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Delayed Celiotomy or Laparoscopy as part of the Nonoperative Management of Blunt Hepatic Trauma

Christian Letoublon · Yao Chen · Catherine Arvieux · David Voirin · Irene Morra · Christophe Broux · Olivier Risse

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Abstract
Background Nonoperative management (NOM) is considered standard treatment for 80% of blunt hepatic trauma (BHT). NOM is associated with some events that may require delayed operation (DO), usually considered a criterion of failure of NOM.
Methods A retrospective case note review was performed on 257 consecutive patients with BHT, with a median age of 32.7 years, admitted from 1994 to 2005. We considered the 186 patients (72%) who had an initial indication of NOM, and focused on the 28 patients who were secondarily operated (DO), mainly on the 22 patients operated on for liver-related indications. Celioscopy was used in five cases.
Results The severity grade of these 22 patients was: zero grade I, seven grade II, ten grade III, four grade IV, one grade V. The timing of DO varied from day 0 to day 11. Ten patients were operated on for a peritoneal inflammatory syndrome. Death occurred in three patients at days 2, 10, and 125. One was attributed to underestimation of hepatic necrosis, another to a nondiagnosed peritoneal inflammatory syndrome; 27, 3% of the patients had liver-related complications.
Conclusions Our data suggest that BHT treated by NOM must be frequently reevaluated and that DO is an actual part of the so-called nonoperative treatment. The use of laparoscopic washing has to be proposed as soon as day 3 or 5 in patients with large hemoperitoneum and any sign of inflammatory response (fever, leukocytosis, discomfort, tachycardia).

C. Letoublon (✉) · Y. Chen · C. Arvieux · D. Voirin · I. Morra · C. Broux · O. Risse
Departement de chirurgie digestive et de l'urgence, Hopital Michallon, BP 217, 38043 Grenoble, cedex, France
e-mail: CLetoublon@chu-grenoble.fr

Introduction

Nonoperative management (NOM) is established as the "gold standard" treatment for blunt hepatic trauma (BHT) in hemodynamically stable or stabilized patients [1–5]. Currently, more than 80% of patients with BHT are treated nonoperatively. The success rate is considered as high in most publications. However, NOM also is associated with an increased frequency of some complications and pitfalls that may require delayed abdominal operation, especially in patients presenting with the most severe lesions (grades IV and V) [1, 6–8].

A delayed operation (DO), by celiotomy or celioscopy, is usually considered a criterion of failure for NOM. Nevertheless, a DO may be considered instead as part of the management scheme. Several indications for DO are obvious, such as hemorrhage, bilioperitoneum, peritonitis, abdominal compartment syndrome, and compression of the liver. A less obvious syndrome, called "inflammatory syndrome" secondary to the action of blood and bile on the peritoneum, was claimed by Carrillo et al. [7] to be an indication for relatively early DO, preferentially by laparoscopy. The purpose of the current study was to review our experience with delayed laparotomy or laparoscopy in patients initially treated by nonoperative management.

Patients and methods

We retrospectively selected patients admitted to the Grenoble University Hospital between January 1994 and December 2005, who were diagnosed with BHT and treated by our team. We considered the patients for whom an initial option of NOM had been chosen, and who were secondarily operated on, including patients for whom the

operation took place between the 6th and the 24th hour after admission. Records were retrospectively reviewed for demographics, severity of trauma (ISS), severity of liver injury (injury scale determined by the AAST based on CT scan [9], indication for operation, timing of operation, operative findings, and conduct of operation. All postoperative complications were recorded.

Special attention was given to screening for a "peritoneal inflammatory syndrome," which for us was the association of signs of a hemoperitoneum with abdominal pain, and/or pyrexia above 38°5, and/or hyperleucocytosis, and/or elevated C-reactive protein (CRP).

Results

A total of 257 patients hospitalized for blunt hepatic trauma from 1994 to 2005 were included (178 men, 65%). Table 1 shows the demographic data by grade of hepatic injury severity. The mean age was 32.7 (range, 7–81) years. Seventy-eight patients (30%) had been transferred from other hospitals. Road traffic accident was the cause of injury in 57% of the cases. It is interesting to note that sports-related accidents accounted for 25% of the cases; most of them (70%) were snow sports.

Seventy-one of these patients (27.6%) underwent emergency laparotomy for hemodynamic instability and/or extrahepatic abdominal injury requiring surgery.

The remaining 186 patients were treated nonoperatively (72.4%). Among these patients, 28 underwent delayed abdominal exploration (15.6%), including 22 for a liver-related indication (5 by celioscopy and 17 by celiotomy). These 22 patients form the core of this report.

The timing of DO ranged from day 0 to day 11 (Fig. 1). Two patients were operated on at day 0 (between H6 and H24). In one patient with a grade III lesion and rupture of the right diaphragm, the indication was hemodynamic collapse and hemorrhage collected by thoracic drainage. In the other patient with a grade III lesion, an abdominal compartment syndrome (ACS) developed during arterial embolization and required laparotomy for decompression, PHP for oozing hemorrhage, and exclusive cutaneous closure.

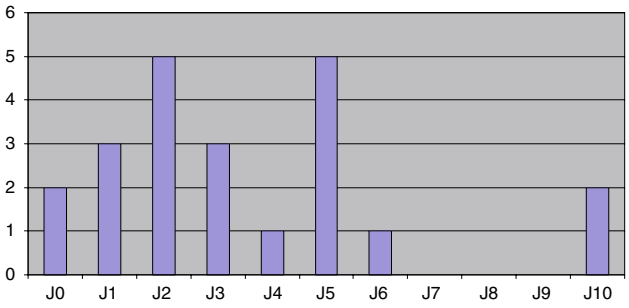

Fig. 1 Time before delayed operation, 22 patients

The liver-related indications for DO are presented in Table 2 and details of operation in Table 3. Two patients were operated on for suspicion of hemorrhage.

In the patient with a grade III injury and rupture of the diaphragm described above, surgery was performed at H10: suture of the diaphragm allowed PHP.

In the other patient, aged 81 years, under clopidogrel for a severe cardiopathy, with a grade III injury, progressive collapse required laparotomy on day 2. A moderate hemoperitoneum and severe necrotizing enteritis were found. Damage control was performed with vacuum pack closure because of diffuse liver oozing and severe persisting collapse [10].

One patient was operated on at the very beginning of our study because the surgeon was overanxious: wash out of the hemoperitoneum was the only procedure required.

Three patients were operated on for an abdominal compartment syndrome (ACS) and were treated from day 0 to day 3 by laparotomy, irrigation, and suctioning. Parietal closure included fascial closure in one patient and was limited to an exclusive cutaneous closure in two patients.

Table 1 Complete series: demographic data, injury severity by grade, initial management

Severity grade	N	OM		NOM	
		N	(%)	N	(%)
I	36	4	11	32	89
II	138	25	18.1	113	91.9
III	52	19	36.5	33	63.5
IV	20	13	65	7	35
V	11	10	90.9	1	9.1
total	257	71	27.6	186	72.4

OM operative emergency management, *NOM* nonoperative management

Table 2 Liver-related indications for delayed operation

Indication for delayed operation	N
Hemorrhage	2
Abdominal compartment syndrome	3
Hepatic compartment syndrome	2
Bilious thoracic drain output	1
Bile peritonitis (puncture)	1
Pain ++ / subcapsular hematoma	1
Inflammatory response	10
Unrecognized Inflammatory syndrome	1
Unjustified anxiety	1
Total	22

Table 3 Details of operation on hepatic lesions

Celiotomy		Details of operation	
Laparoscopy	4	Lavage-drainage	4
Laparotomy	24	Lavage-drainage (of which 9 were sole treatment)	14
		Peri-hepatic packing (removal on days 2, 3, and 4; 2 deaths)	5
		Evacuation of subcapsular hematoma	2
		Hemostasis by simple suture	3
Abdominal release procedure after laparotomy	4	Vacuum pack	1
		Exclusive cutaneous closure	2
		Relaxing cutaneo-aponevrotic incision	1

Two patients were operated on for severe ischemia of the liver associated with a large subcapsular hematoma. Both patients underwent laparotomy, removal of clots, and hemostasis with an argon beam.

One patient was operated on because of a bile leak through a chest tube. On day 5 he was operated on by laparotomy, suture of a diaphragmatic rupture, cholecystectomy, transcystic biliary, and peritoneal drainage.

In one patient a bilioperitoneum was assessed by transparietal puncture and led to a laparotomy on day 5 (lavage–drainage).

Ten patients developed an "inflammatory response" as described by Carrillo, and were operated on between day 2 and day 10 [7]. Six laparotomies and four laparoscopies (including one that was converted to laparotomy) were performed, revealing a predominant bilioperitoneum in five cases and mostly blood in five cases. In every case, the procedure included peritoneal lavage-drainage, combined with cholecystectomy with transcystic drainage in one case. Postsurgical evolution was complicated for six of ten patients. Four of these patients presented with pulmonary complications caused by associated thoracic trauma (one hemopneumothorax and three cases of pulmonary contusion). There were liver-related complications in two of ten patients. One patient who had a secondary biloma was treated by transparietal puncture.

The evolution was difficult in a 56-year-old alcohol- and tobacco-addicted undernourished patient. A stage IV to V BHT was associated to kidney trauma but after successful renal and hepatic artery embolization, he developed a peritoneal inflammatory syndrome at day 2 and underwent celioscopic washing-out. Laparotomy was required 6 hours later because of continuing hemorrhage, and PHP was performed. Several septic events followed, related to hepatic necrosis, requiring repeated atypical hepatic resections. He died at day 125 with multiple organ failure.

One patient progressively developed a peritoneal inflammatory syndrome, which was not diagnosed. He was referred at day 10 and was immediately operated on, but he died soon after.

Global mortality

Three of the 22 patients studied died (13.6%). The first was the 56-year-old patient described earlier. He died on day 125 after prolonged multiple organ failure. The second was an 81-year-old patient treated by anticoagulants, presenting with a stage III lesion and a progressive hemodynamic instability attributed to hemorrhage. Exploratory laparotomy on D2 revealed a moderate hepatic hemorrhage, an ischemic bowel in a context of severe shock. He died despite damage control and resuscitation. There was no postmortem. The third was a 47-year-old patient, presenting with a hepatic stage IV lesion, a thoracic and scapular trauma. There was a clinical deterioration with intense abdominal pain from day 5 not relieved by morphine, with a biological inflammatory syndrome gradually worsening, and the onset of icterus. A hemorrhagic shock came on day 10 with severe acidosis and anuria. The patient was then referred to our unit and laparotomy was immediately performed, revealing a massive hemoperitoneum and hepatic venous hemorrhage. PHP and damage control did not prevent death, which occurred 2 hours later. There was no postmortem.

Global morbidity

This concerned 16 patients if all complications taken into account and six patients (27.3%) when considering only complications related to hepatic lesions or to the therapeutic procedure they required. These six patients presented with one to three complications each (Table 4). Pulmonary complications not directly related to thoracic trauma were observed in one patient. Two cases of pulmonary embolism were diagnosed despite preventive anticoagulant therapy. An external biliary leak through the drain wound was noted in three cases but not considered as a complication, for it healed spontaneously in all cases within a delay of 12, 12, and 13 days. Three patients were treated for a biloma: twice by percutaneous drainage, once by relaparotomy. On day 21, a ruptured false aneurysm

Table 4 Complications related to the hepatic trauma and/or its treatment

Pulmonary complication (no PE)	3	(not related to thoracic trauma)
Rupture false aneurysm	1	(at D21; treated by AE)
Biloma	3	(2 percutaneous drainage, 1 surgical resection)
Thromboembolic complications (with PE)	3	(all of them under preventive treatment)
ACS	1	(treated by Vacuum pack)
Necrosis of the hepatic parenchyma	1	(iterative hepatic resection)

ACS abdominal compartment syndrome, AE arterial embolization, PE pulmonary embolism

Some patients had several complications

induced an acute hemoperitoneum, which was managed by laparotomy, PHP, and successful arterial embolization. Postembolization parenchymatous ischemia and hepatic necrosis required repeated hepatic resections in one patient.

In the subgroup of ten patients operated on for a peritoneal inflammatory syndrome, only two had morbidity related to hepatic lesion: one with a biloma treated by echo-guided puncture, and the above-mentioned with infected hepatic necrosis.

Discussion

The advantages of NOM for blunt liver trauma are well documented. When an active hemorrhage does not require early laparotomy, the presence of hemoperitoneum and severe lesion on CT should not systematically lead to surgery, even if for Fang et al. [11] the association of intraperitoneal extravasation with profuse hemoperitoneum leads to surgery in 100% of the cases. Arterial embolization contributes efficiently to this conservative attitude [12, 13]. Authors usually stress the improved results concerning the death rate because this attitude has become standard; however, the need to use embolization is for some a criterion of later morbidity [14].

Carrillo showed that 24% of the patients treated nonoperatively required a delayed surgery for complications, and he stressed that 67% of these patients presented with grade IV or V lesions [15]. This was confirmed by Christmas in a series of 230 NOM cases [4]. In our series, we considered as NOM the cases for which the decision had been made in ITT. Therefore, we also considered as DO the cases for which surgery had come in between the 6th and the 24th hour. Some authors consider as operative treatment all the cases that undergo surgery within the initial 24 hours, even if a conservative option was initially taken. In our series, only four surgical procedures really correspond to failure of the initial NOM option (4% of NOM), manifested by an early rebleeding. Nevertheless, we think that DO is usually part of the strategy rather than a criterion of failure or complication of the chosen procedure. The observed mortality (three cases) may be related for one case to a late decision for surgery, despite a clinical setting suggesting *a posteriori* the progressive development of a peritoneal inflammatory syndrome. Goldman stresses this risk when commenting on the two deaths in his series, which he attributes to a delayed diagnosis of this peritoneal inflammatory syndrome [8].

The second death in our series, on day 125, was to the result of multiple causes, but an underestimation of parenchymatous necrosis aggravated by arterial embolization probably played a role. For the third patient, aged 81 years under anticoagulotherapy, a massive intestinal ischemia guided a palliative option and his death could not be attributed solely to the NOM initial option.

Initial arterial embolization was used in nine cases in our series. DO was indicated in four of these cases for an abdominal hyperpressure syndrome or for an ACS, within a delay of 6 to 72 hours after this procedure. In four other cases, it was for a peritoneal inflammatory syndrome, with a delay of 48 hours to 5 days. In the last case, it was for severe ischemia of the liver associated to a large subcapsular hematoma. We currently consider that arterial embolization is a useful contribution for the initial nonoperative treatment of severe BHT. Of course it does not prevent DO, but it certainly facilitates its management.

The potential development of an ACS must be kept in mind with this type of patient. Measuring the intra-abdominal pressure by intravesical pressure is justified in case of significant hemoperitoneum [16, 17]. It is important to prevent evolution from intra-abdominal hyperpressure to a complete ACS. If intra-abdominal hyperpressure seems to be related to an important hemoperitoneum, a celioscopy can be considered, but the most commonly suggested therapy is laparotomy, including washing out and drainage. Abdominal closure is adapted to the tension of the abdominal wall and may include fascial, exclusive cutaneous closure, or the "vacuum pack" [10].

We think that an early and systematic screening for signs of an "inflammatory syndrome" as described by Carrillo is most important. When the clinical presentation was complete, associating abdominal pain, hyperleucocytosis, increased CRP level, fever >38°5, surgery revealed an effusion with a high biliary content.

It is interesting to note that lavage-drainage was efficient in the four cases with an incomplete syndrome (associated pulmonary contusion was responsible for the three cases with a longer recovery). This incomplete syndrome corresponded to cases associating massive hemoperitoneum with only one of the previous clinical signs.

Lavage-drainage, completed in four of ten cases by celioscopy, was very efficient in most of the cases, with an almost immediate clinical improvement. Although it is difficult to prove this statistically, it is highly probable that the early exploration and washout was beneficial for the patient and led to a quicker recovery. Celioscopic exploration failed only once because of rebleeding requiring laparotomy 6 hours later.

Drainage inserted during this washout of the abdominal cavity must be wide, oriented toward the zone of hepatic rupture (often visible). The external biliary fistula oriented by this drainage is not really a complication of the procedure but rather a therapeutic step. In our experience, biliary fistulas after a conservative treatment of BHT spontaneously resolve after removal of the drain. A less conservative attitude may be suggested, which with Endoscopic Retrograde Cholangiography would accelerate recovery by inserting a biliary prosthesis [18]. This biliary leak is all the more probable when the lesion is more severe, which justifies screening for it, by puncture or by scintigraphy for Wahl, or more simply by celioscopy, which ensures both the diagnosis and the treatment by washing-out and inserting a wide external drainage [19].

Conclusions

Using NOM for BHT led to improving results but also to a new pathology, complications, and pitfalls that only a strict surveillance may detect on time. Delayed laparotomy or laparoscopy should not be considered as a sign of failure for NOM but as a part of this therapeutic strategy, as well as arterial embolization. Its innocuity is in favor of its large use, supported by the mastery of celioscopy.

We are equally convinced of the interest of discussing celioscopic abdominal exploration between the second and fifth day in case of NOM for BHT with a significant hemoperitoneum, even more important when there are signs of peritoneal inflammation (abdominal pain, fever, and sometimes increased CRP level) or of any kind of abdominal tension.

It is impossible to suggest a randomized study for such an attitude, but we think that promoting the concept of delayed abdominal exploration should improve the management of any severe BHT that does not require immediate laparotomy. It is justified to add DO to the therapeutic armamentarium for BHT, as well as emergency arterial embolization.

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