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The Pit Bull attack causing limb threatening vascular trauma –A case series

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ABSTRACT

INTRODUCTION: Non-fatal human dog bites are commonplace amongst animal attacks on human beings and these present with mainly skin and soft tissue injuries. However, they can also present with life threatening head and neck injuries, massive soft tissue trauma, as well as combined orthopedic and vascular extremity injuries where a high possibility of limb loss exists.

PRESENTATION OF CASES: We present two adult dog bite victims with multiple bites inflicted by large canines identified as Pit-Bull Terriers. They were presented with deep lacerations to the axillary area resulting in limb ischemia and loss of upper limb pulses. The right axillary artery was crushed in both patients whilst the axillary vein was lacerated in one. The vessels were repaired; the wounds debrided and both limbs were salvaged.

DISCUSSION: Canine attacks by Pit Bull Terriers and Rottweiler's can occur at any age and in any anatomical area of the body particularly the limbs. Injuries involving the extremities presenting with no pulses or pulsatile bleeding demand an urgent exploration as any undue delay is intolerable especially if there are bony injuries like fractures or fracture/dislocation. All patients with complex neurovascular injuries should be managed by a multidisciplinary team for an optimal outcome.

CONCLUSION: Attacks by Pit Bull Terriers are more likely to cause severe morbidity than other breeds of dogs. Immediate surgical exploration is required to prevent catastrophic outcomes, especially limb loss. Stronger animal control laws, public education and responsible dog ownership may reduce deaths from these canines.

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1. Introduction

This paper documents 2 case reports on limb threatening vascular trauma following pit bull attack and its results. It is compliant with the process criteria [1]. In the United States, approximately 324 000 people have non-fatal dog bites each year [2]. Animal-patient injuries present as a spectrum of injuries from superficial skin and soft-tissue injury to severe mauling with the most common “biting animals” being the domesticated dog and house cat (78%) [3] and, as expected, the larger the breed the more severe the injury. Children aged 12 years and under were seven times more likely to have a hospital admission following an attack and males accounted for a higher rate of bites than females (52.9%) [2,4]. Injury rates usually tended to decrease with increasing age [2].

Approximately 2% of these injuries go on to require hospitalization for severe soft tissue trauma, neurological, bony and vascular

injuries. In the case of limb trauma, the upper limb is more commonly injured than the lower limb but only a small portion of these injuries end up with limb threatening injuries requiring surgical intervention [5].

There are no known published local data available with which to compare, but the critical injuries are mainly seen in urban areas and most of these injuries are referred to an institution which oversees general surgical as well as orthopaedic, paediatric and vascular trauma. All adult injuries have a joint team approach with a surgeon with general and vascular experience and an orthopaedic surgeon involved in consultation and decision making.

2. Case 1

A 34-year old pregnant mother of two was attacked on a public roadway after dropping her children off to school. She was attacked by two (2) large canines identified as two Pit Bull Terriers. And she sustained severe bites to left arm (minimal) and severe bites to her right axilla and upper arm (Fig. 1). She was rescued by passers-by and taken by ambulance to her local hospital which recognized

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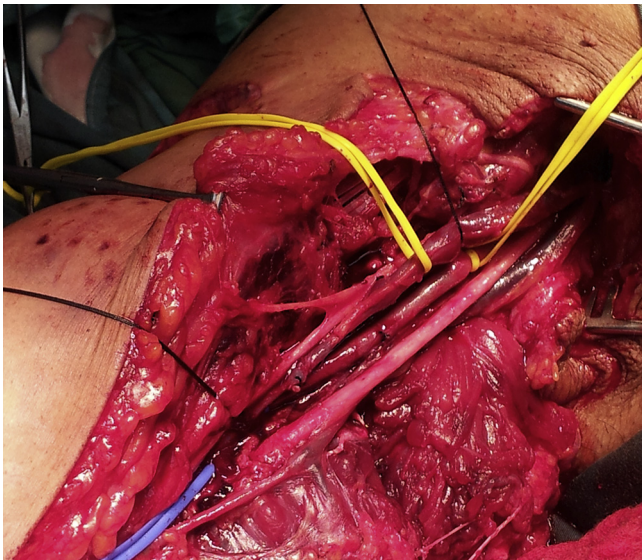


Fig. 1. Showing multiple bite marks with associated crush injury to the arm.

that the bites were severe enough to warrant transfer to a hospital equipped with handling this level of trauma.

She had severe blood loss and was recorded to be in shock initially treated by applying a compressive dressing to tamponade the active bleed which appeared to be venous in origin. The patient was resuscitated and treated for hypovolemic shock and transferred to our facility.

She was stabilized in the A&E department, and an assessment was made to determine the extent of trauma due to the bite injury and to determine the source of her blood loss. Her right hand remained minimally perfused with poor capillary filling, no palpable pulse at the radial, ulna and brachial arteries and it was cooler than the left upper limb. Hand –held Doppler investigation yielded no Doppler signals at the wrist vessels or the brachial artery.

The bleeding from the axilla was greatly reduced by the dressing and a decision was taken to explore it on the presumption that there was vascular injury to the upper brachial or axillary artery (and vein) without the prior need for imaging. If required, an on-table angiogram would be performed during surgery.

At surgery, the axilla was explored and the axillary vein was found to be completely severed (the source of the hemorrhage) and there was a 5 cm length of contused axillary artery which was crushed and thrombosed (Fig. 1). Repair took the form of resection of this section of axillary artery and use of greater saphenous vein from the left thigh and repair of the right axillary artery and vein using this venous conduit (Figs. Fig. 2a,b, Fig. 3, Fig. 4). The limb warmed up and there was a good radial pulse post repair with confirmatory good Doppler signals.

3. Case 2

A 53-year-old male was attacked by a large canine on the roadway as he was entering his front gate and was found at home by his relatives with multiple lacerations and abrasions to right and left upper limbs. At the District Hospital, the superficial sub centimeter puncture wounds were cleaned and primarily repaired, he was initially noted to have bled significantly prior to admission but was not actively bleeding whilst he attended to at the District Hospital. The patient was noted to have a particularly deep laceration over right axilla and was documented to have some loss of sensation over dorsum of hand and a wrist drop but no documentation of pulses was made. He was referred to the area Trauma Centre for further care where he was found to have loss of sensation and

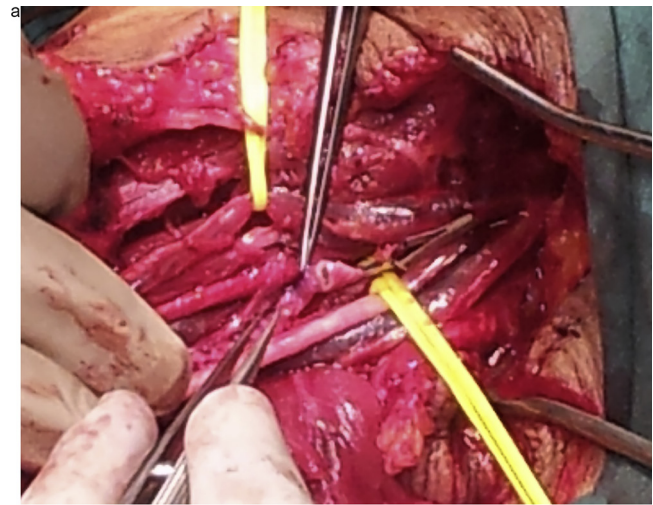


Fig. 2. a) Starting of proximal arterio venous anastomosis using autogenous reverse vein graft. b) Completed proximal arterio venous anastomosis using autogenous reverse vein graft.

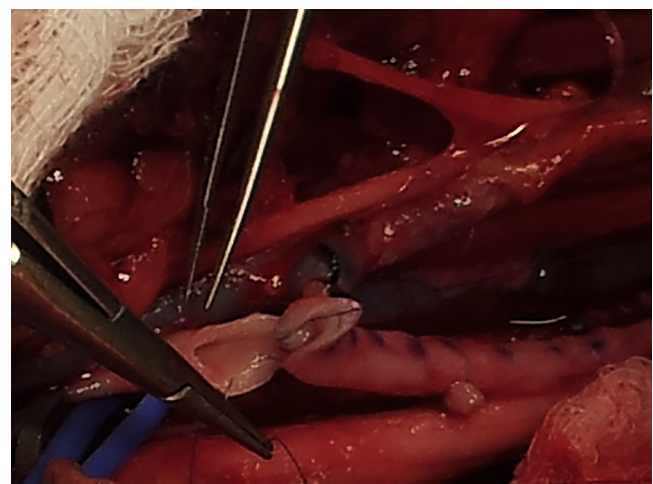


Fig. 3. Distal arterio venous anastomosis using autogenous reverse vein.

wrist drop of right hand and no right radial pulse, coolness to limb, and pallor of the palmer surface of the right hand, on arrival at the Accident and Emergency. Hand-Held Doppler examination noted no recordable signals at the right radial, ulnar and brachial arteries.

The right axilla was explored, via an incision along the deltopectoral groove and onto the chest wall to isolate the axillary artery. The axillary and brachial arteries were isolated and the axillary

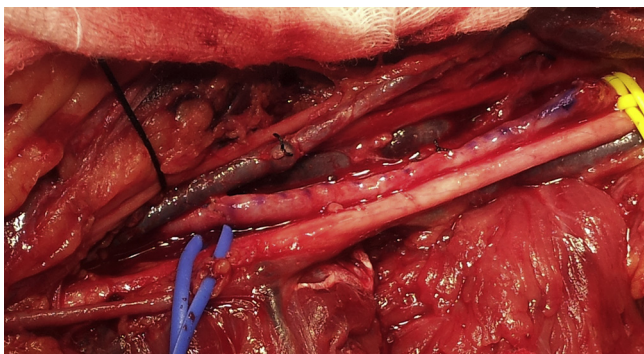


Fig. 4. Completed proximal and distal anastomosis.

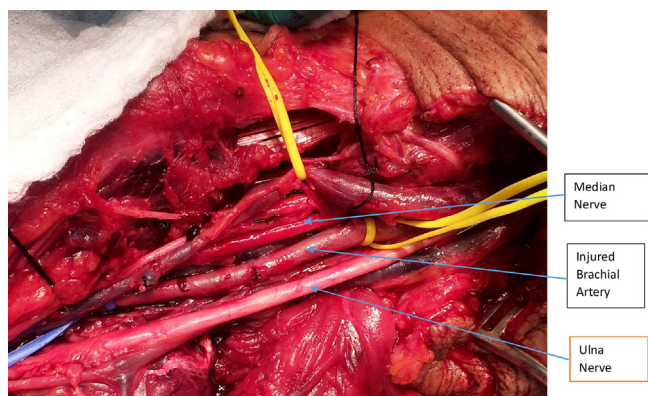


Fig. 5. Intraoperative picture showing the thrombosed brachial artery with surrounding nerves and veins.



Fig. 6. Intraoperative picture showing the damaged endothelium of the brachial artery.

artery was noted to be crushed with no blood flow distal to this segment due to severe thrombosis (Figs. 5 and 6). There was no venous injury and an autogenous reversed greater saphenous vein harvested from the left thigh was used as an interposition graft. Due to the length of time taken to taken to arrival at hospital and the nature and extent of the injury, forearm fasciotomies were also performed.

Following surgical repair, he was found to have a normal palpable right radial, ulna and brachial pulse with good Doppler signals. There was no formal exploration of the radial nerve since, due to the nature of the injury, a neuropraxia was suspected. There was eventual recovery of power and sensation to the affected fingers and



Fig. 7. Healed fasciotomy scar on forearm.

the patient could use his hand and at review 3 years after injury has recovered full use of his right hand after resolution of his wrist-drop (Fig. 7). No wound infection or other notable complications occurred.

4. Discussion

Dog bites are amongst the most common type of animal bites, with the injuries varying from skin and subcutaneous injury to massive tissue loss and limb and life-threatening trauma. A severe attack constitutes a dog repeatedly biting or vigorously shaking a victim with “extreme difficulty in terminating the attack” [6]. Maiming and death are uncommon but in the USA, from 1979 to 1994 there were 279 human deaths recorded due to attacks by dogs [7] and an average of 19 deaths per year occurred from 1979 to 2005 with males and children under 10 having the highest death rate [2,8].

In general, attacks were carried out by American Staffordshire Terriers, St. Bernard's and Cocker spaniels [6] but the type of dog was not always recorded since there was uncertainty with some species identification. In one study, 228 patients were treated for dog bite injuries but only in 82 the breed was recorded and 29 of these were due to Pit Bull Terriers. From 1979 to 1988, 157 dog bites related fatalities occurred (70% being children) and Pit Bull Terriers were involved in 41.6% of cases with German Shepherds being the next most commonly reported species [10]. Deaths caused by Pit Bull Terriers increased from 20% in the 1979/80 period to 62% by 1987/88 and at least 25 breeds of dogs were involved in human deaths from 1979-1998. However, Pit Bull Terriers and Rottweilers were accountable for more than 50% of cases [11].

Attacks by Pitt Bull Terriers were associated with a higher median Injury Severity Scale score (4 vs. 1), higher risk of an admit-

ting Glasgow Coma Score of 8 or lower (17.2% vs 0%) and a greater risk of death. Compared with other breeds of dog, attacks by Pit Bull Terriers were associated with higher morbidity, hospital charges and risk of death [9].

Although the pattern is variable, most injuries due to severe dog bites were on the head, neck or shoulders [7] in adults and head, neck and upper extremity in children [12,13]. Most injuries involved bony and soft tissue trauma [14] but tendon, nerve and vascular injuries were also noted and of all bites causing tendon dysfunction, nerve palsy and vascular trauma, most of these canine bites were on the forearm [15].

Concerning vascular injuries, dog bites were noted to affect the upper extremity (especially the right) most commonly [16] and the vessel injured in decreasing order of frequency was the axillo-brachial artery, the radial artery, radial and ulna artery combination and the cephalic vein [14]. Recognizing the vascular injury appeared to pose no diagnostic dilemma to the examining physician since an absent or decreased pulse was a significant indicator of vascular trauma and most had proximity-only injuries [15]. Generally, the most common vascular hard sign was an absent palpable distal pulse and most common vascular soft sign was a reduced pulse compared with the opposite side. Therefore, the most common clinical finding on examination was abnormal pulse examination (85%) [6,14,15] and absent Doppler signals [14]. Another hard sign found included pulsatile bleeding from a severed artery or torrential haemorrhage from a lacerated vein. In our patients, one presented with torrential bleeding (Case 1), absent pulses and a cool limb, the other with absent pulses and a wrist drop (Case 2). Other clinical features were related to proximity trauma to vessels with findings such as bony fractures, joint dislocation and nerve palsies (Case 2).

No studies have been done to look at the need for early exploration of nerve palsies. Retrospective studies have advocated against early nerve exploration given the fact that most recover with nonsurgical treatment [15].

In the main, injuries involving the extremities presenting with no pulses or pulsatile bleeding demand exploration in urgent fashion and any delay is intolerable especially if there are bony injuries like fractures or fracture/dislocation when an orthopaedic team may vocalize a desire to fix and stabilize the bony injury first, before vascular repair. Imaging may be then rightly regarded as a luxury but a stable patient may undergo anything from a Colour-flow enhanced duplex scan to a CT angiogram to localize and quantify the nature and extent of the injury. Even though the duplex is a relatively inexpensive and non-invasive test, to detect clinically important arterial injuries which may require surgery, colour flow scans may be less sensitive than arteriography in detection of lesions that are small or clinically insignificant [17,18].

The most common type of vessel trauma due to a canine bite was an occlusion (60%) [15], but there are usually two components of a dog bite, a penetrating injury usually causing puncture or laceration to the vessel and a blunt one which may be the more clinically significant injury [13]. Superficial dog bites in children can present in a delayed fashion as well following blunt arterial trauma [19] and one can define a crush injury as a maceration or contusion of the artery [14] with a laceration causing a partial or complete transection (as in our Case1, the axillary vein). In general, vascular injuries of the upper limb vessels take the form of complete transection, laceration, thrombosis with contusion, intimal flap and false aneurysm formation as well as arterio-venous fistulas [20].

Surgical procedures include primary repair, arterial ligation, arterial bypass or combinations of these three and any segmental repair or long segment thrombosis will require a bypass or interposition graft. Our patients both had the thrombosed segments excised with reversed greater saphenous vein interposed in continuity using an end to end anastomosis.

The incidence of infection of wounds following canine bites is considered substantial and upper extremity wounds seem to be more prone to get infected than the lower limb and a delayed presentation compounded this higher incidence [14]. Puncture wounds were more likely to become infected as well as were bites on the hand (which were considered high risk). Prophylactic Penicillin-type drugs then appeared to decrease the likelihood of an infection in this high risk setting [21] and our patients were placed on a second-generation Cephalosporin and an anti-anaerobic drug such as metronidazole and were discharged home with a one week supply.

Both our patients had good post-operative pulses, limb salvage and three and six-month clinic follow up with no adverse sequelae nor wound infections with a return to normal functional activity. Psychological support was provided for the first patient.

5. Conclusion

Canine bites causing vascular injuries are relatively uncommon but larger species such as the Pit Bull Terrier can inflict major injury especially if the victim is attacked by more than one animal. The upper limb is one of the commonest anatomical areas of injury and patients who present with injury to the axillary-brachial artery and vein risk limb threat or death from exsanguination as well. Once the clinical signs such as a low volume or absent pulse is noted and confirmed by Hand-Held Doppler, early exploration and vascular repair is carried out immediately. Fasciotomy may be utilized depending on the duration and extent of the injury and vein graft repair allows for limb salvage and good long-term results. Attacks by Pit Bull Terriers are more likely to cause severe morbidity, hospital admissions and poor outcomes than other breeds of dogs and regulation of these animals may greatly reduce the severity of attacks on unsuspecting individuals. Stronger animal control laws, public education and responsible dog ownership may reduce deaths from these canines.

Conflicts of interest

There is no conflicts of interest amongst the authors in publishing this case series.

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Ethical approval

Ethical approval is not required by our institutions– just to publish to two isolated case report. This is just to document the mere findings and outcome of two isolated cases.

Consent

Informed consent was obtained from both of the patients.

Author contribution

All authors have contributed significantly in this case series. The first two authors have performed the surgery and rest of the authors helped in collecting data, designing, organizing to write the manuscript as well as assisted in critical analysing of the manuscript. All authors have approved the final version of this manuscript.

Registration of research studies

Limb Threatening Vascular Trauma Following Pit Bull Attack –A Case Series UIN #3337.

Guarantor

The corresponding author and the first author (Mr. Patrick Harnarayan) will accept the full responsibility for the work.

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