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CASE REPORT

Snakebite Envenomation, Case Presentation with Limb Salvage Aponevrotomy and Practice Update

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Abstract

Snakebites are a major public health problem relatively common in low-income countries in Africa. Envenomation in children are usually mild or severe and often occurred during outdoor activities in limb extremities, especially the lower limbs. It is considered by WHO as a neglected tropical disease (NTD). It is a serious life threatening emergency in inadequate health facility area since anti venom treatment considered as the mainstay treatment may not be available. Recently the other types of anti-venoms were introduced in practice with more availability and ease the medical care. Nevertheless surgical care is still needed for the wounds that can develop secondary to necrosis and the need of fasciotomy when compartment syndrome seems to develop. We report the case of a school age child who presented with grade 4 signs of envenomation complicated by a compartment syndrome, for which a subcutaneous fasciotomy was performed following anti venom, prophylactic antibiotics and analgesics, with favorable evolution.

Snakebites in children can be more severe and potentially fatal due to their smaller size and higher ratio of venom to body mass. Effective anti-venom, prophylactic antibiotics and fasciotomy in case of a compartment syndrome are very effective means of handling snakebites in children.

Keywords: Snakebite, Envenomation, Fasciotomy.

1. Introduction

Snakebites are a major public health problem relatively common in low-income countries in Africa. One third of the victims of snakebite envenomations are of pediatric age[1] .Snakebite envenomations are a major cause of mortality and permanent disabilities in the pediatric population of tropical countries especially in rural areas[2]. Predominantly, victims are males with a mean age of 10 years old[2].The population-incidence of hospital-attended snakebite is highest for children aged 6–12 years[1].

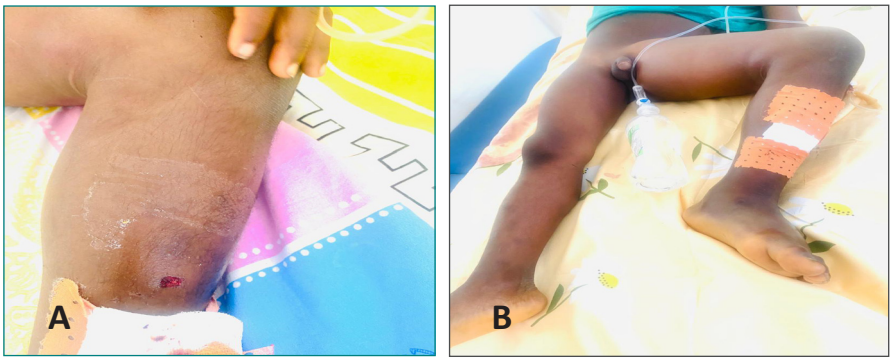

Figure 1. *A: Site of snakebite. B: Left lower limb swelling extending up to the groin crease*

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Envenomations in children are usually mild or severe and often occurred during outdoor activities in limb extremities, especially the lower limbs[3]. Hemostasis disorders frequently occur but are rarely associated with severe exteriorized hemorrhage. Low hemoglobin and leukocytosis with predominant PNN are usually present on full blood count on admission with rapid tendency to normalize before 48 h. The onset of acute kidney injury is a frequent complication but is restored in most patients within 48 h. Local symptoms are the main signs that evolve to a compartment syndrome and tissue necrosis in the absence of antivenom therapy. These local effects are usually pain, swelling, ecchymosis and blisters, that evolve towards significant local tissue necrosis, including myonecrosis and cutaneous necrosis. Swelling is often more severe and widespread in children, although recovery is faster than in adults. The risk of developing compartment syndrome, depends on the site of the bite, the volume and type of venom injected, and the local reaction

Antivenom administration is associated with rapid improvement in hemostasis disorders, reduced blood transfusions and fasciotomy for compartment syndrome as well as a shortened length of stay in pediatric intensive care unit[4].

Figure 2. *Left lower limb fasciotomy*

Acute compartment syndrome (ACS) of the extremity is a limb-threatening condition, resulting from increased pressure within a non-expansile tissue space and, if untreated, results in limb loss. ACS mandates urgent treatment as delayed therapy results in significant morbidity[5]. Fasciotomy is definitive and ensures immediate reduction of intra-compartment pressure by releasing the skin and fascia, so allowing oedematous and swollen muscle to expand[6,7]. Fasciotomy must not be omitted if the clinical scenario demands, but due consideration must be given to the associated morbidity

2. Case Presentation

A 6-year-old male patient who was received at the emergency center after presenting with a left lower limb pain and swelling 18 hours after a snakebite. History reveals that he had he had moderate bleeding from injured site and pain of moderate intensity, which prompted the application of traditional herbs on the wound surface. Evolution 2 hours later was marked by increase in pain intensity and gradual swelling of left lower limb up to the knee level. He consulted at a small clinic where anti-tetanic serum was administered, wound dressing done on the injury site and the patient was referred to the Yaounde University Teaching Hospital for proper management where we received him 18 hours after the snakebite.

He had no contributive past medical or surgical history. Physical examination revealed a tachycardic and tachypnoeic patient at 170bpm and 36 cycles per minute respectively, with a swollen, warm, and tender left lower limb. Swelling extended up to the groin crease. A bleeding punctiform wound of about 1cm on the anterior aspect of the distal 3rd of the left leg was seen. On palpation, we hadweak popliteal and posterior tibia pulses, dorsalispedis pulse absent. There was decreasedmobilisation of the knee, decreased mobilisation of toes. Two left, tender ,firm, smooth inguinal lymph nodes, size:1.5-2cm. Preserved sensation of the limb extremity. Left thigh had a diameter of 31cm (+3cm compared to right), left leg had a diameter of 28cm (+7cm compared to right).

A diagnosis of grade II envenomation of the left lower limb was made. Coagulation profile revealed a decreased Prothrombin time at 58%, (International normalized ratio) INR: 1.36, (Activated partial thromboplastin time) APTT: 30seconds. Biological marker CPK-MB level was 1140 UI/L and the rest of the paraclinical exam was unremarkable.

Figure 3. *Necrosis over the dorsum of the left foot; day 11 post-operative*

Treatment modalities included; analgesics, ant venom serum (polyvalent), prophylactic antibioticsand rehydration. Progression of symptoms 24 hours post admission revealed painful swelling of the left leg, indurated non pitting diffused echymotic lesions, muscular tension, deficit in dorsiflexion and plantar flexion of left foot, cold left foot plantar surface, reduced mobility of toe weak posterior tibia pulse, absent dorsalispedis pulse(compared to the contralateral leg) and paraesthesia of the foot and leg. The diagnosis of grade IV envenomation complicated by an acute compartment syndrome of the left lower limb was made, for which an emergency fasciotomy was done. His stay was complicated on day 10 post-operative by the onset of skin necrosis over the dorsum of the foot and the ankle, which was debrided with proper wound care. The clinical picture hence forth was without particularity and secondary closure of the fasciotomy incisions was done 14 days after surgery. He was discharged 20 days after surgery without complications.

Figure 4. *A: Good tissue granulation on dorsum of the foot; day 20 post-operative B: Leg wounds completely healed; day 20 post-operative*

3. Discussion

Snakebites are responsible for a significant degree of morbidity and mortality worldwide, especially in low-resource countries. There are over 600 identified species of venomous snakes worldwide, with the majority belonging to the Viperidae and Elapidae families.Common names among the Viperidae family are vipers, pit vipers, and adders.Common names among the Elapid family are cobras, coral snakes, mambas, and copperheads.Elapidae bites are associated with minimal local tissue damage and have a neurotoxic syndrome with systemic toxicity. Viperid bites are associated with profound local tissue damage and have hemotoxic syndrome with systemic toxicity. In our case, the snakespecies was not identified as the 6 year old patient couldn't describe the snake properly, but given the clinical presentation dominated by local tissue damage, we strongly believe the snake was a viperid. The symptoms seen from snake envenomations are mainly due to the toxic components in their venom. The exact composition ranges from species to species and can vary significantly from localized tissue destruction to profound coagulopathies. The clinical effect on humans is related to both the potency and the volume of the toxin released during the snake bite. The venom released by the inland Taipan from Australia is the most potent in the world with a lethal dose of only 0.01 mg/kg with an average envenomation of 44 mg. Their envenomations have greater than 80% mortality.

Factors that contribute to the severity of the bite include size of the victim, with larger patients doing better, part of the body bitten, exertion following

the bite, depth of the bite, species of snake causing the bite, time to the presentation at the hospital, and initial first aid given at the scene[8]. Most of these factors contributed to the severity of our patient's case given that he had a weight of 23kg, walked for a long distance after the bite, had a deep bite with a wound on the site within the first 24 hours and his late presentation at the hospital (18 hours after the bite).

The composition of snake venom from a single species of venomous snake can consist of up to 100 different toxic elements. Local tissue destruction is primarily due to hyaluronidase and proteolytic enzymes in the snake venom, which can lead to local tissue edema, blistering, and tissue necrosis. Phospholipase A2 is a common component of snake venom and causes local tissue damage. This compound has both local effects on the surrounding tissues as well as systemic effects on the vascular system and nerve endings. There are a variety of other proteins and polypeptides with toxic effects, such as neurotoxins and hemotoxins. Most of the neurotoxic effects are secondary to damage at both the presynaptic and postsynaptic terminals of the neuromuscular junction. Presynaptic neurotoxins, such as phospholipase A2, damage the terminal axon, which prevents the release of acetylcholine, causing diffuse paralysis. In contrast, postsynaptic neurotoxins, such as alpha neurotoxin, respond well to antivenom and anticholinesterase administration as the toxin binds directly to the acetylcholine receptor [9]. Our patient presented more of local signs of envenomation with local tissue edema, blistering and tissue necrosis. This could be attributed to high doses of hyaluronidase and proteolytic enzymes in the snake venom. There are a wide variety of hemotoxins with effects on the coagulation cascade, platelet activation, and fibrin clot formation as was the situation in our case. Most of the toxins lead to an increased bleeding tendency secondary to a consumptive coagulopathy and defibrination. There are, however, some hemotoxins that promote clotting and thrombosis.

The management of snakebites is made up of general measures, specific measures and surgery for complicated cases. The initial first aid at the scene should be minimal and aim at getting the patient to the nearest treatment center quickly. Varying opinions exist regarding the usefulness of placing the affected extremity in a splint and keeping it at heart level. Therefore, this should only occur if it will not delay transportation. Removal of jewelry and any constrictive clothing on the affected limb is necessary due to the possibility of swelling and circulatory compromise. The patient should be kept calm and encouraged not to exert themselves as this could increase snake venom absorption. Pressure bandages are another controversial topic. If the identity of the snake species is known to cause neurotoxicity and no local tissue damage, the application of a pressure bandage could slow the spread of the venom. However, if the venom is known to cause local tissue damage, the implementation of the pressure bandage may worsen the damage inflicted on the extremity. Application of a tourniquet proximal to the bite results in higher morbidity without any improvement in outcomes, so this practice has been discouraged. The use of venom extractors has also been demonstrated to be ineffective. Local wound manipulation, such as incision or washout, is generally not suggested[10][11]. Specific measure include anti-venom therapy, prophylactic antibiotics and analgesics whereas surgery is mostly dominated by fasciotomy and debridement.

Acute compartment syndrome of the extremities was described approximately 130 years ago[12]. Increased pressure in a confined anatomical

compartment leads to occlusion of venous outflow and ultimately occlusion of arterial inflow and critical ischemia of the affected limb. The syndrome presents as a spectrum of clinical features which evolve rapidly. These include the classical five "Ps" of pain, pallor, absent pulse, paraesthesiaand paralysis[13,14]. Fasciotomy opens the fascial compartmentsso reducing the intra-compartmental pressure. This helps to salvage the limb as was te situation in our case.

4. Conclusion

Snakebite envenomation remains a public health issue in the developing world in general and in sub-Saharan Africa in particular due to the high proportion of the population involved in farming and hunting, as well as child labour. The pediatric population is more vulnerable and should be protected from this deadly injury using appropriate measures starting from good health policy making to proper training of health care givers and equipment of health facilities especially those in the rural areas with the anti-venom serum.

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