

## Nonoperative Management of Blunt Hepatic Trauma

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One hundred-three consecutive patients sustained blunt hepatic trauma were reviewed. Fifteen patients who were conservatively treated were also clinically analyzed with reference to current diagnostic methods. Indication for conservative management of blunt hepatic trauma might be considered as follow; 1) Vital signs are stable or stabilized by transfusion. 2) No significant injuries are associated to the intraperitoneal organs. 3) The amounts of blood in peritoneal cavity is about 500ml at most. 4) Nature and extent of injuries to the liver are subcapsular rupture or lacerations with grade I or II with no active bleeding. Follow-up study by computed tomography (CT) showed that the intrahepatic hematoma spontaneously resolved 6 to 12 months after injury. It is considered that nonoperative management of the selected patients with intrahepatic hematoma are reasonable and safe.

### INTRODUCTION

The liver is the most frequently injured organ in abdominal trauma and the blunt hepatic trauma is associated with multiple organ injury in about 50% of patients.<sup>1,2)</sup> For most of the patients sustaining traumatic liver injury, surgical intervention has long been required. Although mortality rate after major liver trauma ranged from 20 to 60% on account of immediate exsanguination, delayed bleeding and postoperative complications, the majority of injuries of the liver (85-90%) are minor, and bleeding used to cease spon-

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下山 孝俊, 福田 豊, 清水 輝久, 石川 啓, 川口 昭男, 草野 裕幸, 中越 享  
原田 達郎, 平野 達雄, 酒井 敦, 下田 穂積, 三浦 敏夫, 富田 正雄

taneously. Otherwise, it requires simple suture and drainage alone.<sup>1-5)</sup> On the other hand, over the last ten years, significant advance in computed tomography (CT) has occurred at a rapid pace. This has led to the current advance in the diagnosis and management with traumatized patients.

The purpose of this article is to review our experience with blunt hepatic trauma, in appraisal of nonoperative management, as well as evaluation of current methods of diagnosis and treatment.

## MATERIALS AND METHODS

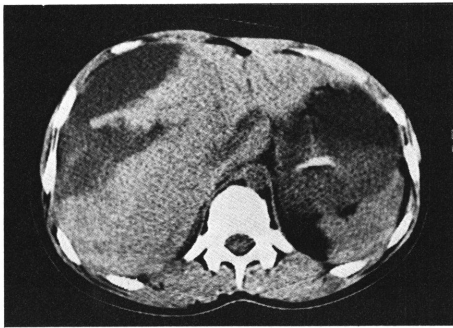
The present study consists of an analysis of 103 consecutive patients who sustained blunt hepatic trauma and admitted alive to the First Department of Surgery, Nagasaki University, during the period from January 1, 1965 to January 1, 1987. The current series of liver injury represented a sequel to the previous series with 60 patients reported from our department by authors covering the period from 1965 to 1977.<sup>5)</sup> Data from the previous series were presented to analyze some changing concepts, in comparison with 43 patients in the recent series from 1978 to 1987, in which most of the patients were diagnosed by US or CT. All patients were confirmed liver injury at surgery or in diagnostic imaging procedures. Eighty-seven were males and sixteen were females. Their ages ranged from newborn to 74 years. Sixty-one patients (59.2%) sustained also one or more associated injuries.

Table 1 shows the mode and extent of liver injury in each series. The modes of liver injury were lacerations in 81, subcapsular ruptures in 20 and central ruptures in 2. Although the incidence of liver lacerations were almost similar in each period, there has been a concomitant increase in the percentage of subcapsular rupture from 11.7% in the previous series to 30.2% in the recent series. The extent of liver injury have been

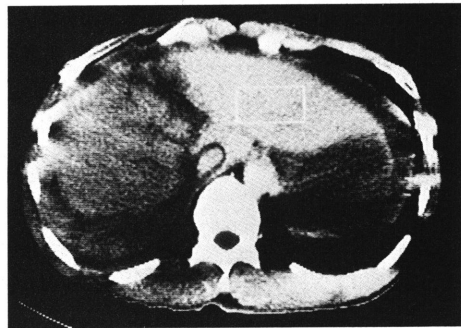
**Table 1** Mode and grade of liver injury in 103 blunt trauma

Mode	1965-1977 No. of patients	1978-1987 No. of patients	Total
Lacerations	52 (86.7%)	29 (67.4%)	81 (78.6%)
Subcapsular rupture	7 (11.7%)	13 (30.2%)	20 (19.4%)
Central rupture	1 (1.7%)	1 (2.3%)	2 (1.9%)
Total	60 (100%)	43 (100%)	103 (100%)
Grade			
I (Minor)	35 (58.3%)	17 (39.5%)	52 (50.5%)
II (Moderate)	13 (21.7%)	18 (41.9%)	31 (30.1%)
III (Severe)	12 (20%)	8 (18.6%)	20 (19.4%)
Total	60 (100%)	43 (100%)	103 (100%)

classified into three types according to the severity of liver injury.<sup>6</sup> Grade I represents 52 patients with minor injury having small laceration of the liver. Grade II represents 31 patients with moderate injury with significant amount of liver parenchymal ruptures in one or two segments, but without main vessels injury (Fig. 1). Grade III represents 20 patients with major hepatic injury with tissue disruption, devitalization, massive hemorrhage and bile leak from main vessels injured (Fig. 2). In the previous series, fifty-eight patients (96.7 %) underwent laparotomy with various techniques, whereas thirteen patients (30.2%) were conservatively managed in the recent series.



**Fig. 1.** CT imaging of 18 year-old student girl (case 2) demonstrating subcapsular rupture of right lobe. She was sustained by roller. After conservative management, she discharged 2 months after injury with normal liver function.



**Fig. 2.** CT imaging of 34 year-old man sustained by a labour disaster. The hepatic parenchyma is divided by multiple lacerations with evidence of an intraparenchymal and subcutaneous hematomas. He died following hepatic failure 11 days after trauma.

## RESULTS

Fifteen patients with blunt hepatic trauma who were conservatively managed were reviewed. In the recent series, thirteen patients were diagnosed and followed up by US or CT. The patients who received subcapsular ruptures and lacerations with grade I or II were mainly selected for conservative therapy. The anatomical location found in liver injury were the right lobe in 13, left lobe and bilateral lobe in one each. Associated injuries occurred in 9 patients (5 rib fractures, 2 kidney ruptures and 2 hemopneumothorax) and were also treated by conservative means.

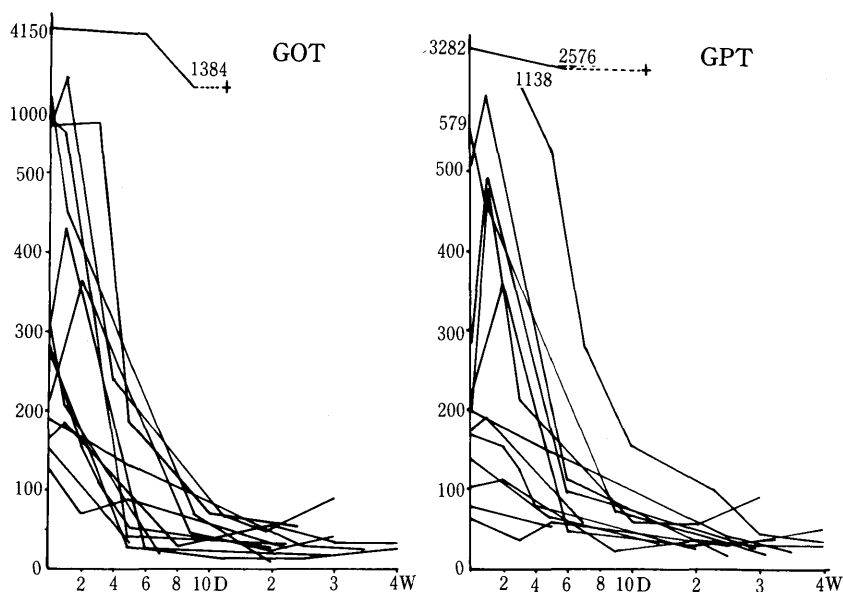
Table 2 lists seven patients with subcapsular rupture and lacerations with grade II or III of blunt hepatic injury. All patients had anemia and two patients were in shock on admission. However, after initial resuscitation with rapid transfusion of Ringer lactate solution or blood transfusion, no further drop in blood pressure was found. A subcapsular hematoma of the liver detected by CT scan was found as lenticular shaped collection of

**Table 2** Cases of conservative management of blunt hepatic trauma with grade II · III

No.	Age · Sex	Affected side	Mode & Grade of injury	Associated injury	Hb (g/dl)	Blood replaced(ml)	Prognosis
1	36 M	right	lac. II	Haemothorax	10.5	1000	alive
2	18 F	right	subc. II	rib	8.2	1600	alive
3	51 M	right	subc. II	(-)	9.7	(-)	alive
4	52 M	left	subc. II	(-)	10.3	(-)	alive
5	47 M	right	subc. II	(-)	9.8	600	alive
6	74 M	right	lac. II	Kidney	9.9	2400	alive
7	34 M	right	cent. II	Haemothorax	6.9	1400	dead

M: Male, F: Female, lac.: lacerations, subc: subcapsular rupture

fluid associated with fluttering of the parenchyma (Fig. 1). However, the attenuation value of the hematoma varied with times of injury. Ultrasonography showed a linear or multiple area of low density with poorly defined margins in lacerations of the liver, and a high echoic area in subcapsular hematoma. One patient with central rupture with grade III (Case 7) died 11 days after trauma because of hepatic failure (Fig. 2) and the other 14 patients did well. Figure 3 shows a change of liver function in 15 patients treated by conservative means after trauma. A rapid increase of GOT and GPT was found in all patients and they returned to normal in 14 survivors. Follow-up CT scan also showed the lesions of hepatic ruptures to usually diminish in size with the passage of time (Fig. 4). The patients with moderate rupture had no complications and healed completely from 6 to 12 months after injury.



**Fig. 3.** Posttraumatic change of GOT and GPT in nonoperative patients with blunt hepatic trauma.

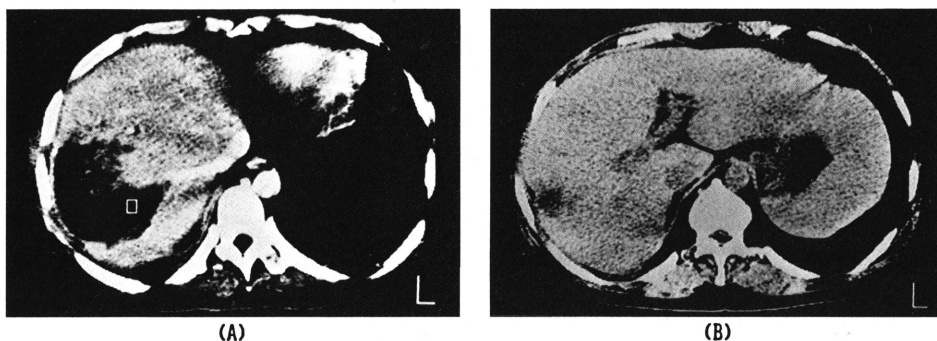


Fig. 4. CT imaging of case 1. (A) 18 hours post-trauma.  
(B) Shrinking of the cavity noted 4 months after injury.

## DISCUSSION

For the treatment of blunt hepatic trauma, the selection of an indication of surgery is important for surgeons. In the previous series, only available diagnostic options for liver injury were exploratory laparotomy based on peritoneal taps for the presence of intraperitoneal bleeding and liver function.<sup>5</sup> Although abdominal taps was described by Byrne and cited to have a diagnostic accuracy of 75% to 95%, it does not evaluate the retroperitoneal bleeding or the potential source of bleeding.<sup>7</sup> Recently, the advanced diagnostic techniques such as ultrasonography (US) or computed tomography (CT) make it possible to evaluate the injuries to the liver or the other organs.<sup>9,10</sup> On the other hand, in the current series, 12.5% of liver injuries had stopped bleeding at the time of laparotomy, and were controlled by simple suture or drainage alone. For most of these patients, the recent improvement in radiological evaluation and diagnosis of liver injury has led to the successful nonoperative management.

The important factors of indication for laparotomy are nature or extent of liver injury and associated injuries to the other intraperitoneal organs. The choice of therapy is usually based on clinical findings under meticulous cares. Major indication for abdominal exploration following blunt hepatic trauma include the following: 1) pneumoperitoneum 2) continuing hemorrhage and shock 3) persistent unexplained abdominal pain and tenderness, and 4) increasing abdominal distension. Either CT or US can then be utilized to detect the etiology of the changing clinical states. Of the diagnostic modalities available, CT has had greater than 90% sensitivity of detection in the liver injury, and also can evaluate other adjacent organs and retroperitoneum.<sup>9,10</sup> A prospective study comparing CT, US and scintigraphy in abdominal trauma concluded that CT was the single best imaging test with fewer false-negative and false-positive results.<sup>9</sup> With the development of these

radiological modalities, the role of arteriography for initial diagnosis has been diminished. However, severely traumatized patients in whom their conditions are unstable may require urgent arteriography not only for diagnosis, but also for the therapy of transcatheter embolization for active sources of hemorrhage whenever needed.<sup>8)</sup>

In our series of 15 patients who were conservatively managed, the liver injuries were detected by US or CT. The main modes of liver injury in these patients were subcapsular ruptures and partial transcapsular ruptures with intraparenchymal hematoma. The incidence of subcapsular rupture following blunt abdominal trauma has been reported to range from 0.33% to 12% of all liver trauma.<sup>1~5)</sup> In our 4 patients, subcapsular hematoma showed a slow increase in size and became stable within 3 days after injury. However, One patient in previous series revealed a rapid increase of subcapsular hematoma and required right lobectomy.<sup>5)</sup> Lacerations of the liver were often treated by conservative means, if bleeding discontinued. It is important in these cases to evaluate the hemorrhagic volume in peritoneal cavity. MAESHIRO *et al.* described 7 patients with blunt hepatic injuries managed nonoperatively, and also suggested that hemorrhagic volume from the injured liver in the peritoneal cavity could be calculated by US and that the patients might be managed nonoperatively, if their hemorrhagic volume were less than 500ml.<sup>14)</sup> Although our two patients with transcapsular ruptures with parenchymal hematoma required blood transfusion of 1,000ml and 2,400ml respectively, they had any uneventful clinical course.

Associated injuries to the abdominal organs were important factors determining the indication of laparotomy. The most common abdominal organs of associated injuries following blunt trauma were the spleen and kidney.<sup>1~5)</sup> Our 2 patients with associated injury of the kidney were also managed conservatively. In these patients of associated injury, diagnostic imaging procedures as well as physical examination should be frequently repeated to determine any deterioration in the clinical status. In a case of major rupture without intraperitoneal bleeding, resection of the liver was indicated. There was no occurrence of hemobilia, abscess formation, or major delayed hemorrhage in other 14 patients. Initiation of the resolution of hematoma occurred 4 to 6 weeks after injury. It is reported that complete or nearly complete resolution of the hematoma was revealed by follow-up examination using US or CT at 4 to 12 months after trauma.<sup>12,13)</sup> Hepatic trauma with subcapsular rupture or partial transcapsular rupture with parenchymal hematoma with grade I or II is a good candidate of conservative therapy. However, surgeons should bear it in mind that late complications are liable to occur and follow-up by US or CT is needed until the hematoma is resolved completely.

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