptly corrected, should any abnormality be present. Blood circulation must be subsequently examined for excessive blood loss. Should any significant blood loss which might lead to hypovolemic shock occur, aggressive fluid resuscitation and exploratory laparotomy must be simultaneously performed in order to control the blood loss. In cases of hemodynamic stability, caution and scrupulous examination along with investigation should be effectively performed. Diagnosis of liver injury is carried out based on history of injury, physical examination, and other examinations. It is somewhat different for penetrating abdominal trauma and blunt abdominal trauma with regard to diagnosis. Penetrating abdominal trauma can be diagnosed based on the following positive findings : history of being stabbed, upper

Table 4. Operative procedures.

Grade	Procedure	No.	%
I	No	6	9.4
	Hepatorrhaphy	4	6.3
II	No	2	3.1
	Hepatorrhaphy	11	17.2
	Hepatorrhaphy with suture ligature of the bleeding points	7	10.9
III	Hepatorrhaphy with suture ligature of the bleeding points and disrupted ducts with drainage	16	25
IV	Hepatorrhaphy with suture ligature of the bleeding points and disrupted ducts with drainage	4	6.2
	Resectional debridement with drainage	5	7.8
	Hepatic artery ligation with resectional debridement with drainage	3	4.7
V	Hepatic artery ligation with resectional debridement with drainage	3	4.7
VI	Perihepatic packing	3	4.7
	-	-	-
Total		64	100

Table 5. Complications and mortality.

Complication	Blunt trauma (No. of patients)	Penetrating trauma (No. of patients)
Bile fistula	5	-
Intraabdominal collection	3	5
Wound dehiscence	2	3
Secondary hemorrhage	1	1
Total (n = 64)	11	9
%	17.2	14.1
Cause of death	No. of patients	No. of patients
Irreversible shock	5	1
Head injury	4	-
Intraabdominal sepsis	2	2
Secondary hemorrhage	-	1
Total (n = 64)	11	4
%	17.2	6.3

abdominal stab wound found during physical examination, abdominal penetrating wound found during local exploration, history of gun shot with penetrating wound, gun shot wound with direct gun shot path to the liver found during physical examination, and liver injury discovered by exploratory laparotomy. On the other hand, blunt abdominal trauma can be diagnosed based on these positive findings : history of severe impact at the upper abdomen, history of falling from a height, hematoma or scratch at the abdomen, abdominal tenderness, guarding, rigidity, rebound tenderness and hypoactive bowel sounds(4), obvious signs and symptoms of blood loss such as systolic blood

pressure below 80 mmHg, gradually decreased value of serial hematocrit, positive abdominal tapping (paracentesis) or positive peritoneal lavage(5), some special investigations such as ultrasonography, CT scan and angiography. These special investigations serve as a secondary measure for the diagnosis of liver injury performed after the patient's condition has been sufficiently stabilized. However, the majority of liver injuries are diagnosed by exploratory laparotomy, a diagnostic method used in all cases of the present study. Management of liver injuries can be divided into 2 categories : 1) non-operative management; 2) operative management. Nowadays, non-operative

Table 6. Results of treatment.

	No.	Recovery		Mortality		Complication	
		No.	%	No.	%	No.	%
Blunt abdominal trauma	41	30	61.2	11	73.3	11	55
Penetrating Abdominal trauma	23	19	38.8	4	26.7	9	45
Total	64	49	76.6	15	23.4	20	31.3

Table 7. Liver injury scale.

Grade	Injury Description	
I Hematoma	Subcapsular, nonexpanding < 10% surface area	
Laceration	Capsular tear, nonbleeding, with < 1 cm deep parenchymal disruption	
II Hematoma	Subcapsular, nonexpanding, hematoma 10% to 50%, intraparenchymal nonexpanding < 2 cm in diameter	
Laceration	< 3 cm 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	> 3 cm parenchymal depth	
IV Hematoma	Ruptured central hematoma	
Laceration	Parenchymal destruction involving 25% to 75% of hepatic lobe	
V Laceration	Parenchymal destruction > 75% of hepatic lobe	
Vascular	Juxtaghepatic venous injuries (retrohepatic vena cava/major hepatic veins)	
VI Vascular	Hepatic avulsion	

management has been accepted as one of the treatment methods for liver injury(6,7). The following are the indications for non-operative management : 1) hemodynamic stable ; 2) no sign of generalized peritonitis ; 3) no hollow viscus injury detected by physical examination, X-rays or CT scan ; 4) a unit with 24-hour close supervision, as well as an operating room capable of providing 24-hour emergency surgery must be available. This management should not be attempted in patients who are more than 55 years old, or have multiple injuries due to difficulty in patient follow-up, especially those with associated head injury. No patients were treated using non-operative management in the present study. The operative management of liver injuries has various procedures depending on the magnitude of parenchymal destruction and associated vascular disruption. Such an anatomic classification is detailed in Table 7(8). Because grade I and grade II injuries are minor liver wounds, the operative management may be as follows : no surgical treatment, because bleeding at the liver wound had already stopped at the time of exploratory laparotomy ; suture ligature of the bleeding points or hepatorrhaphy is the treatment of choice for liver wounds with active bleeding at the time of explora-

tory laparotomy. The present study showed that of all the 30 patients (46.9%) with grade I and grade II injuries, no surgical treatment was performed in 8 patients (12.5%), suture ligature of the bleeding points in 7 patients (10.9%) and hepatorrhaphy in 15 patients (23.5%). Grade III, grade IV, and grade V injuries are severe parenchymal destruction and associated vascular disruption which account for the majority of deaths. Hemorrhage is the leading cause of death, therefore, management of hemorrhage is the first priority by performing the Pringle maneuver and packing of the liver. If the Pringle maneuver is effective, it implicates the hepatic artery and portal vein injury, the next procedure is exposure of the liver substance wound to facilitate direct control of the offending blood vessels and adjacent bile ducts. The operative procedures may be as follows ; hepatorrhaphy with suture ligature of the bleeding points and disrupted bile ducts, hepatorrhaphy with the vascularized omentum. There are several advantages in using the vascularized omentum : 1) the omentum's ability to tamponade major bleeding and minor oozing; 2) by filling large defects within the liver, dead space is decreased, and the chance of developing an abscess is decreased as well ; 3) the omentum is a rich source

of macrophages and when introduced into the traumatized liver, may be beneficial in combatting sepsis (9). Continued bleeding following attempts at control by performing the Pringle maneuver implicates the major hepatic vein or retrohepatic vena cava injury which is a significant factor in the high mortality of liver trauma. The operative procedures may be served to management depending on experiences and expertise of the surgeon. These procedures are intracaval shunt, total vascular isolation, and direct repair. In addition to that previously mentioned, the following operative procedures may be selected to serve either as additional procedures or definite surgical treatment. These procedures are as follows : 1) drainage of the injured liver has been an area of much debate, dogmatic adherence to a policy of draining all parenchymal injuries is no longer appropriate(10,11). If hemostasis has been adequate and no apparent bile leaks exist after repairing grade I or grade II injury, drainage is unnecessary. On the other hand, major complex liver injuries, usually result in considerable parenchymal destruction and should be drained ; 2) resectional debridement is the removal of all the devitalized tissue and markedly traumatized tissue to avoid subsequent autolysis, abscess formation, and secondary hemorrhage ; 3) selective hepatic artery ligation in liver trauma appears to be limited, because high mortality exists in patients in whom hepatic artery ligation has failed to control hemorrhage, the addition of hepatic ligation in a hypotensive patient with a resultant decrease in perfusion to the liver may render the liver sufficiently ischemic to result in subsequent necrosis and sepsis, it is ineffective in controlling hemorrhage from either lobar branch of the portal vein, or from the major hepatic veins or their intrahepatic tributaries ; 4) anatomic hepatic resection is indicated when there has been total disruption of a segment or lobe and when it is the only technique that will control life-threatening hemorrhage ; 5) perihepatic packing refers to the insertion of laparotomy pads or rolls of gauze around the liver, not into hepatic lacerations, it is not only an acceptable means of controlling hemorrhage, but may, in certain instances, be the treatment of choice(12-15).

The present study showed 34 patients with grade III, grade IV, and grade V injuries (53.1%). The operative procedures consisted of hepatorrhaphy with suture ligature of the bleeding points and disrupted ducts with drainage 20 patients (31.2%), hepatic artery ligation with resectional debridement with drainage 6 patients (9.4%), resectional debridement with drainage 5 patients (7.8%), and perihepatic packing 3 patients (4.7%).

Complications are related to the extent of injury to other organs, most of which are accompanying blunt liver trauma. Several post-operative complications after repair of liver injuries are found such as recurrent bleeding, hemobilia, hyperpyrexia, intra-abdominal abscess, biliary fistulae etc. The present study showed post-operative complications as follows : bile fistula 5 patients, intra-abdominal collection 8 patients, wound dehiscence 5 patients, and secondary hemorrhage 2 patients.

Mortality directly related to the number and type of associated injuries. The majority of deaths in the immediate peri-operative period usually results from hemorrhage, and in the post-operative period from sepsis. It must be noted, however, that this data was accrued from institutions dealing with large volumes of liver injury patients(16). Blunt trauma to the liver are more lethal and more difficult to manage than penetrating trauma. This study showed causes of death as follows ; irreversible shock 6 patients due to excessive blood loss, head injury 4 patients, intra-abdominal sepsis 4 patients, and secondary hemorrhage one patient.

## SUMMARY

Between 1992 and 2002, the medical records of 64 patients with liver injury diagnosed during exploratory laparotomy and operated on in Paholpol-payuhasena Hospital were reviewed. Patients with blunt abdominal trauma accounted for the majority of liver injury patients, associated injuries, and complex liver injuries, so more complications and mortality were found in patients with blunt abdominal trauma than those with penetrating abdominal trauma.

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## การรักษาการบาดเจ็บของดับ

ธงชัย พุทธบริวาร, พบ\*

ได้ศึกษาข้อมูลผู้ป่วยบาดเจ็บของดับ ที่ได้รับการผ่าตัดรักษาในโรงพยาบาลพหลพยุหเสนา ในระหว่างเดือนกันยายน พ.ศ. 2535 ถึงเดือนสิงหาคม พ.ศ. 2545 จำนวน 64 ราย เป็นเพศชาย 52 ราย (ร้อยละ 81.2) และเพศหญิง 12 ราย (ร้อยละ 18.8) อายุต่ำสุด 10 ปี สูงสุด 79 ปี ช่วงอายุที่พบมากที่สุดคือ 20-29 ปี พบ 24 ราย (ร้อยละ 37.5) แยกเป็นกลุ่มผู้ป่วยบาดเจ็บของดับจาก แรงอัตการแทรกซ่องท้อง จำนวน 41 ราย (ร้อยละ 64.1) ซึ่งอุบัติเหตุจากการจราจร เป็นสาเหตุสำคัญ และกลุ่มผู้ป่วยบาดเจ็บของดับจากบาดแผลแหงหลอดเลือดท้อง จำนวน 23 ราย (ร้อยละ 35.9) ในกลุ่มนี้การแหงเป็นสาเหตุที่พบบ่อยที่สุด การบาดเจ็บของมัมเป็นการบาดเจ็บรุนแรงที่พบบ่อยที่สุดในกลุ่มผู้ป่วยบาดเจ็บของดับ จากแรงอัตการแทรกซ่องท้อง ในขณะทำการบาดเจ็บรุนแรงที่พบบ่อยที่สุดในกลุ่มผู้ป่วยบาดเจ็บของดับจากบาดแผลแหงหลอดเลือดท้องในปัจจัยที่สำคัญคือ การบาดเจ็บของลำไส้เล็กส่วนปลาย ความรุนแรงของบาดเจ็บของดับพบว่าเป็นแบบ grade II จำนวน 20 ราย (ร้อยละ 31.2) ซึ่งมากที่สุด การรักษาทางศัลยกรรมที่ทำบ่อยที่สุด คือ การเย็บเนื้อดับเข้าหากัน ร่วมกับการเย็บผูก เส้นเลือดและห่อหน้าดีที่เข็มขาด และต่อระบบฯ จำนวน 20 ราย (ร้อยละ 31.2) ผลการรักษาประสบความสำเร็จจำนวน 49 ราย (ร้อยละ 76.6) มีผู้ป่วยเสียชีวิตจำนวน 15 ราย (ร้อยละ 23.4) และมีโรคแทรกซ้อนเกิดขึ้นจำนวน 20 ราย (ร้อยละ 31.3%) ซึ่งส่วนมากเป็นผู้ป่วยบาดเจ็บของดับจากแรงอัตการแทรกซ่องท้อง

ค่าสำคัญ : การบาดเจ็บของดับ, การรักษา

ธงชัย พุทธบริวาร  
จดหมายเหตุทางแพทย์ ๔ 2546; 86: 103-110

\* กลุ่มงานศัลยกรรม, โรงพยาบาลพหลพยุหเสนา, กาญจนบุรี 71000