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Original article

Prospective Registry of Severe Polytrauma. Analysis of 1200 Patients☆,☆☆

Anna Serracant Barrera, Sandra Montmany Vioque, Heura Llaquet Bayo, Pere Rebasa Cladera, Andrea Campos Serra, Salvador Navarro Soto*

Servicio de Cirugía General y del Aparato Digestivo, Hospital de Sabadell, Corporació Sanitària Parc Taulí, Institut Universitari Parc Taulí–Universitat Autònoma de Barcelona, Sabadell, Barcelona, Spain

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ABSTRACT

Introduction: Polytrauma continues to be one of the main causes of death in the population between 10 and 40 years of age, and causes severe discapability in surviving patients. The aim of this study is to perform an analysis of the quality of care of the polytrauma patient using an epidemiological study.

Method: Prospective registry of all polytrauma patients treated at our hospital over 16 years of age, admitted to the critical care area or dead before admission.

Results: From March 2006 to August 2014, we registered 1200 polytrauma patients. The majority were men (75%) with a median age of 45. The mean ISS was 20.9±15.8 and the most common mechanism of injury was blunt trauma (94% cases), The global mortality rate was 9.8% (117 cases), and neurological death was the most frequent cause (45.3%), followed by hypovolemic shock (29.1%). In 17 cases (14.5% of deaths) mortality was considered evitable or potentially evitable, A total of 327 patients (27.3%) needed emergency surgery and 106 patients (8.8%) needed emergency treatment using interventional radiology. 18.5% of patients (222) presented an inadverted injury, with a total of 318 inadverted injuries.

Conclusion: Trauma care at our centre is adequate. A prospective registry of the global care of polytrauma patients is necessary to evaluate the quality of care and improve results.

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* *Corresponding author.*
E-mail address: heura.ivy@gmail.com (H. Llaquet Bayo).

Registro prospectivo de politraumatismos graves. Análisis de 1.200 pacientes

Palabras clave:
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Registro prospectivo
Injury severity score
Mortalidad evitable
Lesión inadvertida

RESUMEN

Introducción: El politraumatismo sigue siendo una de las principales causas de muerte entre los 10 y los 40 años, causando graves incapacidades en los pacientes que sobreviven. El objetivo de nuestro estudio es realizar un análisis de calidad de la atención del paciente politraumatizado mediante un estudio epidemiológico.

Método: Registro prospectivo de todos los pacientes politraumáticos atendidos en nuestro hospital, mayores de 16 años, que ingresan en el área de críticos o mueren antes del ingreso.

Resultados: Desde marzo del 2006 hasta agosto del 2014, registramos 1.200 politraumatizados. La mayoría fueron hombres (75%), con una mediana de edad de 45 años. El ISS medio fue de 20,9±15,8 y el mecanismo de acción más frecuente fue cerrado (94% casos). La mortalidad global fue del 9,8% (117 casos), siendo la muerte neurológica la principal causa de fallecimiento (45,3%), seguida de la muerte por shock hipovolémico (29,1%). En 17 casos (14,5% fallecimiento) la mortalidad fue considerada como evitable o potencialmente evitable. Un total de 327 pacientes (27,3%) precisaron de tratamiento quirúrgico urgente y 106 pacientes (8,8%) precisaron de un tratamiento mediante radiología intervencionista de carácter urgente. El 18,5% de los pacientes (222) presentaron alguna lesión inadvertida, con un total de 318 lesiones inadvertidas.

Conclusión: La atención ofrecida en nuestro centro es correcta. La necesidad de una recogida de datos prospectiva de la atención global a los pacientes politraumatizados es necesaria e imprescindible para poder evaluar la calidad ofrecida y mejorar los resultados.

Introduction

There is a high incidence of polytrauma in developed countries, and it is still one of the main causes of death among young patients aged from 10 to 40 years old. Although there are no standard threshold values, mortality in this group of patients varies from 10% in those with an Injury Severity Score (ISS) lower than or equal to 15, and above 20% when their ISS is higher than 25. The morbidity deriving from polytrauma is also considerable: one case in every 3 of severe polytrauma will result in serious disablement.

Several authors have attempted to establish a relationship between the number of patients treated with multiple trauma and mortality, and they were unable to show any such relationship.[1,2] In 2004 Lauren et al.[2] were the first to analyse this relationship using the data contained in the National Trauma Databank (NTDB), and they found that patient mortality does not vary depending on the size of the Trauma service after adjusting by ISS.

Mortality in this group of patients varies according to whether they are seen in a Trauma centre or not, as a reduction in mortality is found in Trauma centres. This reduction in mortality is associated with a higher level of protocolization and the expertise in Trauma of the health workers in such centres.[3]

Trauma mortality is classified as: avoidable, potentially avoidable or inevitable, depending on its association with an unnoticed injury that may lead to the death of the patient. In worldwide series, avoidable mortality varies from 2% to 29%. This variation and the widely differing data in different studies are due to the lack of an established classification of the errors that cause unnoticed injuries, together with the lack of a universal definition of mortality due to trauma. These factors hinder the comparison of data.[4]

Since 1982, polytrauma patient mortality has been classified in three stages,[5] with 3 peaks: within the first hour after the accident, from the first to the fourth hour after the accident, and after the first week. After 1995, several publications showed that the third peak in mortality vanishes, with a two-mode mortality curve.[6–8] The disappearance of the third mortality peak is due to the increased protocolization of care for these patients.

Overall mortality in polytrauma patients has gradually fallen over the years thanks to the protocolization of treatment. Dutton et al.[9] published an overall reduction in mortality of 3.4% from 1997 to 2008. The largest fall in mortality here was observed in the group of patients with an ISS between 17 and 25, as their mortality fell from 8.3% to 4.8%. Several authors have evaluated the relationship between the mortality in this group of patients and the degree to which healthcare staff are trained and governed by protocol, using the ATLS protocol, among others. An inversely proportional correlation is usually found: with more training, mortality decreases. In a recent study Navarro et al.[10] identified a reduction in avoidable mortality as a ratio of the number of professionals trained using the ATLS[5] method. Nevertheless, the survey by Morales et al.[11] in 2006 among residents in our country underlined the feeling that there is a lack of training in Trauma.

The first study of data to be described and published was undertaken in the United States. This was the Major Trauma Outcome Study (MTOS).[1] The MTOS contains more than

120 000 entries from 140 hospitals in the United States, Canada, Great Britain and Australia, after 1982. The work published by Champion et al.,[12] which includes approx. 80 000 entries on polytrauma patients in 139 hospitals in North America from 1982 to 1987 is a summary of this database. Thanks to this data gathering it has been possible to start evaluating the quality of care for polytrauma patients.

With all of the recorded data the mortality prediction system known as the TRISS (the Trauma and Injury Severity Score)[12] emerged. This is obtained on the basis of the Revised Trauma Score (RTS) and the Injury Severity Score (ISS). The TRISS is universally used, although it has severe limitations. Its most serious limitation is its considerable variability depending on the population studied; if it is applied to different populations around the world such as Scotland,[13] Hong Kong[14] or Spain[15]..., it gives very disparate results that cannot be compared.

Several publications describe retrospective descriptive studies which undertake an epidemiological analysis of polytrauma patients. However, with the current bibliography it is hard to establish standard data that would make comparisons possible and set standard values in Spain. Nevertheless, as described by the group of Costa et al.,[16] Trauma records must be kept to evaluate the quality of care. The aim of our study is to analyse the quality of polytrauma patient care by means of an epidemiological study.

Methods

A descriptive study of patients with severe polytrauma treated in our hospital (a referral hospital for polytrauma patient care in Catalonia). This included all polytrauma patients over the age of 16 years old who required admission to the critical care unit or who died before admission. Patients under the age of 16 years old were excluded, together with all of the patients who were not admitted to the critical care unit (those under observation or admitted to a hospitalisation ward, etc.).

Data are prospectively recorded in an Access®-type database in protected format, to prevent duplications or the entry of outlier data.

Different types of variables are recorded: epidemiological (sex and age), trauma (mechanism and time), severity criteria (TRISS, ISS), pre-hospital and hospital vital signs (heart rate, breathing rate, systolic and diastolic blood pressure, Glasgow scale score, oxygen saturation), analytical data (leukocytes, lactic acid, base excess, haemoglobin...), complementary examinations, diagnosed lesions and their treatment, unnoticed lesions, complications and case outcome (death, discharge to home, discharge to rehabilitation centre...). All data are subsequently revised cyclically by a committee that specialises in treated polytrauma patients.

Unnoticed lesions are those which are detected after the first 24 h. of polytrauma patient care in the hospital. Four types of error lead to the appearance of unnoticed lesions: clinical error, radiological error, an error in communication and surgical error. We understand a clinical error to be one that leads to lesions going undetected in the first clinical examination of the patient. Radiological error arises when a lesion goes unnoticed in the first complementary examination, so that it is detected when the diagnostic test result is checked. Communication error occurs when different medical specialities communicate. Lastly, surgical error arises when a lesion goes undetected during a surgical exploration or procedure.[4]

Mortality is classified in 3 types: avoidable, potentially avoidable and inevitable. An avoidable death is directly caused by an avoidable error. A potentially avoidable death stems from an avoidable error, although we cannot know whether the death would have occurred anyway. An inevitable death is one that would have occurred regardless of the existence or otherwise of any errors in the treatment of the patient.

Statistical analysis: descriptive analysis of quantitative data according to core tendency readings (mean, median) and dispersion (standard deviation and interquartile range) and qualitative data with percentages.

Results

From March 2006 until August 2014 we recorded 1200 polytrauma patients.

The majority of them were men (75%), with a median age of 45 years of age (minimum: 16 years old; maximum: 100 years old). 72% of the patients were haemodynamically stable when they arrived at our hospital (see Table 1).

The average ISS was 20.9±15.8. A total of 503 patients (42%) had a low ISS (ISS≤15), 404 patients (34%) had a medium ISS (ISS from 16 to 24), and 293 patients (24%) a high ISS (ISS>25). 94% of trauma was of the blunt type. Falls (20.4%) were the most common cause, followed by traffic accidents involving cars (18.2%), motorcycle accidents (18.1%) and falls from a height (15%). Stab wounds were the most common penetrating trauma (86%) (see Table 1).

Total mortality in our series was 9.8% (117 patients). The most frequent cause of death was neurological (45.3%), followed by hypovolemic shock (29.1%) (see Table 1).

In our series there is a clear peak in intrahospital mortality during the first 24 h, when 46% of deaths occur. The other deaths are distributed throughout the following days quite uniformly (see Fig. 1). Mortality according to the ISS was 1.7% (9 patients) of those with low severity trauma (ISS≤15), 1.9% (7 patients) of medium severity cases (ISS from 16 to 24) and 30.5% (101 patients) of high severity patients (ISS≥25). Of the 117 polytrauma patients who died, 17 of these deaths were considered to be avoidable or potentially avoidable (14.5%). Dividing mortality according to the ISS we find that 11.8% (2 patients) had an ISS≤15, 5.8% (one patient) had an ISS of from 16 to 24, and the majority, 82.4% (14 patients) had an ISS≥25.

A total of 327 patients (27.3%) needed urgent surgery, and 648 procedures were performed. Trauma-orthopaedic surgery was the most frequent (39.8%), together with abdominal surgical procedures (32.1%) (see Fig. 2). The most frequent abdominal procedures were those which included intestinal surgery (intestinal resections, intestinal suture and lesions of the intestinal mesentery) (30.3%), followed by splenectomy (20.2%) and thirdly hepatic surgery (mainly hepatic packing) (16.8%) (see Table 2).

On the other hand, 114 endovascular procedures were performed in 106 patients (8.8%). In 2 patients angiography was repeated due to the suspicion of repeated bleeding (which was confirmed in one case); in 6 others more than one

Table 1 – Epidemiological Data.

Sex	301 women (25%), 899 Men (75%)			
Age	Median 45 years old (Min. 16 years old, Max. 100 years old)			
ISS 20.9±15.8	ISS<15	503 (42%)		
	ISS 16–24	404 (34%)		
	ISS>25	293 (24%)		
Haemodynamic stability	Stable HMD	862 (71.8%)		
	Unstable HMD	292 (24.3%)		
	Unknown	46 (3.8%)		
Cause	Blunt: 1125 patients (93.7%)	Fall	249	22.1%
		Car	205	18.2%
		Motorcycle	204	18.1%
		Fall from height	186	16.5%
		Knocked down by traffic	111	9.9%
		Bicycle	73	6.5%
		Blow (aggression)	38	3.4%
		Crushing	33	2.9%
		Strangulation	8	0.7%
		Electrocution	2	0.2%
		Explosion	1	0.1%
		Others	15	1.3%
	Total blunt		1125	100%
	Penetrating 75 patients (6.3%)	Stab wound	65	86.7%
		Firearm	9	12.0%
		Goring	1	1.3%
	Total penetrating		75	100%
Total mortality 117 patients (9.8%)	Neurological death	53 (45.3%)		
	Hypovolemic shock	34 (29.1%)		
	MOF	12 (10.3%)		
	Respiratory failure	11 (9.4%)		
	Cardiac arrest	7 (6%)		

MOF: multiple organ failure; HMD: haemodynamically.

procedure was performed (the embolisation of more than one organ) during the angiography itself. In 8.3% (12 angiographies) of the procedures no therapeutic embolisation was required. This technique was most commonly used to treat pelvic vascular lesions (42.1%), followed by lesions of the solid abdominal organs (37.7%) and for orthopaedic lesions (14%) (see Fig. 3). Of the procedures used to treat solid organ lesions, spleen embolisation was the most frequent (40.5%), followed by hepatic (26.2%) and renal (23.8%) embolisation.18.5% of the patients (222) had an undetected lesion, with a total of 318 undetected lesions. Limb fractures were the most frequent (27.4%), followed by abdominal lesions (17.3%) and cranioencephalic trauma (13.8%) (see Table 3). The most common error leading to undetected lesions was radiological (54.4%), followed by error due to clinical failure to detect a lesion (42.8%). Surgical error in not detecting a lesion (1.6%) and error due to communication failure (0.9%) were exceptional.

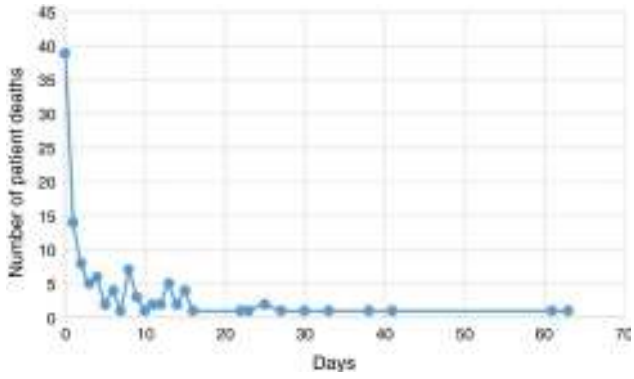

Fig. 1 – Distribution of mortality.

Discussion

The quality of care for polytrauma patients may be evaluated using different indicators. Of these, mortality is one of the most objective and representative.

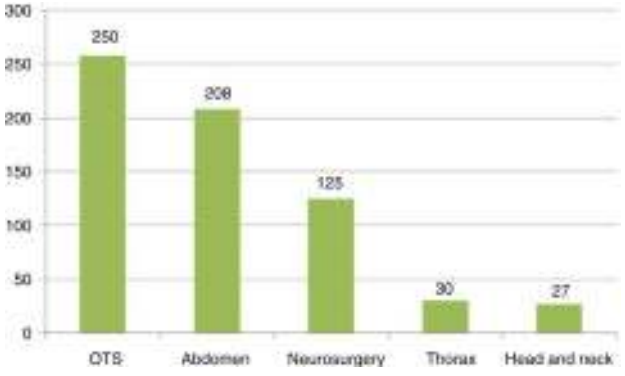

Fig. 2 – Types of emergency surgical operations (in number of procedures). OTS: orthopaedic and traumatological surgery.

Table 2 – Intra-abdominal Lesions That Required Emergency Surgery.

	No.	%
Intestinal	63	30.3
Spleen	42	20.2
Hepatic	35	1.8
Diaphragmatic	9	4.3
Abdominal wall	9	4.3
Renal	7	3.4
Evisceration	5	2.4
Gastric	5	2.4
Suprarenal	4	1.9
Vascular	4	1.9
Cava vein	3	
Gonadal vein	1	
Pancreatic	3	1.4
Bladder	2	1.0
Pelvic (packing)	2	1.0
Urethral	1	0.5
Perineal	1	0.5
Others	16	7.7
Unexamined retroperitoneal haematoma	7	
Normal laparotomy	4	
Haemostasis	3	
Normal laparoscopy	2	
Total	208	100

Total mortality in our series stands at 9.8%. It is lower than 2% for an ISS<25, and it is 30.5% for an ISS>25. The total mortality of our series is within the quality standards described in the literature. Champion et al.[12] describe a mortality lower than 10% for ISS<25, and higher than 25% in ISS≥25, in a group of polytrauma patients comparable to those studied by us. Dutton et al.[9] describe lower figures of mortality (total mortality 3.4%), although the majority of the patients they studied were low-grade cases of polytrauma (average ISS 10.8).

These patients are treated in our hospital by a multidisciplinary team that is largely and increasingly trained according to the ATLS protocol. As the work by Navarro et al.[10] describes, the better staff are trained in the care of polytrauma patients, the more mortality tends to decrease. Protocolization and the training of specialists who care for these patients in our hospital must influence the correct percentages of mortality in our series.

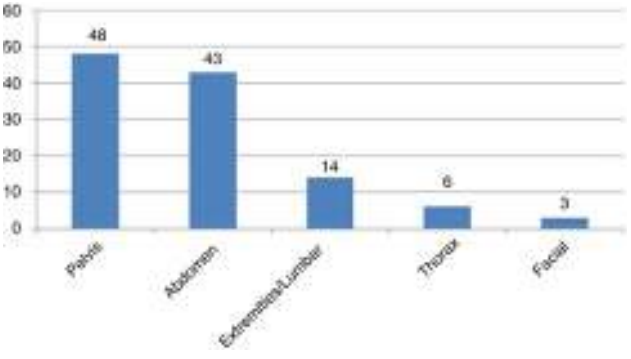

Fig. 3 – Types of emergency angiographies performed (in number of procedures).

Table 3 – Undetected Lesions.

	No.	%
Extremity fractures	87	27.4
Abdominal	55	17.3
Intestinal	14	
Splenic	12	
Hepatic	8	
Urethral	4	
Renal	4	
Retroperitoneal haematomas	3	
Pancreatic	3	
Duodenal	2	
Suprarenal	2	
Bladder	1	
Diaphragmatic	1	
Abdominal wall	1	
Cranioencephalic	44	13.8
Thoracic	36	11.3
Haemothorax	15	
Pneumothorax	10	
Pulmonary	4	
Cardiac	2	
Pneumomediastinum	2	
Haemomediastinum	2	
Broncoaspiration	1	
Low-grade injuries to the extremities	34	10.7
Facial	21	6.6
Spinal column lesions	18	5.7
Nerve	13	4.1
Pelvic	5	1.6
Others	5	1.6
Vascular	4	
Thyroid	1	
Total	318	100.0

The incidence of avoidable and potentially avoidable mortality in our series amounts to 14.4%, and this is comparable with the percentages described worldwide in the literature (from 2% to 29%).[4]

With respect to the distribution of mortality in our series, we only found a peak in intrahospital mortality in the first 24 h following patient arrival at the emergency service. After this peak in the first 24 h no other peak in mortality was found, given that deaths are distributed quite homogeneously. Recent studies, such as the one by Demetriades et al.,[8] describe the tendency for the last peak to disappear, due to the greater protocolization of care. We therefore believe that it is this group of patients which would benefit from increased protocolization in Primary Care. We have no pre-hospital data that would permit us to analyse the classic peak in mortality prior to arrival at hospital that is described in the literature.[5,8]

The incidence of undetected lesions (18.5%) in our current series is within the range described in the literature, where it varies from 1.4% to 22%.[16–19] Patients of this type are usually hospitalised for longer, and have more severe ISS than those without such lesions. The spectrum of undetected lesions in our hospital is similar to those described in other series: fractures are the most frequent, followed by abdominal and cranioencephalic lesions. The increased protocolization of care for patients of this type and the implementation of a third-party revision will help us to reduce their incidence.

The therapeutic management of polytrauma patients can be conservative and medical, conservative with the aid of interventional radiology, or surgical. Surgical management in our hospital (27.3%) is undertaken by a team of general, orthopaedic and neurological surgeons. The most frequent surgical procedures are orthopaedic-traumatological and abdominal. The increase in the use of conservative treatment by interventional radiology has been described in several studies. They describe how it is used and the improvement in the overall prognosis for patients. In our hospital it is used in a total of 8.8% of cases, with good results.

We can conclude our study by saying that the care offered to polytrauma patients in our hospital is correct. We believe that our prospective data gathering for the whole care process of these patients is necessary and indispensible for the evaluation of quality and to improve outcomes.

Conflict of Interests

The authors declare that they have no conflict of interests.

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