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Trauma Injuries Associated with Rope Bullfights in the Azores: A Cross-Sectional Study

Trauma Associado às Touradas à Corda nos Açores: Um Estudo Transversal

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ABSTRACT

Introduction: The aim of the study was to describe trauma injuries associated with rope bullfights in the Azores, Portugal, regarding the cause of the incident, trauma mechanism, most affected anatomical areas, and injury severity.

Methods: Two-year cross-sectional study in the local hospital with prospective data collection. Patients who were consecutively admitted to the local hospital's emergency department with trauma injuries from the bull's direct impact or from falls either during the bull's escape or when handling the rope, were included. Data on general demographics, lesion characteristics, treatments, need for hospitalization and mortality were collected.

Results: Fifty-six incidents and 80 trauma injuries were identified. The main cause of trauma was the bull's direct impact (37; 66.07%) and the mechanism of injury was blunt trauma in all patients (100%; 56). Head and neck injuries (27; 33.75%) were the most common. The median Injury Severity Score at the emergency department admission was 4. *Major* trauma was noted in five patients (8.92%). Ten patients (17.85%) needed hospitalization with a median hospital stay of seven days. Three of the 10 hospitalized patients (30%) were previously admitted to the intensive care unit. Surgery was performed in six patients (10.71%).

Conclusion: The main cause of trauma was the bull's direct impact, and the mechanism of injury was blunt trauma. The most affected anatomical areas were the head and neck. These findings are a wake-up call to the impact of these events regarding the economic costs they entail, the costs for the health of the local population, the safety measures currently implemented and the availability of the necessary means to treat these patients.

Keywords: Multiple Trauma; Severity of Illness Index; Wounds and Injuries; Wounds, Nonpenetrating

RESUMO

Introdução: O objetivo deste estudo foi caracterizar as lesões traumáticas tauromáquicas ocorridas nas touradas à corda nos Açores no que diz respeito à causa do incidente, mecanismo de trauma, área anatómica mais afetada e gravidade das lesões.

Métodos: Estudo unicêntrico, transversal, com a colheita prospetiva de dados realizada durante dois anos. Foram incluídos os doentes que consecutivamente recorreram ao serviço de urgência do hospital local por lesões traumáticas ocorridas por trauma direto com o animal ou quedas aquando da fuga ou manuseio da corda. Foram colhidos dados demográficos gerais, características da lesão, tratamentos efetuados, necessidade de internamento hospitalar e mortalidade. Foi realizada uma análise estatística descritiva com recurso ao *software* estatístico SPSS.

Resultados: Registaram-se 56 admissões hospitalares e 80 lesões traumáticas. A principal causa de traumatismo foi o trauma direto com o animal (37; 66,07%) e o mecanismo de lesão foi o trauma fechado (56; 100%). As áreas anatómicas mais afetadas foram a cabeça e pescoço (27; 33,75%). A mediana de *Injury Severity Score* foi de 4 à admissão hospitalar. Cinco doentes (8,92%) apresentaram trauma *major*. Dez doentes (17,85%) necessitaram de internamento hospitalar com uma mediana de dias de internamento de sete (IIQ 4,5 dias). Três (30%) dos doentes internados necessitaram de internamento em unidade de cuidados intensivos. Seis doentes (10,71%) foram submetidos a cirurgia.

Conclusão: A principal causa de traumatismo foi o trauma direto com o animal e o mecanismo de lesão foi o trauma fechado. As áreas anatómicas mais afetadas foram a cabeça e pescoço. Estes dados constituem um alerta para o impacto destes eventos no que diz respeito aos custos económicos que acarretam, aos custos para a saúde da população local, às medidas de segurança atualmente implementadas e à disponibilidade dos meios necessários para tratar estes doentes.

Palavras-chave: Feridas e Lesões; Ferimentos não Penetrantes; Índice de Gravidade de Doença; Trauma Múltiplo

INTRODUCTION

Bullfighting-on-a-rope (*tourada à corda*) is involved in traditional festivities held in the Autonomous Region of the Azores and characterised by the running of bulls, attached by the neck to a rope guided by six shepherds along the street. These events are very popular in the region, carried out daily between May and October. More than 99% of these events are held at the Terceira Island, with a small percentage being held at the other eight islands of the Azores. Every year, patients who suffer traumatic injuries related to the direct contact with the animals, or falls when escaping or handling the rope, are looked after at the emergency department of local hospitals.

The international scientific literature on traumatic injuries caused by cattle horns is scarce. Its incidence is higher in geographical areas and societies where cattle coexist in the same area as people,[1] related to accidents at work

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involving farmers, herders and ranchers, or in countries with a bullfighting tradition including Portugal, Spain, the south of France and Latin American countries.[2,3] Incidents related to bullfights are mostly described in the published series,[2,3] and most of these are based on isolated case reports in the same context[4-7] or incidents involving wild cows in India.[8-10]

Penetrating trauma by a bull's horn is the most common mechanism[2] while the inguinal region and the lower limbs are mostly affected.[2,3] Vascular injuries are often associated with trauma to the inguinal region and thigh (around 20%)[2] requiring urgent surgical repair affecting around 30% of the patients.[3] Vascular injuries are a prognostic factor of severity and mortality.[2]

The authors are not aware of any descriptive studies in bullfighting-on-a-rope events. The aim of this study was the assessment of traumatic bullfighting injuries in three Azorean islands (Terceira, São Jorge and Graciosa) considering the cause of the incident, the mechanism of trauma, patients' most affected anatomical areas and injury severity.

METHODS

Study design and population

This was a cross-sectional study with prospective data collected from May 1, 2018 to October 31, 2019.

Patients who consecutively attended the emergency department at the *Hospital de Santo Espírito da Ilha Terceira* (HSEIT) were included, coming from the three Azorean islands within the study hospital's catchment area (Terceira, São Jorge, and Graciosa islands), due to traumatic injuries sustained in bullfighting-on-a-rope events due to direct trauma caused by the animal or falls while escaping or handling the rope. Patients attending emergency due to injuries sustained in bullring bullfights, or bull injuries outside the festive context under study (bullfighting-on-a-rope) were excluded from the study.

Variables

General demographic data were collected (age, gender, nationality, and place of residence), festivity [type of event and participation as shepherds, *capinhas* (members of the public who face the bull and attract its attention) or members of the general population], injury characteristics (cause of trauma, mechanism of injury, affected anatomical area(s) and severity), haemodynamic status on hospital admission, treatment(s) carried out in emergency, admission requirement (department or hospital transfer) and mortality. In case where admission was required at the HSEIT, prospective follow-up was carried out, length of stay, treatment, and need for surgery (urgent or elective and surgical procedure) were recorded. In case where hospital transfer was required, the indication/diagnosis at the time of transfer was recorded. Morbidity and mortality of patients who underwent surgery were recorded.

Definitions

As regards the festive environment, the patients' participation as shepherds refers to the professionals responsible for handling the bull's rope and controlling its mobility throughout the festival, and as *capinhas* refers to those patients who bullfight or cape the animal during bullfights. This distinction was made because they represent possible populations at risk of injury due to their proximity to the animal during these events.

As regards the cause of injury, data were collected as being caused by direct trauma caused by the animal or falls when escaping or handling the rope. The mechanism of injury was ranked as penetrating or closed.

The injury severity was determined by the anatomical Injury Severity Score (ISS) system, using the Abbreviated Injury Scale (AIS).[11] Major injury was defined as ISS > 15.[12] Haemodynamic instability was defined as systolic blood pressure (SBP) < 90 mmHg or a drop in SBP > 40 mmHg or heart rate > 90 bpm or altered state of consciousness.[13]

Surgical morbidity and mortality at 30 days was recorded according to the Clavien-Dindo classification.[14]

Data treatment

The study was approved by the Hospital Ethics Committee in accordance with the Declaration of Helsinki. Data were collected by a team of general surgery registrars, general surgery consultants and orthopaedic surgeons working at the HSEIT who looked after the patients on admission to emergency.

Data were collected in an Excel database stored in a hospital network folder, with exclusive access by those involved in data collection. These did not contain any identifying information, keeping data confidentiality and anonymity.

Statistical analysis

A descriptive analysis of data and SPSS calculations were carried out. Quantitative variable data were presented as medians and interquartile ranges, while those regarding qualitative variables were presented as absolute and relative frequencies.

RESULTS

A total of 56 patients were admitted to emergency throughout 2018 and 2019, due to injuries sustained in bullfighting-on-a-rope events. General demographic data are shown in Table 1. The median age was 46 years with an interquartile range of 30.25 years, and 16.07% (9) of the patients were female.

Regarding the cause of trauma, 66.07% (37) of the events were related to direct trauma with an animal, while

the remaining 33.92% (19) were related to falls when escaping or handling the rope. Closed trauma occurred in 100% of the cases.

The injuries by anatomical area are shown in Table 2, with 80 injuries in total, affecting the 56 patients who attended emergency. Head and neck (27; 33.75%), lower

Table 1 – General demographic data

Variable		No. of patients
Gender		
(n = 56)	Female	9 (16.07%)
	Male	47 (83.93%)
Residence		
(n = 56)	Azores	45 (80.36%)
	Mainland Portugal and Madeira	2 (3.57%)
	Abroad	9 (16.07%)
Participation		
(n = 56)	Public	50 (89.28%)
	Shepherd	3 (5.36%)
	Capinha	3 (5.36%)

Table 2 – Injuries per anatomical area. Minor trauma included pain or external injuries including minor lacerations, contusions, abrasions, haematoma, or superficial burns.

Anatomical area	No. of injuries	Diagnosis	No.
Head and neck	27 (33.75%)	Wounds and abrasions	19
		Minor trauma	6
		Head trauma associated to fracture	2
Thorax	16 (20.00%)	Wounds and abrasions	2
		Minor trauma	7
		Costal fracture	4
		Clavicle fracture	3
Abdomen	2 (2.5%)	Wounds and abrasions	1
		Splenic fracture	1
Spine	1 (1.25%)	Transverse apophysis fracture	1
Upper limb	15 (18.75%)	Wounds and abrasions	4
		Minor trauma	2
		Shoulder luxation	1
		Proximal humerus fracture	1
		Radium fracture	5
		Phalangeal fracture	2
Lower limb	19 (23.75%)	Wounds and abrasions	7
		Minor trauma	7
		Femoral fracture	1
		Tibial and fibular fracture	2
		Metatarsal fracture	1
		Achilles rupture	1
TOTAL:			80

limbs (19; 23.75%), chest (16; 20%) and upper limbs (15; 18.75%) were the most affected anatomical areas, in descending order. Twenty-two patients (39.28%) presented with injuries affecting more than one area. Excluding external injuries and other traumas to the limbs (lacerations, contusions, abrasions and burns regardless of the location),[11] a predominance of orthopaedic injuries was found - Table 2; 22 bone fractures were diagnosed, with a predominance of radius fractures (5), rib fractures (4) and clavicle fractures (3).

When analysing the severity of the injuries, a median ISS score of 4 was found on admission and 10.5 in patients who required hospitalisation. Five patients (8.92%) presented with major trauma (ISS > 15). All major trauma episodes were related to direct trauma with the animal and affected patients from members of the public. Eighty percent (4) of major traumas affected male patients. Two patients (3.6%) presented haemodynamically unstable on admission.

As regards treatment at emergency, 16 patients were treated at the minor surgery room; 12 patients had their wounds disinfected/debrided and other dressings; 10 patients made symptomatic therapy (including analgesia, fluid therapy or antiemetics); 11 fractures were reduced and/or immobilised at the trauma room (five patients presenting with radius fractures and three clavicle fractures). In only five patients (8.92%) was no treatment carried out in emergency. Six patients (10.71%) underwent urgent surgery at the operating room (Table 3), with no post-operative morbidity or mortality.

Hospitalisation was required for ten patients (17.85%) with a seven-day median length of stay (IQR 4.5 days). Four patients were admitted to general surgery, four to orthopaedics and one to neurology. One patient was transferred to the neurosurgery department at another local hospital, due to a complex fracture of the skull cap involving the foramen magnum, associated with subarachnoid haemorrhage, subdural haematoma, and foci of frontal and temporal contusion. Reasons for admission and treatment modalities are shown in Table 4. Three (30%) patients were admitted to intensive care.

There were no hospital deaths. Data on treatment or morbidity and mortality regarding the patient transferred to the neurosurgery department at another local hospital were unavailable.

DISCUSSION

In two years, around 460 bullfighting-on-a-rope events were held in the Autonomous Region of the Azores, 99% of these in the Terceira Island. Throughout this period, 56 patients were admitted to hospital due to a direct trauma caused by the animal and blunt trauma was the main mechanism of injury, mostly affecting the head and neck.

When attacking, a bull lowers its head by flexing its neck and, as soon as it reaches its target, it extends its neck, applying great force to the entry point of the horns as a result of the animal's great mass and acceleration.[2] As its target is lifted off the ground, it makes a circular movement with its head, causing it to rotate around the horn with all its weight and causing extensive tissue damage.[2] Due to mechanisms related to the height of the animal's head and the way it attacks, a higher incidence of penetrating injuries are described in literature, mostly affecting the thighs, groin, perineum and abdomen.[2,3] In this study, both the mechanism of injury (closed trauma) and most affected anatomical areas (head and neck) were different from those described in international literature. The fact that the animals have their horns protected at these events may be one of the reasons for the predominance of closed injuries. In addition, factors related to the festive environment, held throughout the streets of local parishes with the participation of the population, may lead to an increase in the number of injuries related to falls, explaining the differences. Finally, it should be noted that this study did not specifically assess injuries caused by the animal's horn, so it was expected that there would be a greater number of blunt traumatic injuries associated with falls when the animal escaped or when handling the rope.

As for the severity of injuries, although there was a predominance of minor trauma (median ISS 4), major trauma occurred in 8.92% of the patients who attended emergency. It was hypothesized that shepherds and *capinhas*, due to their greater proximity to the animal during rope control and

Table 3 – Surgery in the operating room, under general anaesthesia/sedation

Diagnosis (n)	Procedure	No. of patients
Splenic fracture (1)	Splenectomy	1
Shoulder luxation (1)		
Tibial and fibular fracture (2)	Luxation and/or fracture reduction	4
Femoral fracture (1)		
Achilles rupture (1)	Tenorrhaphy	1
TOTAL:		6

Table 4 – Reason for admission

Ward	Reason for admission	Treatment	Previous admission to the ICU (days)	Length of stay (days)
General Surgery	Costal fracture	Symptomatic therapy and monitoring	N/A	1
General Surgery	Costal fracture	Symptomatic therapy and monitoring	N/A	10
General Surgery	Costal fracture complicated with pneumothorax	Thoracic drainage Symptomatic therapy and monitoring	N/A	8
General Surgery	Costal fracture complicated with splenic fracture	Splenectomy in OR Symptomatic therapy and monitoring	1	5
Orthopaedics	Femoral fracture	Reduction in OR	N/A	6
Orthopaedics	Tibial and fibular fracture	Reduction in OR	N/A	8
Orthopaedics	Tibial and fibular fracture	Reduction in OR	N/A	5
Orthopaedics	Achilles rupture	Tenorrhaphy in OR	N/A	1
Neurology	Subarachnoid haemorrhage in a complex skull fracture	Symptomatic therapy and monitoring	1	12
Neurosurgery	Subarachnoid haemorrhage, pneumocephalus, subdural haematoma, brain contusion and complex fracture involving the foramen magnum	Unavailable data*	Unavailable data*	11

N/A: not applicable; OR: operating room.
* Data related to the length of stay in ICU and treatment regarding the patient transferred to Neurosurgery at another hospital were unavailable

handling, could represent a sub-population at risk. However, it should be noted that members of the public presented with all major traumas. Given the high number of bullfight events and the fact that these events are part of the region's tourist attractions, studies with larger samples are required to assess this relationship and to reconsider the effectiveness of the safety measures currently in place and the warnings that should be given to the population.

Although it has shown some limitations in predicting outcomes when there are multiple fractures affecting the lower limbs or in patients presenting with head trauma,[15,16] ISS is a good indicator of severity.[17] Out of the hospitalised patients, 40% presented with major trauma with a median ISS of 10.5 (IQR 17.7). In addition, 30% of the hospitalised patients were admitted to the intensive care unit (ICU) and 50% required urgent surgery in the operating room. These figures confirm the significant use of hospital resources, associated with high costs. In addition to these costs and the need for resources to be made available, the aeromedical evacuations carried out to transfer patients from the islands of São Jorge and Graciosa to the HSEIT and from the HSEIT to other local hospitals should be considered, while these were not recorded in this study, even though they represent relevant limitations related to insularity and which should be taken into account when considering these patients.

The study hospital is the only one covering the three islands of the Azores where most of these events take place. However, the authors highlight the constraints related to insularity potentially leading to an underestimated number of episodes related to these events. Although some injuries involving patients from the islands of São Jorge and Graciosa were recorded, it is hypothesized that some minor incidents were looked after at the basic emergency units of the health centres on these islands.

To the best of our knowledge, this is the first descriptive study of traumatic injuries associated with bullfights. As such, we believe that this work adds value to any previous knowledge and represents a starting point for further studies.

The small sample size and the short data collection period are limitations of the study and have not allowed any statistical significance and consistency of the results, even though they could be a starting point for other studies aimed at better characterising these injuries and their correlations.

For a catchment area of around 65,000 people,[18] one bullfight-on-the-rope for every 283 population has been held. The 56 traumatic episodes led to 80 injuries, 22 bone

fractures, 10 hospital admissions, three ICU admissions and six surgical interventions in the operating room. Over the two years of the study, for every 100 bullfights held, 17 traumatic injuries have occurred, 15 days of hospital stay, one patient admitted to the ICU and 1.3 surgeries in the operating room. Although these figures should be interpreted with caution due to the small sample size, these are a reminder of the impact of these events in terms of the economic costs involved, the health costs for the local population, the safety measures currently in place and the availability of resources to look after these patients.

CONCLUSION

Direct trauma was the main cause found in this study. There was a predominance of closed trauma, and the head and neck were mostly affected. An 18% hospitalisation rate and an 8% major trauma rate were found; around 11% of the patients underwent surgery in the operating room.

AUTHOR CONTRIBUTION

BV: Study design, writing of the study protocol, data collection, analysis and interpretation; writing of the manuscript and approval of the final version

VT, AV: Study design, review of the study protocol, data collection and interpretation; critical review of the manuscript

DS, DM, FP, JS, LM, LP, MV, OR, SV, RB, TO, AM: Study design; data collection and final approval of the manuscript

ASo: Study design, data collection, analysis, and interpretation; critical review of the manuscript

ASi, DG: Study design, data collection and critical review of the manuscript

IB: Data analysis and interpretation and critical review of the manuscript

HUMAN AND ANIMAL PROTECTION

The authors declare that this project complied with the regulations that were established by the Ethics and Clinical Research Committee, according to the 2013 update of the Helsinki Declaration of the World Medical Association.

DATA CONFIDENTIALITY

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

CONFLICTS OF INTEREST

IR has received consultancy fees from Novo Nordisk; fees for lectures, presentations, conferences, manuscript writing or educational events from Boehringer Ingelheim, Astra Zeneca and MSD; support for attendance at meetings and/or travel from MSD, Ferrer Portugal, and Novo Nordisk.

The authors declare that they have no conflicts of interest related to this work.

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