

The spectrum of animal related injuries managed at a major trauma centre in South Africa

EU Wessels,¹ VY Kong,^{1,2} J Buitendag,³ S Moffatt,⁴ R Weale,⁵ AB Ras,² M Ras,² MTD Smith,² GL Laing,² JL Bruce,² W Bekker,² V Manchev,² DL Clarke^{1,2}

¹ Department of Surgery, University of the Witwatersrand, Johannesburg, South Africa

² Department of Surgery, University of KwaZulu-Natal, Durban, South Africa

³ Department of Surgery, Tygerberg Hospital, Stellenbosch University, Cape Town, South Africa

⁴ Department of Surgery, University Hospitals Coventry and Warwickshire NHS Trust, Coventry, United Kingdom

⁵ Department of Surgery, North West Deanery, Manchester, United Kingdom

Corresponding author: Victor Kong (victorywkong@yahoo.com)

Background: Humans come into contact and interact with an array of animals in a number of areas and environments. We set out to review our experience with animal-related injuries in Pietermaritzburg, KwaZulu-Natal, South Africa.

Methods: All patients who sustained an injury secondary to an interaction with an animal in the period December 2012–December 2017 were identified from the Hybrid Electronic Medical Registry (HEMR).

Results: There were 104 patients in the study sample. The mean age of patients in the study was 32.8 years, with a range from 1 to 76 years old. 75% (n = 78) were male and 25% (n = 26) female. Out of the 104 animal-related injuries, 67 were blunt trauma, 39 penetrating trauma and 3 a combination of blunt and penetrating trauma. The species causing trauma included dogs (53), horses (29), cows (18), buffalo (1), warthog (1), impala (1) and a single goat (1). The median time from injury to hospitalisation was 46.62 hours (range from 0 to 504 hours). Injuries occurred to the head (n = 32), face (n = 9), neck (n = 32), abdomen (n = 22), urogenital system (n = 6), upper limb (n = 39) and lower limb (n = 39). The Injury Severity Score (ISS) mean for the patients was 8.16, the range 1–4, the median 9 and the standard deviation 6.88. In 49 patients the treatment was non-operative. In the remaining 55 patients, a total of 68 operative procedures were required. Operations included wound debridement/surgical washout (n = 38), laparotomy (n = 9), arterial repair/ligation (n = 8), skin graft (n = 4), craniotomy (n = 5), fasciotomy (n = 2), amputation (n = 1), and placement of an ICP monitor (n = 1). 49 of these operations were for patients with dog bite injuries. The mean hospital stay was 0.13 days with a range of 0–4 days. Four patients were admitted to the Intensive Care Unit (ICU) and two patients died.

Conclusion: Human interactions with animals may result in injuries which require surgical treatment. The most common animal injury is a dog bite but in the case of the larger domestic farm animals, blunt force type injuries and goring can result in significant injuries which require complex surgical interventions.

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Introduction

Humans come into contact and interact with an array of animals in a number of different environments. These include the work place, home, and during recreational activities. Human and animal interactions may occur in both urban and rural settings and these different contexts may result in nuances in both the spectrum and the management priorities of these injuries. Despite the frequency of human and animal interactions, the literature on the topic is limited.¹⁻⁵ Our trauma center serves a vast area and a diverse population in the KwaZulu Natal Province of South Africa. This includes both the city of Pietermaritzburg and the rural western hinterland of the province. This mix of urban and rural means that animal-

related injuries are relatively common in our environment. In light of this, we set out to review and describe our experience with animal related injuries. Our objective was to increase our understanding of the nature and outcome of these injuries, to use this information to refine our current management algorithms and strategies and to inform potential injury prevention approaches.

Materials and Methods

Clinical Setting

This study was a retrospective review of our prospectively maintained regional electronic registry (HEMR). It was

undertaken in the Pietermaritzburg Metropolitan Trauma Service (PMTS), Pietermaritzburg, South Africa. Our registry was reviewed for the 5-year period from December 2012 to December 2018. Ethics approval to maintain this database has been granted by the Biomedical Research Ethics Committee (BREC) of the University of KwaZulu-Natal (BE221/13 and BE 207/09). KwaZulu-Natal is located on the east coast of the country and has a population of over 11 million people. Fifty per cent of the population live in the rural areas. The PMTS provides definitive trauma care to the city of Pietermaritzburg, the capital of KwaZulu-Natal (KZN) province. It is one of the largest trauma centers in the province and serves as the referral center for 19 rural hospitals, with a total catchment population of over three million people. The urban district (UD) includes the city of Pietermaritzburg and the surrounding suburban areas. The rural district (RD) includes all areas outside the geographical boundaries of the city of Pietermaritzburg. Surgical staff maintain a digitised registry for assessment and re-evaluation of outcomes. This registry is known as the Hybrid Electronic Medical Registry (HEMR).

The Study

All patients who sustained an injury secondary to an interaction with an animal in the period December 2012–December 2017 were identified from the HEMR. Basic demographic descriptions were performed. The severity of injury was grouped using the Abbreviated Injury Scale (AIS) and Injury Severity Score (ISS). Outcomes reviewed included the need for surgery, the type of surgery and the associated morbidity and mortality.

Statistics

Data were processed and analysed using Stata 13.0 (Stata Corp. 2013. Stata Statistical Software: Release 13. College Station, TX: Stata Corp LP).

Results

Demographics

There were 104 patients who sustained an animal related injury. Seventy five per cent (n = 78) were male and 25% (n = 26) female. The mean age was 33 years (range: 1–76 years). There were 67 blunt trauma, 39 penetrating trauma and 3 patients with a combination of blunt and penetrating trauma. The species causing trauma included (53) dogs, (29) horses,

(18) cows, (1) buffalo, (1) warthog, (1) impala and (1) goat. Table 1 depicts the breakdown by species. Of the 29 horse related injuries, 17 were kicks and the remainder falls. Ten of the dog bite victims were aged ≤ 16 years. The mean time from injury to admission was 16 hours.

Body Region Injured

Injuries occurred to the head (n = 32), face (n = 9), neck (n = 32), abdomen (n = 22), urogenital system (n = 6), upper limb (n = 39) and lower limb (n = 39). The mean Injury Severity Score (ISS) was 8 with a standard deviation of 6.8. The dog bites were to the following body regions: head and neck (41%), upper limbs (57%) upper leg (6%), lower leg (57%), abdomen and groin (6%). Of the 17 horse-kick injuries, ten were to the face or head, four to the abdomen, two to the chest and one to the groin (Table 2).

Table 2. Physiology on Presentation

Mean HR (BPM)	91.7
HR range (BPM)	47-193
Median HR (BPM)	88
Mean SBP (mmHg)	126.31
SBP range (mmHg)	78-198
Median SBP (mmHg)	123.5
Mean lactate (mmol/L)	3.75
Lactate range (mmol/L)	0.6-27
Median lactate (mmol/L)	1.8
Mean GCS	14.13
GCS range	2-15
Median GCS	15
Mean Temp (°C)	36.38
Temp range (°C)	33-37.8
Median Temp (°C)	36.3
Mean pH	7.36
pH range	7.11-7.54
Median pH	7.36
Mean Hb (g/dL)	11.97
Hb range (g/dL)	3.78-16
Median Hb (g/dL)	12.4
Mean RTS	7.2823
RTS range	3.8028-7.8408
Median RTS	7.8408

Table 1. Species causing injury

Dog	53
Horse	29
Cow	18
Buffalo	1
Warthog	1
Impala	1
Goat	1

Management

In 49 patients the treatment was nonoperative. In the remaining 55 patients a total of 68 operations were required. The animal injury most likely to require surgery is a dog bite, of which (72%) required surgery, followed by cattle and horse related injuries of which (34%) and (32%) required

Management	Count
Non-surgical management	49
Wound debridement/surgical washout	38
Fasciotomy	2
Laparotomy	9
Artery repair/ligation	8
Craniotomy	5
ICP Monitor	1
Skin graft	4
Amputation	1

Species	Management	Count	Percentage	
Dog 53	Non-surgical management	15	28%	
	Debridement	34		
	Fasciotomy	1		
	Laparotomy	1		
	Arterial repair	8		
	Skin graft	4		
	Amputation	1		
	Horse 29	Non-surgical management	20	68%
		Debridement	2	
Laparotomy		3		
Craniotomy		3		
Subdural evacuation		1		
Neurosurgery unspecified		1		
Cow 18		Non-surgical management	12	66%
	Debridement	1		
	Fasciotomy	1		
	Laparotomy	4		
	Subdural evacuation	1		
Impala	Laparotomy	1		
Buffalo	Non-surgical management	1		
Warthog	Debridement	1		
Goat	Non-surgical management	1		

surgical management respectively. Table 3 documents the type of surgical procedures required. These include wound debridement/surgical washout (n = 38), laparotomy (n = 9), arterial repair/ligation (n=8), skin graft (n=4), craniotomy

Mechanism/species	Injury
Dog bite	Gastric perforation
Horse kick	-Single small jejunal perforation with soiling of the entire abdomen
Horse kick	Small bowel perforation with four quadrant contamination
Fall from horse	Proximal jejunal injury, pancreatic contusion, grade II renal injury
Penetrating injury from cow (goring)	Single jejunal perforation at mesenteric border,
Penetrating injury from cow (goring)	Rectal Injury
Penetrating injury from cow (goring)	Midline Laparotomy - repair of anterior abdominal wall defect + lymph node biopsy
Penetrating injury from cow (goring)	Diaphragm injury and liver laceration
Penetrating horn injury from impala	Single small bowel injury

(n = 5), fasciotomy (n = 2), amputation (n = 1), and placement of an ICP monitor (n = 1). The management is subcategorised according to species and is shown in Table 4. Of the nine laparotomies, the following injuries were identified: gastric perforation (1), and small bowel perforation (8). The animal injures requiring laparotomy were dog bite (n = 1), kick by horse (n = 2), fall off a horse (n = 1), gored by cow (n = 4), and gored by antelope (n = 1). The injures found at laparotomy are documented in Table 5. Of the ten children who sustained a dog bite, six required surgery. These operations included one laparotomy for a gastric repair and five debridements. All the vascular injuries were secondary to dog bites and included the injuries to the following vessels: brachial artery (4), radial or ulnar artery (3) and superficial femoral artery (1). Out of the 16 upper limb dog bites in our series 8 sustained a vascular injury. The mean hospital stay was 0.13 days with a range of 0–4 days. Four patients were admitted to the Intensive Care Unit (ICU) and two patients died.

Discussion

Human and animal interactions are common and may result in serious injury. Our data is similar to that reported from other regions in that animal-related trauma occurs most commonly in males in their third decade.¹⁻⁵ This is usually the economically active group who work with animals. The one exception to this is dog bites where there is a significant number of children who are at risk of being bitten. The most common animal to cause trauma is the domestic dog and these bites require debridement and antibiotic therapy.⁶⁻⁸ In addition, in South Africa, there is the associated risk for the transmission of viral illness and appropriate steps must be taken to administer rabies prophylaxis. Dog bites can

require more complex surgical interventions which include vascular exploration, amputation and laparotomy. Dog bites to the upper limbs in particular are a risk for vascular injury to the brachial artery which is relatively superficial, being just proximal to the elbow. The ulnar and radial arteries are also prone to injury. This was the situation in eight patients. Dog bites are a public health problem as dogs can roam and may enter areas like school yards and other public spaces where they can come into contact with children and adults. Strategies to prevent dogs from roaming and to minimize contact between humans and unknown dogs are necessary.

Interactions with horses and cattle include falls, kicks and being gored or butted.^{9,12} With cattle, the majority of injuries are secondary to being gored or kicked.^{9,10} Goring creates a highly septic wound which needs to be aggressively debrided and washed out. Five patients, in our series, required a laparotomy after being gored in the abdomen, by cattle (n = 4) and in one case by an antelope (n = 1). Agricultural workers must be conscious of the implications of these injuries, when working with cattle. Cattle are large unpredictable animals and can be aggressive if startled. Injury prevention strategies must educate farm workers as well as modify the working environment with appropriate planning and equipment. Barriers help protect workers during milking, when cows may be startled by the application of milking devices. Other events which may startle cattle include tagging, and separating calves from mothers. Farm workers must be trained to understand animal behavior and to employ safe handling techniques.^{9,10} Farm workers and equestrian enthusiasts are at risk of horse-related injuries. These include being kicked by the horse or falls from a horse. Figure 1 shows a hoof print on the chest of a lady following a kick to her chest. These injuries can require major surgical interventions and the sheer weight of the animal must be borne in mind when thinking about the mechanism. Those who fall from horses are at risk of spinal and neurological injury and care must be taken to preserve cervical spine immobilisation and to exclude any intracranial injury. Over a third of the 29 patients who sustained their injury from a horse required a major surgical intervention of which half were neurosurgical. Agricultural workers must be taught about health and safety and provided with appropriate animal handling and protective equipment. Particular care must be paid to potential head and neck injuries in people who work with horses, as these can be significant.

Blunt force injuries to the abdomen may result in both solid visceral injury and hollow visceral injury.¹³ Generally hollow visceral injury is associated with delayed diagnosis and a prolonged hospital course. This is very much the case in this series and the two laparotomies undertaken for patients who had been kicked by a horse were associated with significant contamination and the need for repeat surgery. The other laparotomy was for a rider who had fallen off a horse and sustained a jejunal laceration as well as a pancreatic and renal injury. Staff treating patients who have been kicked by a horse need to be aware of the potential of a blunt hollow visceral injury.



Figure 1. Horse hoof print on the chest of a female equestrian

In our series, interactions with wild animals were much less common than with domestic species. Humans come into contact with wild animals either as workers on game ranches or whilst hunting. The injury is usually a goring. The size of the wild animal determines largely which parts of the body are injured. Once again workers and hunters must be educated about the dangers of dealing with these animals especially when they are trapped or frightened, as sudden goring movements can result in significant injuries.

There is evidence to suggest that there are significant barriers to access of trauma care in rural areas both globally and within South Africa. The resources available to treat trauma in rural environments^{14,15} are often less than adequate, and in addition rural trauma victims face prolonged transfer periods to urban trauma centers. The major industries and activities in rural areas are agriculture, forestry and tourism and these are the very activities which are likely to place humans in close proximity to both domestic and wild animals. In light of this, strategies to prevent animal related injury in rural areas are particularly necessary.

Conclusion

Human interactions with animals may result in injury which requires surgical care. The most common animal injury is a dog bite. In the case of the larger domestic animals, blunt force type injuries and goring can result in significant injuries which require complex surgical interventions. Injury prevention strategies need to be informed by these findings.

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