

Visceral Injury in Abdominal Trauma: A Retrospective Study



Lesão Visceral em Trauma Abdominal: Um Estudo Retrospectivo

Sara LEITE¹, António TAVEIRA-GOMES², Hugo SOUSA²
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ABSTRACT

Background: Abdominal trauma is a major cause of morbi-mortality all over the world which makes it essential an approach focused on rapid diagnosis and treatment. The main goals of this study are to identify global epidemiologic data of abdominal trauma in our tertiary trauma center and to study traumatic lesions, treatment and outcome.

Material and Methods: Retrospective analysis of the clinical file of all patients admitted with abdominal trauma, over a period of 5 years, in a tertiary trauma center.

Results: the total mean of ages was 42.6 years and the male gender was the most affected (74.2%). At admission, most patients had a Revised Trauma Score > 4. The mainly causes of trauma were blunt from motor-vehicle collisions (39.9% as motor-vehicle occupant and 10.7% from pedestrian collisions) and falls (25.5%). Penetrating trauma, by abdominal stab wounds and gunshot wounds, occurred only in 12.3% of the cases. Hollow visceral injuries were more frequent in that context. In 19.5% of the cases multiple abdominal organ injury occurred. Conservative treatment was performed in 65.3% of the cases. Global mortality was 12%, being null after penetrating lesions.

Conclusions: Abdominal trauma, more frequently, is the result of motor-vehicle crashes and falls, being blunt in the majority of the cases. The most affected organs are solid and the approach is conservative. Hollow visceral lesions continue to be of difficult diagnose.

Keywords: Abdominal Injuries; Multiple Trauma; Portugal; Retrospective Studies; Wounds and Injuries.

RESUMO

Introdução: O trauma abdominal é uma importante causa de morbi-mortalidade em todo o mundo, o que leva a que seja fulcral uma abordagem focada no rápido diagnóstico e tratamento. Este estudo tem como objetivos principais, por um lado, identificar dados epidemiológicos globais do trauma abdominal no Centro Hospitalar de São João e, por outro, estudar as lesões traumáticas, tratamento e *outcome*.

Material e Métodos: Análise retrospectiva do processo clínico de todos os doentes admitidos com traumatismo abdominal, durante um período de cinco anos, num hospital central universitário.

Resultados: A média total de idades foi de 42,6 anos e o sexo masculino, foi o mais afetado (74,2%). A maior parte dos doentes tinha um *Revised Trauma Score* > 4, na admissão. Os mecanismos traumáticos mais frequentes foram fechados por acidente de viação (39,9% em ocupantes de veículo e 10,7% por atropelamento) e queda (25,5%). O trauma perfurante, por lesão de arma branca ou de fogo, ocorreu em apenas 12,3% dos casos. As lesões de víscera oca ocorreram mais neste contexto. Em 19,5% dos casos ocorreu lesão de mais do que uma víscera abdominal. O tratamento conservador foi feito em 65,3% dos casos. A mortalidade total foi de 12%, sendo nula nos casos de lesão penetrante.

Conclusão: O trauma abdominal resulta de acidentes de viação e quedas, mais frequentemente, sendo fechado na maioria dos casos. Os órgãos mais vezes afetados são maciços e o tratamento conservador. As lesões de víscera oca continuam a ser de difícil diagnóstico.

Palavras-chave: Estudos Retrospectivos; Ferimentos e Lesões; Portugal; Traumatismos Abdominais; Traumatismos Múltiplos.

INTRODUCTION

Abdominal trauma is a major cause of morbidity and mortality worldwide¹⁻⁴ and, for that reason, early diagnosis and treatment are crucial.⁵ There are two major mechanistic groups of injury: the more prevalent are blunt injuries, due to road traffic accidents and falls, among others, and penetrating injuries, mainly stabbing and gunshot wounds,^{6,7} with an increasing incidence over the last decade.⁶ Intra-abdominal trauma may affect solid organs and induce several self-limited injuries⁶ or may be the cause of hollow visceral injuries. These, although less prevalent (approximately 1% of blunt injuries),⁸ may imply a more difficult diagnosis, with delayed treatment and therefore associated with increased morbidity and mortality.⁹⁻¹¹ The liver and spleen are most

commonly affected^{7,12} with related hollow visceral injuries, in up to 10% of patients.⁸ The most commonly used diagnostic tests include FAST (Focused Assessment with Sonography in Trauma), which is portable, quick and non-invasive,^{13,14} allowing for the exclusion of intra-peritoneal, pleural or pericardial effusion¹⁵ and computed-tomography (CT scan), a gold-standard in blunt injury,⁵ which has emerged as a major aid in non-surgical therapeutic decision regarding hepatic, splenic and renal injuries.^{6,11} Laparoscopy is a quick and minimally invasive procedure enabling the diagnosis and treatment of injuries¹⁶ and is used in the event of a penetrating injury, in stable patients, in order to exclude a peritoneal perforation.^{6,16} Its role in a blunt injury is not yet

1. Departamento de Cirurgia. Faculdade de Medicina. Universidade do Porto. Porto, Portugal.

2. Serviço de Cirurgia Geral. Centro Hospitalar de São João/Faculdade de Medicina da Universidade do Porto. Porto, Portugal.

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fully understood, but may be considered in stable patients with a suspected intra-abdominal injury.¹⁷ The most recent reports demonstrate that an incorrect diagnosis is reached in up to 45% of the patients.¹⁷ There is an indication for laparotomy in unstable patients with signs of peritonitis and hollow visceral injury³ however is no longer recommended in penetrating injuries, due to the high rate of a non-therapeutic laparotomies (approximately 38%).¹⁸ Therefore, hepatic (without any increase of mortality rate, in 70% of the patients)¹¹ and splenic injury (mainly in stable patients, after a blunt injury)¹⁹ may involve non-surgical treatment or surgery which, in 20 % of the patients,⁶ is performed in order to re-establish physiology and haemostasis, by performing essential resections in some cases including temporary stoma (damage control surgery).⁶

The major objective of our study aimed to identify global epidemiological data of abdominal trauma in *Centro Hospitalar de S. João* and to study traumatic injuries, their treatment and outcome.

MATERIAL AND METHODS

Our study involved a retrospective analysis of clinical records of all patients admitted in a central university hospital for abdominal trauma during a five-year period (May 2006 to May 2011), during which patients' demographic data,

as well as the *revised trauma score* at the time of hospital admission, diagnostic and therapeutic approaches, time of stay and hospital discharge medical information was collected. In addition autopsy records of deceased patients at the *Delegação do Norte do Instituto Nacional de Medicina Legal* were reviewed

Data analysis used the SPSS version 19.0 software.

Our study was approved by the Ethics Committee of *Hospital de São João*.

RESULTS

Abdominal trauma was the reason for hospital admission in 326 patients, between May 2006 and May 2011. The average age of the patients was 42.6, with a male predominance (74.2%). The most common forms of injury were road traffic accidents (39.9% involving vehicle passengers and 10.7% involving pedestrians) and falls (25.5%). Most patients had a *revised trauma score* > 4 at the time of hospital admission. The main demographic characteristics, severity scores and outcomes are presented in Table 1.

Blunt injuries, mainly due to road traffic accidents and falls, were the most common events in our group of patients (85.3%). Solid visceral injuries, namely involving the spleen, liver and kidney (Table 2) were the most prevalent (91.9%).

Table 1 – Demographic characteristics, severity score and outcome

	Blunt trauma n (%)	Penetrating n (%)	Non-specified n (%)	Total n (%)
Age	43.7	36.5	-	42.6
Gender				
Male	203 (62.3)	32 (9.8)	7 (2.1)	242 (74.2)
Female	75 (23.0)	8 (2.5)	1 (0.3)	84 (25.8)
Mechanism of injury*				
Traffic accident	165 (50.6)	-	-	165 (50.6)
Fall	83 (25.5)	-	-	83 (25.5)
Stabbing	-	22 (6.7)	-	22 (6.7)
Gunshot	-	18 (5.5)	-	18 (5.5)
Others	30 (9.2)	0	8 (2.5)	38 (11.7)
Revised Trauma Score*				
> 4	245 (75.2)	35 (10.7)	4 (1.2)	284 (96.2)
< 4	6 (1.8)	0	1 (0.3)	7 (2.1)
Non specified	27 (8.3)	5 (1.5)	3 (0.9)	35 (10.7)
Outcome*				
Recovery	241 (73.9)	40 (12.3)	6 (1.8)	287 (88.0)
Deceased	37 (11.3)	0	2 (0.6)	39 (11.9)

*p < 0.05

Perforating injuries due to stabbing or gunshot occurred in only 12.3% of the patients. Although rare, hollow visceral injuries, when compared with solid visceral injuries, occurred more often in this context, with 66.7% of stomach injuries and 25% of colon injuries due to gunshot and with 26.9% of small bowel injuries due to stabbing (Table 3).

More than one abdominal organ was affected in 19.5% of the patients. Road traffic accidents (involving vehicle occupants) involved 8.9% of the total number of associated injuries. The most common injury associations involved the liver and the spleen (5%), liver and kidney (4.6%), spleen and kidney (3.7%) and small bowel and colon (1.5%).

As regards diagnostic tests, these were not specified in 4.3% of the cases. Abdominal CT-scan was the most

commonly used test (71.5%) in 96.6% of the patients with a *revised trauma score* > 4, followed by abdominal ultrasound (62.6%). Diagnostic peritoneal lavage was rarely used (in 0.6% of the patients) and in 4% of the patients laparotomy was immediately performed.

Intra-abdominal visceral injury with a surgical indication was detected by diagnostic tests in 47.8% of the cases.

The presence of non-identified injuries in blunt trauma patients submitted to surgery occurred in 75% of the patients. Single lesions of the small bowel, colon and liver were the less diagnosed by the tests (20.5%, 13.6% and 13.6% of the patients, respectively, with $p < 0.05$).

Non-surgical treatment was carried out in 65.3% of the patients and surgery was used in the remaining patients.

Table 2 – Injury mechanism versus involved organ

Injury mechanism	Organ							Total
	Spleen*	Liver	Kidney	Stomach*	Small bowel*	Colon*		
Fall								
<i>n</i>	24	24	25	0	2	2		77
% from injury mechanism	28.9%	28.9%	30.1%	0%	2.4%	2.4%		
% from organ	22.2%	22.2%	30.1%	0%	7.7%	12.5%		
% from total	7.4%	7.4%	7.7%	0%	0.6%	0.6%		23,7 %
Road traffic accident								
Vehicle occupant								
<i>n</i>	54	51	27	1	8	4		145
% from injury mechanism	41.5%	39.2%	20.8%	0.8%	6.2%	3.1%		
% from organ	50.0%	47.2%	32.5%	16.7%	30.8%	25.0%		
% from total	16.6%	15.6%	8.3%	0.3%	2.5%	1.2%		44.5%
Road traffic run over								
<i>n</i>	11	10	12	0	2	3		38
% from injury mechanism	31.4%	28.6%	34.3%	0%	5.7%	8.6%		
% from organ	10.2%	9.3%	14.5%	0%	7.7%	18.8%		
% from total	3.4%	3.1%	3.7%	0%	0.6%	0.9%		11.7%
Stabbing injury								
<i>n</i>	0	6	2	1	7	2		18
% from injury mechanism	0%	27.3%	9.1%	4.5%	31.8%	9.1%		
% from organ	0%	5.6%	2.4%	16.7%	26.9%	12.5%		
% from total	0%	1.8%	0.6%	0.3%	2.1%	0.6%		5.4%
Gunshot injury								
<i>n</i>	5	8	3	4	4	4		28
% from injury mechanism	27.8%	44.4%	16.7%	22.2%	22.2%	22.2%		
% from organ	4.6%	7.4%	3.6%	66.7%	15.4%	25.0%		
% from total	1.5%	2.5%	0.9%	1.2%	1.2%	1.2%		8.5%
Other								
<i>n</i>	14	9	14	0	3	1		41
% from injury mechanism	36.8%	28.7%	36.8%	0%	7.9%	2.6%		
% from organ	13.0%	8.3%	16.9%	0%	11.5%	6.3%		
% from total	4.3%	2.8%	4.3%	0%	0.9%	0.3%		12.6%
Total								
<i>n</i>	94	99	69	6	23	15		347
% from total	33.2%	33.2%	25.5%	1.8%	7.9%	4.8%		106.4%

* $p < 0.01$

Table 3 – Penetrating injury versus involved organ

Penetrating injury	Organ							Total
	Spleen	Liver	Kidney	Stomach	Small bowel	Colon		
Stabbing injury								
<i>n</i>	0	6	2	1	7	2	18	
% from injury mechanism	0%	27.3%	9.1%	4.5%	31.8%	9.1%		
% from organ	0%	5.6%	2.4%	16.7%	26.9%	12.5%		
% from total	0%	1.8%	0.6%	0.3%	2.1%	0.6%	5.4%	
Gunshot injury								
<i>n</i>	5	8	3	4	4	4	28	
% from injury mechanism	27.8%	44.4%	16.7%	22.2%	22.2%	22.2%		
% from organ	4.6%	7.4%	3.6%	66.7%	15.4%	25.0%		
% from total	1.5%	2.5%	0.9%	1.2%	1.2%	1.2%	8.5%	
Total								
<i>n</i>	5	14	5	5	11	6	46	
% from total	1.5%	4.3%	1.5%	1.5%	3.3%	1.8%	13.9%	

Table 4 – Outcome versus Treatment

Outcome (Mortality)	Treatment			Total
	Laparotomy*	Solid visceral injury treatment	Hollow visceral injury treatment*	
Yes				
<i>n</i>	8	6	1	15
% from the outcome	44.4%	15.8%	2.6%	
% from treatment	57.1%	10.5%	2.4%	
% from total	7.1%	1.8%	0.3%	9.2%
Yes, with re-intervention				
<i>n</i>	0	0	1	1
% from the outcome	0%	0%	100.0%	
% from treatment	0%	0%	2.4%	
% from total	0%	0%	0.3%	0.3%
No				
<i>n</i>	6	49	34	89
% from the outcome	6.9%	17.5%	12.1%	
% from treatment	42.9%	86.0%	82.9%	
% from total	5.3%	15.0%	10.4%	30.7%
No, with re-intervention				
<i>n</i>	0	2	5	7
% from the outcome	0%	28.6%	71.4%	
% from treatment	0%	3.5%	12.2%	
% from total	0%	0.6%	1.5%	2.1%
Total				
<i>n</i>	14	57	41	112
% from total	12.4%	17.4%	12.5%	42.3%

* $p < 0,001$

Surgery was more frequent in patients with a penetrating injury (77.5%) and with a hollow visceral injury (87.5%).

The patients with a blunt trauma and solid visceral injury, mainly hepatic, renal and splenic were treated conservatively (71.6%, 74.4% and 70.6%, respectively). Whenever a surgical approach was required, hepatic packing, vascular repair and resections were the most common surgical procedures.

Laparotomy without any additional procedure was performed in 12.4% of the patients (Table 4). There was an

increased mortality affecting those patients, mostly due to head injuries.

Surgical re-intervention was needed in 7.1% of the patients (more frequent in patients with a hollow visceral injury, affecting 14.3%). Only one patient died upon surgical re-intervention.

Patients with single hollow visceral injury had, on average, a longer hospital stay, than those who suffered a single solid visceral injury (24.3 days vs. 19.9 days).

From the patients with a *revised trauma score* < 4,

approximately 86% suffered blunt trauma ($p = 0.026$); 66.7% of the patients with a *revised trauma score* < 4 were submitted to surgery due to the presence of uncontrolled bleeding. All the patients with a single stomach injury, 14.3% of the patients with a simultaneous liver and spleen injury and 11.1% of the patients with a single colon injury presented a *revised trauma score* < 4 at admission.

Mortality rate in our group of patients was 12%. Blunt trauma was the cause of death in 94.9% of the patients, mainly related to road traffic accidents (20% involving pedestrians and 17.7% involving vehicle occupants). Most deceased patients (74.1%) presented a *revised trauma score* > 4 at admission and 89.1% of the patients presented a serious single solid visceral injury. There was no mortality related with penetrating injuries.

DISCUSSION

Mechanisms underlying a traumatic injury are very important to determine individual diagnosis and therapy. In our study, in line with others,^{6,7} blunt trauma is most frequent and is mainly related to road traffic accidents and falls, affecting mainly solid organs (liver and spleen). A penetrating injury requires a more careful approach, due to a higher percentage of underlying hollow visceral injury. As referred by several authors^{4,8-11} we found that clinical detection of these injuries was more difficult, but of note, in contrast to previous reports, there was no increased mortality in the present study. FAST and CT-scan are the preferred diagnostic tests^{1,5,6,8} and, in 41.1% and in 39.4% of the patients, respectively, they did not correctly detect all injuries, mainly in the presence of blunt trauma. Hollow visceral injuries were the least detected, namely when affecting the small bowel and the colon. These results are in line with previous descriptions^{5,6,8-11} referring to FAST's low sensitivity and specificity and CT-scan variable sensitivity in the detection of a hollow visceral injury, as major constraints.

Although some authors describe some advantages of diagnostic laparoscopy in a trauma context,¹⁶⁻¹⁸ this is not frequently used. The highest percentage of laparotomies without any additional procedure was performed in patients involved in road traffic accidents (as vehicle occupants). Although 90.9% of the patients presented a *revised trauma score* > 4 at the time of hospital admission, an increased mortality was observed in these patients. These results are explained by serious deterioration due to extra-abdominal complications (due to a related head injury, in 97.4% of the

cases).

Trauma no longer means surgery,^{12,15,19} in line with the observed increase in non-surgical therapeutic approaches, mainly in patients with blunt trauma. We found, in our study, a higher percentage of related injuries in this context, requiring a careful follow-up, with close surveillance of injury signs that may indicate the need for a surgical approach. On the other hand, surgery was the preferred approach upon penetrating injury. In these patients, there was no mortality, in line with a *revised trauma score* > 4 at the time of hospital admission.

The highest percentage of surgical re-intervention observed in patients who suffered hollow visceral injury is explained by a damage control initial approach, also referred by other authors,^{6,20} in addition to essential resections and temporary stomata of colon and small bowel (in 75% of the patients). All patients submitted to re-intervention presented a *revised trauma score* > 4 at the time of hospital admission, in line with an observed low mortality (only one patient died).

CONCLUSION

Abdominal trauma is a major cause of morbidity and mortality and the study of the epidemiological context in which it occurs is crucial for correct management. In our Hospital, blunt trauma is globally the most prevalent and is related to relatively stable traumatic injuries, allowing for non-surgical control. Nevertheless, due to the likely occurrence of hidden injuries, a careful follow-up is needed, in order to identify signs of non-diagnosed injuries that may require additional therapy. On the other hand, although less frequent, perforating trauma is responsible for a higher percentage of hollow visceral injuries, generally submitted to surgical treatment, with higher need of re-intervention and, therefore, with longer hospital stay. Trauma approach is increasingly aimed and has evolved to focus on a rapid diagnosis, with less invasive procedures and, whenever possible, with non-surgical treatment, seeking to minimise the risk of non-diagnosed injuries with a possible surgical indication.

CONFLICT OF INTERESTS

The authors have no conflict of interests to declare.

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Av. Almirante Gago Coutinho, 151

1749-084 Lisboa, Portugal.

Tel: +351 218 428 215

E-mail: submissao@actamedicaportuguesa.com

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