ORIGINAL ARTICLE

Abdominal injuries treated in a referral hospital: analysis of outcomes, treatment approaches, and prognostic scales

María Teresa González-Nicolás Trébol[1], Jesús Pérez-Tierra Ruíz[2], Jose María Miguelena Bobadilla[2]

Objectives. To describe the abdominal injuries treated in our hospital. We assessed the behavior and reliability of prognostic scales, analyzing the correlations between them and therapeutic decisions and outcomes.

Methods. Retrospective study including all patients with major abdominal injuries admitted to our hospital between 2009 and 2015. We gathered epidemiologic and clinical data, outcomes, and scores on several prognostic scales.

Results. The median age of the 153 patients we identified from case records was 38 years; 73.9% were males. Most cases involved blunt trauma (94.1%) sustained in traffic accidents (60.1%). The spleen and the liver were the organs most often affected (in 44.4% and 36.6%, respectively). The median length of stay in the hospital was 11 days, and overall mortality was 13%. Although conservative management was successful in 62.7% of the cases, we found that patients who had a higher ISS (Injury Severity Score) or TRISS (Trauma and Injury Severity Score) assessments more often required surgery or died (*P*=.0001, both comparisons). Those who had longer hospital stays had a higher Revised Trauma Score or TRISS (*P*=.001 and *P*=.016, respectively).

Conclusions. The causes of abdominal injuries and the types treated in our hospital were similar to those described for the rest of Spain. Punctuation on prognostic severity scales correlated directly with the need for surgery, length of hospital stay, complications, and mortality.

Keywords: Multiple trauma. Wounds and injuries, abdominal. Injury severity scores. Trauma scoring systems.

Authors affiliation:
[1]General Surgery Department and Digestive System, Hospital Miguel Servet University, Zaragoza, Spain.
[2]General Surgery Department and Digestive System, Hospital Lozano Blesa University Clinic, Zaragoza, Spain.

Corresponding author:
María Teresa González-Nicolás Clover
General Surgery Service and Digestive System
Miguel University Hospital Servetus
Paseo Isabel la Católica, 1-3
50009 Zaragoza, Spain

E-mail:
mtgonzalezn@salud.aragon.es

Article information:
Received: 29-1-2018
Accepted: 10-6-2018
Online: 11-12-2018

Editor in charge:
Guillermo Burillo Putze

Traumatismo abdominal en un hospital de tercer nivel. Análisis de resultados, consideraciones terapéuticas y evaluación con índices pronóstico

Objetivo. Conocer la epidemiología y distribución de los traumatismos abdominales en nuestro medio. Evaluar el comportamiento y fiabilidad de la aplicación de índices pronósticos de gravedad analizando su correlación con las decisiones terapéuticas y los resultados obtenidos

Método. Estudio retrospectivo en el que se han incluido todos los pacientes con diagnóstico de traumatismo abdominal grave ingresados en un hospital español de referencia, entre 2009 y 2015. Se registraron variables epidemiológicas, clínicas y de resultados, así como la puntuación de distintos índices pronósticos.

Resultados. Muestra 153 pacientes, con mediana de edad de 38 años y predominio masculino (73,9%). Correspondieron a traumatismos de tipo cerrado (94,1%) y su etiología principal los accidentes de tráfico (60,1%). El bazo fue el órgano más frecuentemente afectado (44,4%), seguido por el hígado (36,6%). La mediana de la estancia hospitalaria fue de 11 días y la mortalidad global de 13%. Aunque el 62,7% se manejó con éxito de forma conservadora, se observó una mayor puntuación de Injury Severity Score (ISS) y Trauma and Injury Severity Score (TRISS) en aquellos pacientes que precisaron tratamiento quirúrgico (p = 0,0001), en los que fallecieron (p = 0,0001) y en aquellos con mayor estancia hospitalaria (RTS –Reevised Trauma Score– p = 0,001 y TRISS p = 0,016).

Conclusiones. La etiología de los traumatismos abdominales y los balances lesionales en nuestro medio fueron similares a los observados a nivel nacional. La puntuación en las escalas estudiadas tuvo una asociación directa con la necesidad de tratamiento quirúrgico, los días de estancia hospitalaria, la morbilidad y la mortalidad.

Palabras clave: Politraumatismo. Lesiones abdominales. Injury severity score. Índices de gravedad de traumatismos.

Introduction

In Spain, isolated abdominal trauma represents 8-17% of the total number of traumatisms, ranking 4th behind severe head trauma, thoracic trauma and limb trauma. However, it is difficult to obtain specific epidemiological data in our environment[1].

In the last decade, an evident trend of conservative management of severe abdominal trauma[2] has been observed, which implies control of hemodynamic stability of the patient and strict and protocolized clinical monitoring of its evolution. This has been possible due to the standardization and improvement of imaging techniques such as ultrasound or computed tomography (CT)[3-6].

Generally, improvement in the quality of care for severe trauma fundamentally involves monitoring the

process. Therefore, an objective method in the unification of the performance criterion is the stratification of severity. In order to be able to optimize the resources directed to its handling in each individual case. A fundamental tool in this task is the application of specific scales or prognostic indexes of severity[7]. In several studies, correlations have been observed between the values of certain scales and mortality[8,9].

The ISS (Injury Severity Score) is based on an anatomical grading of severity of injury and characterizes 6 body regions and assigns a score based on it[7]. It behaves adequately as a predictor of poor prognosis but has some limitations, since it does not value the presence of multiple lesions in the same area of the body, such as, for example, the result of a firearm injury, which could imply an underestimation[7,10].

The physiological impact of trauma is assessed with the RTS (Revised Trauma Score) formulated from the Glasgow Scale Score (GCS), Systolic Blood Pressure (SBP) and Respiratory Frequency (RF)[7].

Finally, the TRISS scale (Trauma and Injury Severity Score), which combines: the anatomical pattern of the lesions, the systemic response to them and the age, a variable of great influence on the prognosis of the lesions of the polytraumatized patient. The values range from 0 to 100% and should be interpreted as the estimated probability of mortality[7].

The objective of this study is to analyse the epidemiology and distribution of abdominal trauma in our environment, as well as to check the behaviour and reliability of the application of prognostic indexes of severity and to evaluate their correlation with the therapeutic decisions carried out and the results obtained in a third level hospital.

Method

A retrospective observational study was conducted on a series of consecutive cases of patients admitted to a third level hospital between January 2009 and December 2015.

Patients over 16 years of age admitted to our centre with a diagnosis of abdominal trauma (although not the main diagnosis) were included in the study with scores on the ISS ≥ 16 and/or GCS < 9 scales.

Patients under 16 years of age were not included, as they are a population group with different behaviour in the treatment and prognosis of polytrauma injuries. Also excluded from the study were pregnant women, polytraumatism without abdominal involvement and patients with an ISS < 16, as well as those with incomplete data or erroneous diagnostic coding.

As the specific coding of abdominal trauma is neither accessible nor contemplated as such in the International Classification of Diseases (ICD-9), the clinical histories corresponding to the most specific indexes and related to their diagnoses and procedures with abdominal trauma were selected, and therefore cranial or thoracic trauma without abdominal involvement were not included in the study (Table 1).

Table 1. Diagnostics coded according to ICD9

800-829	Fractures
860	Traumatic haemothorax and pneumothorax
861	Heart and lung trauma
862	Trauma to intrathoracic organ other and neom
863	Gastrointestinal tract trauma
864	Trauma to the liver
865	Trauma to the spleen
866	Trauma to kidney
867	Pelvic organ trauma
868	Trauma to intra-abdominal organ other
869	Trauma to internal organ neom
870-879	Open wounds head, neck and trunk
880-887	Open wounds upper limb
890-897	Open wounds lower limb
900-904	Blood vessel lesions
910	Superficial lesion face, necks and scalp except eye
911	Superficial trunk injury
912	Superficial shoulder and arm injury
913	Superficial injury to forearm and wrist
914	Surface lesion hand except finger
915	Surface lesion finger hand
916	Superficial lesion limb except foot
917	Superficial foot and toe injury
918	Superficial eye and appendage lesion
919	Surface lesion other, multiple and neom
920-924	Consutions with intact skin surface
925-929	Crushing injuries
950-957	Nerve and spinal cord injuries
E810-E819	Railway accidents

The following variables were studied:

- Epidemiological: age, sex and etiology.
- Clinics: type of trauma (open/closed), anatomical structures affected.
- Prognostics: related to the application of scales (ISS, RTS and TRISS).
- Outcome: need for surgical treatment, type of surgical treatment received, hospital stay, surgical morbidity and early mortality (> 30 days).

The work was approved by CEICA (Clinical Research Ethics Committee of Aragon).

The analysis was performed with IBM SPSS Statistics Base 22.0 for Windows. A descriptive statistic (mean, median and standard deviation) was performed. For the comparative analysis between subgroups, the normal distribution of the data was checked with the Kolmogorov-Smirnov test. The χ^2 and Fisher tests were applied for contingency tables with qualitative variables, t-de Student and U by Mann Whitney in the presence of a quantitative variable and the Pearson correlation for purely quantitative variables. The value of $p < 0.05$ was considered to determine statistical significance.

Results

A total of 153 patients out of the 328 initially reviewed were included in the study.

The mean age was 42.4 ± 17.9 years and the most affected age interval was those under 30 years where 30% of cases were grouped.

Table 2. Mean score on the RTS and TRISS scales for each ISS group

ISS	RTS	TRISS
16-34	747 (0.1)	7.7% (1.4)
35-50	7.1 (0.2)	24.0% (3.3)
> 50	6.2 (0.2)	66.4% (4.9)

RTS: Revised Trauma Score; TRISS: Trauma and Injury Severity Score; ISS: Injury Severity Score.

Men accounted for 73.9% and traffic accidents were the main etiology (60.1%). The second most frequent cause being a fall of more than one metre in height (17%). Of the traumas, 94.1% were closed. The spleen was the most frequently affected organ with 44.4% of injuries, followed by the liver (36.6%) and kidney (24.8%). Mesosal lesions constituted 15.7%.

Patients were grouped according to their ISS score as follows: ISS = 16-34 (44.4%), ISS = 35-50 (34.6%) and ISS > 50 (20.9%). Table 2 presents the mean RTS and TRISS values for each group.

Conservative treatment was given to 62.7% of patients. A total of 26.8% of liver lesions were surgical, 50% splenic lesions, 83.3% mesos lesions, 16.2% renal lesions and 100% pancreatic lesions. In 12.5% of the patients there were no postoperative complications, and in the rest (according to the Clavien-Dindo classification[11]) 16.1% were grade I, 42.9% grade II, 8.9% grade III, 5.4% grade IV and 14.3% grade V.

The mean ISS value for grade I of Clavien Dindo's classification was 37 ± 1.6, for grade II 53.5 ± 3.4, for grade III 46.4 ± 8.2, for grade IV 51.2 ± 1.3 and for grade V 62.6 ± 6.6 (Figure 1).

The percentage of inadvertent lesions among patients initially indicated for conservative treatment was 3.9% and the overall failure rate for conservative treatment was 6.8%. Comparing morbidity in patients who were initially managed surgically with those who were "deferred" due to conservative treatment failure, no statistically significant differences were found (P = 0.939). However, the mortality in these patients was higher than the mortality of patients initially intervened by surgery (24.6% versus 28.6%), this difference being statistically significant (p < 0.001).

Table 3. Probability of mortality estimated with the TRISS scale and mortality observed in the study

TRISS	Patients	Deceased n (%)
< 10%	79	1 (1.3%)
10-50%	41	2 (4.8%)
>50%	33	17 (51.5%)

TRISS: Trauma and Injury Severity Index.

A 13.1% overall in-hospital mortality was recorded. If we also break it down into early (defined as death from the first to the seventh day of hospital admission) and late (after the seventh day of hospital admission), we obtain an overall early mortality of 11.1% and late mortality of 2%. Table 3 shows the distribution of deceased patients in the groups with a mortality estimate with the TRISS scale low (< 10%), intermediate (10-50%) and high (> 50%). It was higher in the female sex (p = 0.04) and in the surgical subgroup (p = 0.002).

The mean hospital stay was 17.9 ± 26.7 days in a range ranging from one day to 220 with a median of 11 days.

Surgical treatment was required for 77.8% of open abdominal trauma compared to 34.7% of closed abdominal trauma, this difference being significant (p = 0.014). The reason for the surgical indication in them was: hemodynamic instability in 57.1% of them and hollow viscera lesion in 42.9%.

The mean ISS score was higher in those patients requiring surgical treatment, 49.8 versus 35.5 (p < 0.001). A higher ISS score was also observed in deceased patients (p < 0.001) (Table 3).

The mean RTS score was lower in those patients who underwent surgery (6,633 versus 7,379) (p = 0.001), and also in those who died (p < 0.001). In addition, there was a relationship between RTS value and hospital stay (p < 0.001) with little linear correlation (p = 0.302).

TRISS values adjusted for type of trauma were higher in patients undergoing surgery (42.0% versus 15.9%) (p < 0.001) and in those who died (p < 0.001); correlation was also observed between TRISS value and hospital stay (p = 0.016).

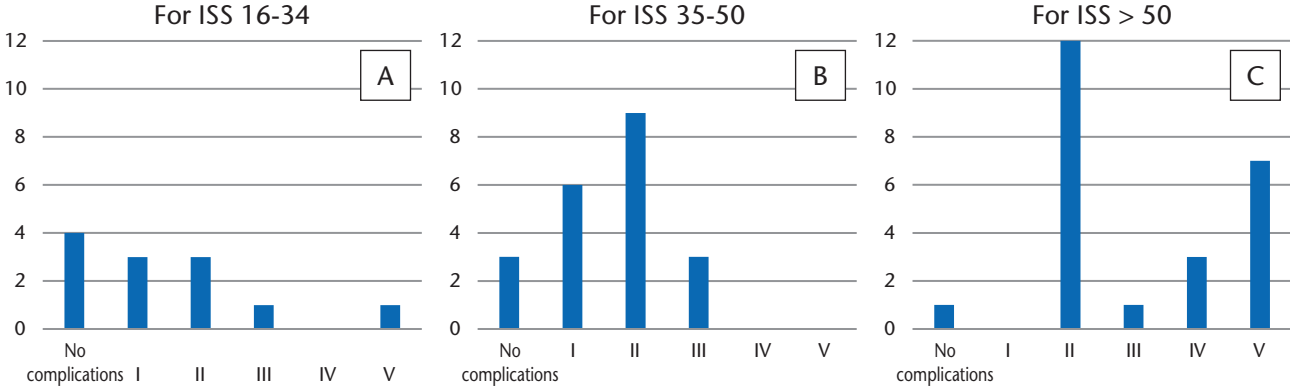

Figure 1. Morbidity according to Clavien Dindo scale in Injury Severity Score (ISS) group of 13-34 (A), from 35 to 50 (B) and greater than 50 (C).

Table 4. Average score on scales by treatment type, average stay and mortality

	Treatment		P	Stay (days) Mean (SD)	P	Mortality		P
	Surgical	Conservative				Alive	Deceased	
Age (years) [mean (SD)]	42.8 (16.6)	42.2 (18.7)	0.208		p = 0.496 ρ = 0.055	40.9 (1.4)	52.2 (5.3)	0.064
Etiology			0.114		p = 0.955			0.583
Traffic accidents	29	62		16.8 (2.2)		80	11	
Accident at work	4	6		19.7 (7.2)		9	1	
Sports Accident	1	2		11.0 (0.6)		3	0	
Fall from more than one meter in height	9	17		23.1 (8.8)		26	5	
Penetrating wound*	9	3		14.8 (4.3)		12	1	
Other	5	6		18.1 (8.7)		11	2	
Type of trauma			0.01		p = 0.752			0.273
Open	7	2		11.4 (2.7)		9	0	
Closed	50	94		18.3 (2.3)		124	20	
ISS [mean (SD)]	49.8 (2.5)	35.5 (1.3)	< 0.001*		p = 0.113 ρ = 0.129	37.59 (1.25)	62.60 (3.48)	< 0.001*
RTS [mean (SD)]	6.6 (0.2)	7.4 (0.1)	0.001*		p < 0.001* ρ = 0.302	7.29 (0.09)	5.84 (0.26)	< 0.001*
TRISS [mean (SD)]	42.0 (4.9)	15.9 (2.0)	< 0.001*		p = 0.016* ρ = 0.195	18.46 (2.00)	73.29 (6.21)	< 0.001*

p = significance level: p = Pearson's correlation coefficient.
*Penetrating wounds: bull horn, stab wound, firearm

The most sensitive scale to determine the degree of need for surgical treatment of a patient was the ISS, with an area under the curve (AUC) of 0.732. The optimal cut-off point according to the Youden index was 42, with a sensitivity of 60% and a specificity of 80%. However, the 43.2% cut-off point on the TRISS scale had a higher specificity, reaching 91% (Figure 2).

Discussion

It is still difficult to find specific epidemiological data related to abdominal trauma in our country due in part to the existence of great heterogeneity in hospital records, as there are no standardized and generally assumed definitions for documenting, reporting and comparing records of severe traumatized patients.

In our study, as in the reviewed literature, the most prevalent cause of severe abdominal trauma was traffic accidents (60.1%)[1,2,9]. Penetrating wounds had a similar prevalence in our setting (7.8%) compared to what has been described in the literature (6.7%)[1,2,12]. Sport accidents were a minor cause in our setting (2%), compared to what is described in the literature (5.6%)[2].

The polytraumatized patient profile in our setting was similar to that referred to in the existing bibliography[1,2].

Although there was no difference in the age of men and women with severe trauma, the mortality recorded in our study was higher in the female group, 45.0% as opposed to 23.3% (p = 0.04), due to the fact that the traumas in this group were of greater severity, which is reflected in the highest value in the ISS scale and in the TRISS scale and therefore with greater clinical and physiological repercussion, with lower values in turn in the RTS scale.

Of the polytraumatics in the series, 9.8% presented an AIS of 6 that directly conditions an ISS of 75, with TRISS being a good predictor of mortality in these patients. However, there was an overestimation in the intermediate group (TRISS 10-50%). This may be due to the fact that this group has an average ISS of 45.8.

The low overall mortality in the study (13%) compared to other series such as the RETRAUCI study (18%) may be due to the exclusion of purely traumatic head injuries (without co-existence of abdominal lesions)[2,13].

Most traumatisms recorded were closed (94.1%), a higher percentage than the bibliography[1,2,8] which places it around 80-85%. In addition, all patients who died in our study died as a result of closed trauma.

In closed trauma, the spleen was the most frequently injured organ with 44.4%, followed by the liver 36.6%. Figures similar to the existing bibliography[1,14,15]. In contrast, the prevalence of small bowel injury was lower in our setting (3.3%) than that observed in other studies (5-10%)[2,16,17].

In relation to treatment, despite the studies that support the laparoscopic approach[18], our centre tends to approach open trauma by means of a medium laparotomy because most of the surgical indication is marked by hemodynamic instability. In addition, the type of wound (contamination, number of trajectories) and the presence of associated lesions make this the route of choice for a thorough exploration of the abdominal cavity.

Although the role of interventional radiology is important for the treatment of splenic lesions[9,11], there seems to be an underutilization of this resource in our center.

According to the National Institute of Statistics[19] the average stay in Spain is 11.94 days. In our study it is 17.88 days for an admission of 220 days, therefore, when considering other indicators less influenced by extreme values such as the median, in the case of our study 11 days is closer to the national value[19].

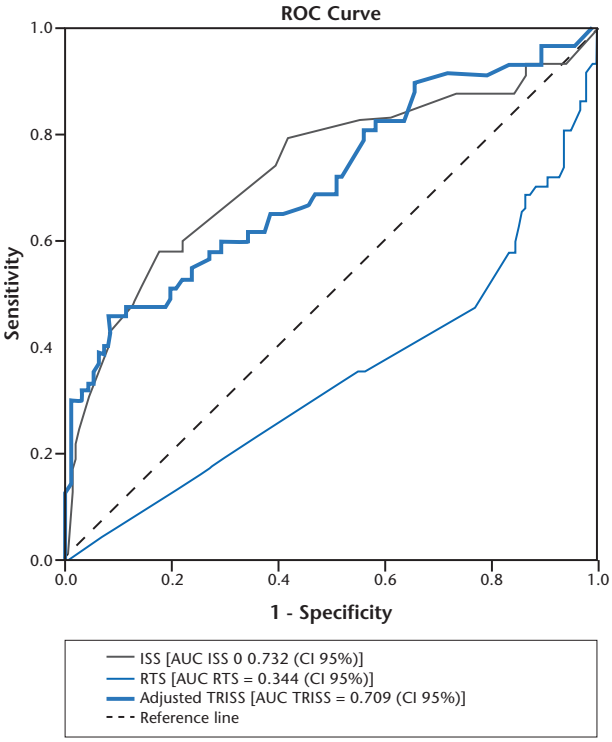

Figure 2. ROC curve of the scales. ISS: Injury Severity Score; RTS: Revised Trauma Score; TRISS: Trauma and Injury Severity Index.

In general, and as we have seen in the study, the most sensitive scale to determine the degree of need for surgical treatment is the ISS and the most specifically the TRISS.

The TRISS scale was widely used and had a good level of discrimination in our setting[13]. In order to overcome the intrinsic limitations of the ISS, the NISS scale (New Injury and Severity Score) was proposed, which is more sensitive, as it considers the severity of the injury regardless of its location in order to determine the TRISS, and the NTRISS scale (New Trauma and Injury Severity Score) was created. However, there are no significant differences in the analysis of sensitivity and specificity between the two scales[20].

To overcome the limitations of TRISS, Lefering et al. proposed the Revised Injury Severity Classification (RISC) model that includes clinical and analytical variables. When comparing it with other scales such as ISS, NISS, RTS or TRISS, a range of area under the curve ROC was obtained ranging from 0.767 to 0.877, presenting an AUC (area under curve) of 0.90. The same authors have developed the RISC II which includes, in addition to its 11 original variables, pupil size and reactivity[21].

The score obtained should never prevail in the decision-making process regarding the patient's clinical situation, especially haemodynamic instability. But if combined with clinical monitoring parameters in those patients with an ISS > 42 or a TRISS > 43.2%, values that in our environment have been associated with a greater tendency to surgical management, can change the strategy in conservative treatment, intensifying it and allowing early prophylaxis of multiorgan failure.

In several studies[8,22,23] the application of a prospective clinical management protocol in patients with closed abdominal trauma allows, in most cases, to establish a conservative treatment. In our country there has been a growing trend in recent years towards such management without worsening the results in terms of hospital stay.

Mortality was higher in the surgical treatment group. This may be due to the fact that patients undergoing surgical treatment presented greater clinical severity at the time of arrival at the emergency department (mean values of ISS 49.8, RTS 6.6 and TRISS 42.0% versus ISS 35.5, RTS 7.4 and TRISS 15.9% in conservatively managed patients). In addition, in most of these patients the surgical indication was established due to hemodynamic instability.

Another condition of the type of treatment is the mechanism of injury. The need for a surgical approach is greater in open trauma (77.8%) compared to 34.7% in closed trauma. Given that a greater number of concomitant lesions[1,4,8] are described in the literature, there is a certain tendency towards systematic surgical review of severe open trauma due to the risk of inadvertent injury.

The American Association of Traumatological Surgery (AAST) has established a systematized and graduated classification, with scores ranging from I to VI in relation to image diagnosis of the type of lesion in solid intrabdominal viscera[24]. According to this, at equal degree of injury, not all organs have the same response to conservative treatment. Liver lesions[25,26] and kidney lesions respond best to conservative treatment (73,2 and 83,8% respectively), while vascular lesions in mesos and pancreatic lesions mostly required urgent surgical intervention[16].

A careful interpretation must be given to the relationship observed between the degree of injury and clinical severity (ISS, RTS, TRISS) and the Clavien Dindo scale score, since it is impossible to ignore the effect of the rest of the extraabdominal lesions in the context of polytraumatism on morbidity in patients requiring surgical treatment.

As conclusions of this work, we can deduce that:

The characteristics of the type patient with abdominal trauma in our hospital correspond to a male, with an average ISS of 40.9, an average RTS of 7.1 and an average TRISS of 25.6%, and the victim of a traffic accident.

The scores on the scales studied had a direct association with the need for surgical treatment, days of hospital stay, morbidity and mortality, so it can help decision making.

For progress in the study of severe traumatic pathology in our environment and the quality control of care it is necessary to establish registration systems. Initiatives such as the RETRAUCI project[2,13] and the creation of a national registry of polytraumatized patients would help to better understand distribution and contribute to

improving resource management and optimization of care efficiency, while promoting professional training and education in this area.

Conflicting interests: The authors declare no conflict of interests in relation to this article.

Contribution of the authors: All authors have confirmed their authorship in the author's responsibilities document, publication agreement and transfer of rights to EMERGENCIAS.

Financing: The authors declare the non-existence of external funding in relation to this article.

Ethical responsibilities: This work has been approved by CEICA (Research Ethics Committee of Aragon). All participants gave their consent to participate in the study. All authors have confirmed the maintenance of confidentiality and respect for patients' rights in the author's responsibilities document, publication agreement and transfer of rights toEMERGENCIAS.

Article not commissioned by the Editorial Board and peer-reviewed externally

References

1 Alberdi F, García I, Atutxa L, Zabarte M. Epidemiología del trauma grave. Med Intensiva. 2014;38:580-8.
2 Chico-Fernández M, Llompart-Pou JA, Guerrero-López F, Sánchez-Casado M, García-Sáez I, Mayor-García MD, et al. Epidemiología del trauma grave en España. REgistro de TRAuma en UCI (RETRAUCI). Fase piloto. Med Intensiva. 2016;40:327-47.
3 Hajibandeh S, Hajibandeh S. Systematic review: effect of whole-body computed tomography on mortality in trauma patients. J Inj Violence Res. 2015;7:64-74.
4 Campillo-Soto Á, Soria-Aledo V, Renedo-Villarroya A, Millán MJ, Flores-Pastor B, Girela-Baena E, et al. Utilidad de la tomografía computarizada para el diagnóstico de lesiones intestinales y mesentéricas en el trauma abdominal cerrado. Cir Esp. 2009;86:13-6.
5 Talari H, Moussavi N, Abedzadeh-Kalahroudi M, Atoof F, Abedini A. Correlation Between Intra-Abdominal Free Fluid and Solid Organ Injury in Blunt Abdominal Trauma. Arch Trauma Res. 2015;4:1-4.
6 Stengel D, Rademacher G, Ekkernkamp A, Güthoff C, Mutze S. Emergency ultrasound-based algorithms for diagnosing blunt abdominal trauma. Cochrane Database Syst Rev. 2015;9:1-12.
7 Grace A, Shyam C. Compendio de las escalas de evaluación de riesgo en el paciente politraumatizado. Cir Esp. 2013;93:213-21.
8 Lladó L, Jorba R, Parés D, Borobia FG, Biondo S, Farran L, et al. Influencia de la aplicación de un protocolo de actuación en el tratamiento de los traumatismos abdominales cerrados. Cir Esp. 2002;72:79-83.
9 Ortega-Deballona P, Delgado-Millán A, Jover-Navalón JM, Limones-Esteban M. Manejo diagnóstico en el tratamiento conservador del traumatismo abdominal. Cir Esp. 2003;73:233-43.
10 Prat Fabregat S, Gonzalez Matheu E, Placer Lopez de Alda A, Siches Cuadra C, Suso Vergara S, Sanchez-Lloret Tortosa J. Politraumatizados, ISS y control de calidad. Emergencias. 1997;9:86-90.
11 Dindo D, Demartinez N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6,336 patients and results of a survey. Ann Surg. 2004;240:205-13.
12 Turégano F, Ots JR, Martín JR, Bordons E, Perea J, Vega D, et al. Mortalidad hospitalaria en pacientes con traumatismos graves: Análisis de la mortalidad evitable. Cir Esp. 2001;70:21-6.
13 Chico-Fernández M, Llompart-Pou JA, Sánchez-Casado M, Alberdi-Odriozola F, Guerrero-López F, Mayor-García MD, et al. Mortality prediction using TRISS methodology in the Spanish ICU Trauma Registry (RETRAUCI). Med Intensiva. 2016;40:395-402.
14 Cirocchi R, Corsi A, Castellani E, Barberini F, Renzi C, Cagini L, et al. Case series of non-operative management vs. operative management of splenic injury after blunt trauma. Ulus Trauma Acil Cerr Derg. 2014;20:91-6.
15 Jiménez M, Costa D, Jover-Navalón JM, Turégano F, Ceballos J, Yuste P, et al. Traumatismo esplénico en España: ¿en qué punto estamos? Cir Esp. 2013;91:584-9.
16 Asensio JA, Martín W, Petrone P, Roldán G, Pardo M, García JC, et al. Traumatismos duodenales: Lesiones complejas. Cir Esp. 2003;74:308-15.
17 Asensio JA, Navarro S, Forno W, Roldán G, Rivas LM, Salim A, et al. Lesiones Vasculares Abdominales. El desafío del cirujano traumatológico. Cir Esp. 2001;69:386-92.
18 Li Y, Xiang Y, Wu N, Wu L, Yu Z, Zhang M, et al. A Comparison of Laparoscopy and Laparotomy for the Management of Abdominal Trauma: A Systematic Review and Meta-analysis. World J Surg. 2015;39:2862-71.
19 Instituto Nacional de Estadística [sede Web]. Madrid: INE.es; 2009- (actualizada el 21 de diciembre de 2017; Consultado 4 Enero 2018). Disponible en: http://www.INE.es
20 Domingues CA, Coimbra L, Poggetti RS, Nogueira LS, de Sousa RMC. New Trauma and Injury Severity Score (TRISS) adjustments for survival prediction. World J Emerg Surg. 2018;13:12.
21 Ali BA, Lefering R, Moral MF, Otano TB. Validación del modelo de predicción de mortalidad de navarra y comparación con el revised injury severity classification score ii en los pacientes con traumatismo grave atendidos por el sistema de emergencias de Navarra. Emergencias. 2018;30:98-104.
22 Prachalias AA, Kontis E. Isolated abdominal trauma: diagnosis and clinical management. Curr Opin Crit Care. 2014;20:218-25.
23 Como JJ, Bokhari F, Chiu WC, Duane TM, Holevar MR, Tandoh MA, et al. Practice management guidelines for selective nonoperative management of penetrating abdominal trauma. J Trauma. 2010;68:721-33.
24 Moore EE, Shackford SR, Pachter HL, McAninch JW, Browner BD, Champion HR, et al Organ injury scaling: spleen, liver, and kidney. J Trauma. 1989;29:1664-6.
25 Jover-Navalón JM, Ramos JL, Montón S, Ceballos J. Tratamiento no operatorio del traumatismo hepático cerrado. Criterios de selección y seguimiento. Cir Esp. 2004;76:130-41.
26 González-Castro A, Cañas BS, Soledad M, Peña H, Ots E, José M, et al. Traumatismo hepático. Descripción de una cohorte y valoración de opciones terapéuticas. Cir Esp. 2007;81:78-81.