Blunt hepatic trauma: comparison between surgical and nonoperative treatment

Trauma hepático contuso: comparação entre o tratamento cirúrgico e o não operatório

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A B S T R A C T

Objective: The objective of this study is to examine the outcomes of blunt hepatic trauma, and compare surgical and non-surgical treatment on patients admitted with hemodynamic stability and with no obvious indications of laparotomy. **Methods:** This is a retrospective study of cases admitted to a university teaching hospital between 2000 and 2010. In this period, 120 patients were admitted with blunt hepatic trauma. Sixty five patients (54.1%) were treated non-operatively and fifty five patients were operated upon. Patients who were to undergo surgical treatment were divided into two groups: (A) all those patients undergoing surgical treatment (55) and (B) those patients with no obvious indication for surgery (13). **Results:** Patients treated non-operatively had better physiological conditions on admission, had less severe injuries (except the grade of hepatic injury), received less blood components and had lower morbidity and mortality rates than patients operated upon (Group A). Patients operated upon, but with no obvious indications for surgery, had higher rates of complication and mortality than non-operated patients. **Conclusion:** A non-operative approach results in lower complications, a lesser need for blood transfusions and a lower mortality rate.

Key words: Liver. Wounds and injuries. Wounds and injuries. Wounds, nonpenetrating. Laparotomy. Trauma severity indices.

INTRODUCTION

The liver, due to its size and anatomical position, is often injured in abdominal trauma. Hepatic injuries correspond to approximately 5% of admissions in emergency rooms worldwide. Its prevalence has risen in the last three decades as a result of an absolute increase in the number of cases and also as a result of an improvement in diagnostic methods [1-5].

In the USA, in recent decades, non-operative treatment has become the choice for patients with blunt abdominal trauma, hemodynamic stability and no signs of peritonitis. The advent of new diagnostic technologies in recent years, such as Computed Tomography (CT), has allowed a paradigm shift from surgical treatment to non-surgical treatment for selected patients. The use of CT for patients with blunt abdominal trauma determines the presence of a liver injury and its organ injury scale, and excludes other significant lesions, avoiding unnecessary surgery [6-9].

Besides the advantage of avoiding morbidity from a laparotomy, non-operative treatment of hepatic lesions has shown other benefits such as a reduction in the need for blood transfusions, a lower rate of abdominal complications, a shorter length of hospital stay and lower mortality [10-12].

This study aims to examine the outcomes of blunt hepatic trauma, and compare surgical and non-surgical treatments for patients admitted with hemodynamic stability and with no obvious indications of laparotomy.

METHODS

This is a retrospective study of cases admitted to a university teaching hospital, equivalent to a Level 1 Trau-

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ma Center, located in a metropolitan region with a population of approximately 2.7 million. From January 2000 to December 2010, 265 patients were admitted with hepatic trauma. All patients under 14 years old and patients operated in other hospitals and subsequently later referred were excluded from this study. Of these 265 patients, one hundred and twenty (45.3%) were admitted to the emergency room (ER) with blunt hepatic injuries. This group represents the sample analyzed in this study.

Our non-operative treatment procedure includes all patients with blunt hepatic trauma with hemodynamic stability on admission, or after initial reanimation, and with no indication of surgical treatment due of extra and intra-abdominal associated injuries, independent of Glasgow coma scale and severity of hepatic injury. Failure of non-operative treatment determines that a laparotomy be carried out, after the initial decision to treat the patient non-operatively.

The following factors were analyzed: age, gender, cause of injury, systolic blood pressure (SBP) on admission, Glasgow Coma Scale (GCS), Revised Trauma Score (RTS), Injury Severity Score (ISS), probability of survival (TRISS), AIS head, ATI, grade of injury according to the Organ Injury Scale of the American Association for the Surgery of Trauma (OIS-AAST), presence of associated abdominal injuries, need for blood transfusion, amount of packed red blood cells, platelets and fresh frozen plasma transfusions, complications (related and non-related to the liver), need for surgical intervention, length of hospital stay and mortality [13-18].

Among complications related to the liver, the following were considered: re-bleeding from the hepatic lesion, biliary fistula, biliar peritonitis, liver abscess and intra-abdominal abscess. Among non-related complications, the following were considered: pneumonia, empyema, atelectasis, respiratory distress syndrome, urinary tract infection, digestive and urinary fistulas, sepsis and brain injury.

Patients undergoing surgical treatment were divided into two groups:

· Group A: All the patients submitted for surgical treatment (55 patients).

· Group B: We excluded the patients with obvious indication for surgery: hypotension, evidence of peritonitis, vascular lesions, associated lesions in the hollow viscus. We also excluded patients who required a splenectomy. We reviewed the causes of death of these patients and verified the relation to neurological damage (13 patients).

Patients who failed non-operative treatment (6) were compared with those who didn't (59).

This research project was approved by the Institutional Review Board of the Faculty of Medical Sciences, UNICAMP (protocol number 382/2010).

The chi-square test, exact Fisher test and the Mann-Whitney test were all used for statistical analysis purposes. Statistical significance was assumed at $p<0.05$.

RESULTS

The causes of trauma are illustrated in figure 1.

Between 2000 and 2010, 120 patients were admitted with blunt hepatic trauma. Sixty five patients (54.1%) were treated with non-operatively and fifty five patients were operated upon. Patients treated non-operatively had better physiologic conditions on admission, less severe injuries (except the grade of hepatic injury), received fewer blood components and had lower morbidity and mortality rates. All the aspects evaluated are described in table 1.

Complications related to the liver were found in two patients (3.1%) submitted for non-operative treatment, two patients had re-bleeding from a liver injury, and complications not related to the liver were found in seven patients (10.8%) submitted for non-operative treatment: four of them had pneumonia, one had Acute Respiratory Distress Syndrome, renal failure and sepsis, one patient had Acute Respiratory Distress Syndrome, and one patient had tracheal stenosis. Within this period, six patients failed non-operative treatment (four due to peritonitis and two due to hypovolemic shock), with a success rate of 90.8% for non-operative treatment in this period. One patient submitted for non-operative treatment died due to hypovolemic shock (operated on the fourth day because of re-bleeding in the liver) and the survival rate was 98.5% for non-operative treatment.

As a further analysis, we excluded, from Group A, those patients who received surgery and who had obvious indication for surgery, as previously mentioned. All evaluated aspects are described in table 2. Of the patients operated on in Group B, six had complications related to the liver (five had re-bleeding from hepatic injury and one had biliar fistula and hepatic abscess) and ten had non-liver related complications (six had pneumonia, two had pneumonia and sepsis, one had infection in a leg injury and one had acute renal failure). Four patients from Group B died (three due to hypovolemic shock and one due to sepsis).

Patients who failed non-operative treatment did not demonstrate significant differences in physiological conditions and severity of injuries. These patients had a significantly higher need for blood transfusions, higher

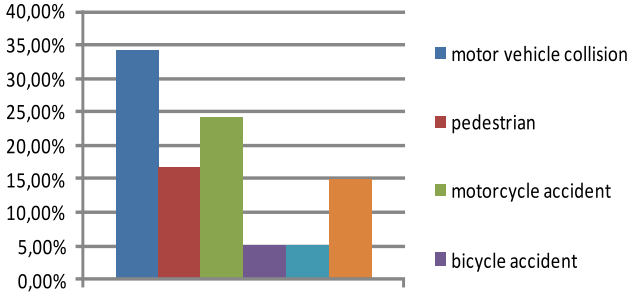

Figure 1 - *Distribution of the mechanisms of blunt trauma between 2000 and 2010.*

Table 1 - Comparison between patients undergoing surgical and non-operative treatment.

Aspect evaluated	Surgical treatment N=55		Non-operative treatment N=65		p value
Gender (male)	45	(81.8%)	46	(70.8%)	0.159
Mean age	32.29	(± 12.31)	32.15	(± 13.90)	0.613
RTS*					0.0001
= 7.84	17	(30.9%)	58	(89.2%)	
< 7.84	38	(69.1%)	7	(10.8%)	
Mean Systolic Blood Pressure on admission*	96.94	(± 34.70)	122.19	(± 21.28)	<0.0001
Mean Glasgow Coma Scale*	10.11	(± 4.48)	14.40	(±1.81)	<0.0001
Mean ISS*	28.43	(± 12.97)	14.09	(±9.81)	<0.0001
Mean AIS head*	1.98	(± 2.05)	0.37	(± 0.85)	<0.0001
Mean TRISS*	0.74	(± 0.3)	0.97	(±0.03)	<0.0001
Mean ATI*	16.42	(± 10)	11.51	(±5.57)	0.004
Grade of liver injury					0.784
I-II-IIII	42	(76.4%)	51	(78.4%)	
V	13	(23.6%)	14	(21.6%)	
Blood transfusion*	45	(81.8%)	21	(32.3%)	<0.0001
Mean packed red blood cell infused*	9.62	(± 7.87)	2.38	(± 3.21)	<0.0001
Mean platelets units infused*	4.46	(± 7.48)	0		<0.0001
Mean fresh frozen plasma units infused*	12.39	(± 17.35)	1	(± 3.74)	<0.0001
Associated abdominal lesions*	37	(67.3%)	18	(27.7%)	<0.0001
Complications related to the liver*	22	(40%)	2	(3.1%)	<0.0001
Non-liver related complications*	35	(63.6%)	7	(10.8%)	<0.0001
Mortality*	23	(41.8%)	1	(1.5%)	<0.0001
Length of hospital stay	15.86	(± 16.36)	9.62	(± 9.55)	0.272

** Parameters with statistical significance (p<0.05).*

morbidity and higher mortality than the patients who successfully underwent non-operative treatment. All aspects evaluated are described in table 3.

DISCUSSION

Motor vehicle collisions are the main cause of blunt hepatic trauma. Pachter et al, in a multi-centric study involving 404 patients, found 291 victims (72%) of car accidents [10]. Another study with 136 patients demonstrated that car accidents were responsible for 84% of patients with blunt hepatic trauma, followed by pedestrians (7%), beatings (5%) and motorcycle accidents (2%) [19]. Von Bahten et al demonstrated that 46.5% of all blunt hepatic traumas were caused by car accidents, 33.5% by pedestrians hit by cars and 9.5% by assaults [20]. A study in Sweden, with 46 patients, found that motor vehicle crashes (MVC) accounted for 43% of the cases of blunt hepatic trauma [21]. This study also revealed a predominance of MVCs as a mechanism of blunt trauma, in agreement with literature.

The decision to treat non-operatively is influenced basically by the hemodynamic status of the patient, the grade of hepatic lesion, the presence of abdominal associated injuries and the neurological status. Meredith et al, in a study of 126 patients admitted with blunt hepatic trauma, revealed an average of grade 2.6 on the AAST-OIS scale of liver injuries [22]. That mentioned study demonstrated that 15% of patients had grade I liver injury, 40% had grade II, 22% had grade III, 14% had grade IV and 7% had grade V. Pachter et al demonstrated a predominance of grade II (31%) and grade III (36%) liver injuries [10]. This study found a prevalence of Grade I, II and III lesions, together representing nearly 80% of all injuries. Initially it was thought that non-operative treatment could be successfully used only for smaller lesions in the liver. However, some studies demonstrated that non-operative treatment of complex lesions of the liver is also related to lower morbidity and mortality [12,23]. This study observed that there were no differences in the grades of hepatic injury between the patients undergoing surgery and those who received non-operative treatment, including those who failed non-operative treatment.

Abdominal injuries associated with hepatic injuries occurred more frequently in the spleen and in the kidneys. Bynoe et al didn't find associated abdominal injury in patients with blunt hepatic trauma treated with non-surgical therapy [24]. In this study we showed that 18 patients,

Table 2 - Comparison between patients without obvious indications for surgery and patients undergoing non-operative treatment.

Aspect evaluated	Surgical treatment N=13		Non-operative treatment N=65		p value
Gender (male)	11	(84.6%)	46	(70.8%)	0.304
Mean age	32.77	(± 15.13)	32.15	(± 13.90)	0.930
RTS*					0.0001
= 7.84	6	(46.2%)	58	(89.2%)	
< 7.84	7	(53.8%)	7	(10.8%)	
Mean Systolic Blood Pressure on admission	128.85	(± 19.38)	122.19	(± 21.28)	0.228
Mean Glasgow Coma Scale*	11.69	(± 3.94)	14.40	(±1.81)	0.005
Mean ISS*	22.15	(± 13.08)	14.09	(±9.81)	0.033
Mean AIS head*	2. 25	(± 2.09)	0.36	(± 0.85)	<0.0001
Mean TRISS*	0.94	(±0.08)	0.97	(±0.03)	0.006
Mean ATI	12	(± 6.59)	11.68	(± 5.65)	0.946
Grade of liver injury					0.471
I-II-IIII	9	(69.2%)	51	(78.4%)	
V	4	(30.8%)	14	(21.6%)	
Blood transfusion	7	(53.8%)	21	(32.3%)	0.139
Mean packed red blood cell infused*	5.86	(± 3.13)	2.37	(± 3.17)	0.005
Mean platelets units infused	0		0		1.000
Mean fresh frozen plasma units infused*	5.67	(± 3.93)	1	(± 3.74)	<0.0001
Associated abdominal lesions	5	(38.5%)	18	(27.7%)	0.437
Complications related to the liver*	6	(46.2%)	2	(3.1%)	<0.0001
Non-liver related complications*	10	(76.9%)	7	(10.8%)	<0.0001
Mortality*	4	(30.8%)	1	(1.5%)	<0.0001
Length of hospital stay	19.31	(± 16.16)	9.62	(± 9.55)	0.076

** Parameters with statistical significance (p<0.05).*

from a total of 65 with blunt hepatic trauma, had associated abdominal injuries. In a retrospective study with 1,125 patients with blunt abdominal trauma, Malhotra et al concluded that patients with blunt abdominal trauma, and with concomitant injury to the liver and the spleen, have a greater need for blood transfusion, a higher mortality rate and a higher fail rate for non-operative treatment [25]. Associated lesions are associated with higher mortality in patients undergoing surgery for blunt hepatic trauma [26].

The occurrence of non-related liver complications (10.8% in the patients submitted for non-operative treatment in this study) was lower than the 38.4% rate observed in another study involving 128 patients [23]. Yet another study demonstrated that these complications occurred in 5% of their patients submitted for non-operative treatment [10]. The most frequent complications related to the liver, in patients with blunt abdominal trauma, are re-bleeding from the hepatic lesion and hepatic abscess and increases in the grade of hepatic lesion [27,28].

In this study it was shown that fatal outcomes for patients with hepatic trauma occur in approximately 5-20% of cases, with a mortality rate of 1.5% in patients selected for non-operative treatment. Pachter et al, Croce et al and Meredith et al demonstrated a mortality rate of 7%, 9% and 9% respectively [10,19,22]. The lower mortality observed in this study can be explained by an improved selection of patients for non-operative treatment. Another study, involving 738 patients with hepatic trauma, demonstrated a higher mortality in patients with advanced age, hemodynamic instability, blunt trauma and a higher grade of hepatic lesion [29].

Regarding the treatment of choice for patients with blunt hepatic trauma, Bynoe et al reported a percentage of 79.6% of patients undergoing surgical treatment [24]. Pachter et al reported a portion of 53% of patients undergoing surgical treatment, in agreement with our study [10].

Until 1995, surgical treatment was the treatment of choice for blunt hepatic trauma. The reluctance of surgeons to opt for non-operative treatment was associated with three main concerns: (1) the idea that hepatic bleeding would not cease until surgery was performed, (2) the idea that non-performance of drainage of bile would result in biliary fistula and infection and (3) the possibility of not finding an associated injury in the event of a positive diagnosis of peritoneal lavage [6,10,21,23]. The perception that over 86% of liver injuries stop bleeding at surgery, along with the large number of non-therapeutic laparotomies,

Table 3 - Patients failing non-operative treatment.

Aspect evaluated	Patients failing non-operative treatment N=6		Patients successfully undergoing non-operative treatment N=59		p value
Gender (male)	6	(100%)	40	(67.8%)	0.098
Mean age	32.33	(± 14.33)	31.06	(± 12.29)	0.821
Mean day of fail in non-operative treatment	3	(± 1.87)			
RTS					0.625
= 7.84	5	(83.3%)	53	(89.8%)	
< 7.84	1	(16.7%)	6	(10.2%)	
Mean Systolic Blood Pressure on admission	110	(± 26.26)	122.88	(± 21.26)	0.212
Mean Glasgow Coma Scale	14.66	(± 0.81)	14.45	(± 1.70)	0.822
Mean ISS*	10.16	(± 3.81)	14.33	(± 10.19)	0.607
Mean AIS head	0		0.36	(± 0.83)	0.278
Mean TRISS	0.99	(±0)	0.97	(± 0.03)	0.307
Mean ATI	11	(± 5.32)	12	(± 5.67)	0.785
Grade of liver injury					0.761
I-II-IIII	5	(83.3%)	46	(78%)	
V	1	(16.7%)	13	(22%)	
Blood transfusion*	5	(83.3%)	16	(27.1%)	0.005
Mean packed red blood cell infused	3.40	(± 1.14)	2.67	(± 3.62)	0.134
Mean platelets units infused	0	0	1		
Mean fresh frozen plasma units infused	6.25	(± 8.95)	0.16	(± 0.68)	0.013
Associated abdominal lesions	1	(16.7%)	17	(28.8%)	0.526
Complications related to the liver*	2	(33.3%)	0	(100%)	<0.0001
Non-liver related complications	0		7	(11.9%)	0.372
Mortality*	1	(16.7%)	0	(100%)	0.002
Length of hospital stay	8.66	(± 5.68)	9.47	(± 10.22)	0.893

** Parameters with statistical significance (p<0.05).*

made non-operative treatment become the treatment of choice for patients admitted with hemodynamic stability [5,10,19,21,27].

Non-operative treatment is related to a reduced need for blood transfusions (as shown in Table 1), fewer complications and lower mortality, for patients with blunt hepatic trauma admitted with hemodynamic stability [5,10,19,21,22,24].

This study observed that those patients operated upon were presented as more critical cases, and with more severe lesions, than those who underwent non-operative treatment, as observed by Croce *et al.*[19]. This justifies the higher incidence of complications (related and non-related to the liver) and mortality. When patients with no obvious indication for laparotomy were compared with those undergoing non-operative treatment, it was observed that the two groups were more homogeneous in hemodynamic stability. The ISS was higher in patients undergoing surgery, which can be explained by the higher AIS head and lower Glasgow Coma Scale, since ATI and grade of liver injury were the same in both groups. Again it was observed that blood transfusions were of larger volumes, and complications and mortality higher, in patients undergoing surgery. Although patients with neurological damage were mostly operated upon, some studies have demonstrated that non-operative treatment is safe for these patients [30]. Another important advantage of non-operative treatment, observed in this study and others, is the lesser need for blood transfusions. In Brazil, this is an important advantage, since the amount of blood available for transfusions is limited in many hospitals. In this study, non-operative treatment was shown to be safe for patients admitted with hemodynamic stability, with an overall mortality of 1.5%.

Non-operative treatment of blunt hepatic trauma has a higher success rate for patients admitted with hemodynamic stability and has become the treatment of choice for such patients. A non-operative approach results in lower complications, a lower need for blood transfusions and a lower mortality rate, even in patients admitted with higher grades of lesions.

RESUMO

Objetivo: *Analisar a evolução do trauma hepático fechado e comparar o tratamento operatório e não operatório em pacientes admitidos com estabilidade hemodinâmica e nenhuma indicação óbvia de laparotomia.* ***Métodos:*** *Estudo retrospectivo de casos admitidos em um hospital universitário entre 2000 e 2010. Os pacientes submetidos ao tratamento operatório foram distribuídos em dois grupos: a) todos os pacientes submetidos ao tratamento cirúrgico e b) pacientes sem indicações óbvias de laparotomia.* ***Resultados:*** *Neste período, 120 pacientes foram admitidos com trauma hepático fechado. Sessenta e cinco pacientes (54,1%) foram submetidos ao tratamento não operatório e 55 pacientes foram operados. Pacientes submetidos ao tratamento não operatório tiveram melhores parâmetros fisiológicos na admissão, menor gravidade de lesões (exceto pelo grau de lesão hepática), menor necessidade de transfusão sanguínea e menor morbidade e mortalidade quando comparados aos pacientes operados. Os pacientes operados sem indicação óbvia de cirurgia tiveram maiores taxas de complicações e mortalidade do que os pacientes submetidos ao tratamento não operatório.* ***Conclusão:*** *O tratamento não operatório resultou em menor taxa de complicações, menor necessidade de transfusão sanguínea e menor mortalidade.*

Descritores: *Fígado. Ferimentos e lesões. Ferimentos não penetrantes. Laparotomia. Indices de gravidade do trauma.*

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