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Case Report Open Access

Successful Treatment of Compartment Syndrome Following Animal Envenomation by Fasciotomy through Small Incisions, Case Reports

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Abstract

Three cases of compartment syndrome caused by Habu-Snake bite and stone fish sting are treated by fasciotomies through small skin incisions. In Okinawa, the most southern prefecture in Japan, many suffer animal envenomation including 140 cases of Habu-Snake bites. Some of them develop compartment syndrome but usually recover soon after the fasciotomy and take uneventful course if diagnosis is not delayed. Different from compartment syndrome caused by trauma, ischemia, or others, those caused by water-soluble toxins following animal envenomation were expected to be treated successfully with small incisions for fasciotomy. The consecutive three cases of compartment syndrome following Habu-Snake bite and stone fish sting had fasciotomies through 1.5 to 3 cm skin incisions, instead of long skin incisions which are usually made in the same length as the underlying compartment, under following close observations with high index of suspicion of recurrence. Through small skin incisions, compartment syndrome could be released completely and the wounds could be maintained uneventfully with negative pressure therapy without recurrence, infection, or contracture. This method should be considered as an option to treat compartment syndrome caused by animal envenomation and may allow victims to avoid large scars that they should carry for the rest of their life.

Keywords: Compartment syndrome; Animal envenomation; Snake-bite; Fish sting; Small incision; Fasciotomy

Introduction

Okinawa, located in a subtropical region and surrounded by the sea, suffers many animal bites and stings. Among these, pit viper bite (what is called Habu bite) and stone fish sting are the two most harmful because they cause even death or compartment syndrome in the extremities. Their venom can cause not only hypotension and cardiac failure but also melting of soft tissues and bleeding. Accepting 40 cases or more animal bites or stings yearly it became apparent compartment syndrome caused by animal envenomation can be improved soon after fasciotomy and irrigation. This time three cases of compartment syndrome caused by animal envenomation are treated by fasciotomy through small skin incisions and following negative pressure wound therapy. The results were successful without contracture or ugly scar.

Case Presentation

Cases were a Habu bite on the dorsum of the hand and two stone fish stings on the palm and planta (Table 1).

Case	Age years	Diagnosis	Site	Tissue pressure mmHg	Time to fasciotomy hours	Late effects
1.	58	Habu bite (Compartment syndrome)	Upper extremity	70	15	Small scars
2.	9	Stone fish sting (Compartment syndrome)	Lower leg	90	12	Small scars
3.	34	Stone fish sting (Compartment syndrome)	Hand	95	4	Small scars

Table 1: Cases were a habu bite on the dorsum of the hand and two stone fish stings on the palm and planta.

Initial treatments included serum injection and irrigation of the bite wound through a small skin incision for Habu-Snake bite, and immersion of the injured area in hot water at 45 degrees Celsius for fish sting [1]. Picking up the signs such as numbness, excruciating spontaneous pain or pain on passive motion, it is our policy to maintain strong suspicions not to misdiagnose the compartment syndrome and to perform fasciotomies without delay. If time permits and diagnosis cannot be determined, tissue pressures is measured by a simple manometer technique where the instrument is consisted of 18G needle, intravenous extension tubes, a syringe, and sphygmomanometer with the needle and a distal line filled with normal saline (Figure 1) [2,3].

Figure 1: Measurement of tissue pressure a simple manometer technique.The instrument is consisted of 18G needle, intravenous extension tubes, a syringe and sphygmomanometer with the needle and a distal line filled with normal saline. The pressure of manometer is elevated slowly while air is injected into the line connected to the needle and compartment. When the meniscus of normal saline filled in the distal line and needle becomes from a concave configuration to a flat configuration and then is moved distally as some normal saline in the line is pushed into the compartment, the pressure at that time should be read as the tissue pressure.

In three cases, tissue pressure ranged 70 to 95 mmHg (Table 1). Skin incisions for fasciotomies were much shorter than the length of the underlying compartment but just 1.5 to 3 cm long. They were initially just put on the wounds of bites, then added on the points of the beginning and the end of the fasciotomies.

Blunt dissections in the subcutaneous fat layer were performed in a circle around the small wounds and fasciotomies were made from an incision to another partly in a blind and mostly along the fibers of the fascia (Figure 2).

Special attention was paid on the anatomical locations of the superficial branch of the radial nerve, lateral and medial forearm cutaneous nerve in the upper extremity, and the greater and short saphenous nerves in the lower extremity, which were left intact as the fasciotomy was abandoned if a difficulty was noted during splitting the fascia blindly. In that case, another skin incision was added on the line of intended fasciotomy.

In all the cases, just after the fasciotomy, a large amount of fluid was drained through every incision, soft tissues including skin and muscle became dramatically softer, the joints involved in areas of compartment syndrome gained wider range of motions soon and pains disappeared.

Wounds were maintained with negative pressure therapy with foams on the wounds. Fourteen Fr suction tubes were used to aspirate the foams on the incisions for negative pressure therapy or to drain the fluid when placed directly in the wounds (Figures 3-5).

All three cases were diagnosed as compartment syndrome by positive clinical signs such as excruciating pain and numbness, and results of tissue pressure measurements, that are far over the normal values of 30 to 40 mmHg (Table 1).

Cases of Habu-Snake bite on the dorsum of the hand and stonefish sting on the palm were released under local anesthesia and a case of stonefish on the planta, who was 9 years old, underwent fasciotomy under general anesthesia. All the cases took uneventful recoveries without infection, contracture or ugly scar (Figures 3-5).

Figure 2: Clinical photos of fasciotomies through small incisions and following negative pressure wound therapy. Through a small incision fasciotomy is blindly made toward the next incision (a) Area of blunt dissection around the small incision (yellow circle, ●) and lines of fasciotomy (green line,-) are shown in (b). Negative pressure wound therapy on incisions. (c) Note the 14Fr suction catheter is jumping the foams one after another applying negative pressure on each wound. Incisions on the extensor side of upper extremity. (d) Note a suction tube with safety pins is placed in the wound just on the fasciotomy when amount of discharge is large. (e) Then foams and tubes are applied on all over the wound for negative pressure wound therapy.

Figure 3: Clinical photos of case 1 on arrival. (a) Note bite wounds can be seen in the first web space, small incisions and following negative pressure therapy. (b) Clinical photos one month after the fasciotomies. (c) Note that no contracture but small scars are left.

Figure 4: Clinical photos of case 2 on arrival. (a) Note a sting wound can be seen on the right greater toe, skin incisions for fasciotomies. (b) Clinical photos 2 months after the fasciotomy. (c) Note that no contracture but small scars are left.

Figure 5: Clinical photos of case 3 on arrival. (a) Note a sting wound can be seen on the right palm, negative pressure wound therapy after fasciotomies. (b) Clinical photos 3 months after the fasciotomy. (c) Note that no contracture but small scars are left.

Discussion and Conclusion

In Okinawa more than 140 people suffer from Habu-Snake bite every year [4]. For stonefish sting, actual number of victims is not reported but a case of death following stonefish sting was reported in 2011 [5].

Toxins of Habu-Snake and stonefish are not only poisonous enough to putting a victim to death just with one envenomation [6], but also proteolytic enough to cause bleeding and melting in the invaded tissues [7]. It is reported that Habu-Snake toxins injected in the hand of a dog can infiltrate the elbow in 3 hours [6]. It is generally recommended that with high index of suspicion the compartment syndrome should be diagnosed without delay and be relieved immediately by releasing fasciotomy.

The clinician should not wait for additional cardinal signs to evolve when compartment syndrome is highly suspected and a normal pressure reading must not deter the surgeon from performing fasciotomy when clinical exam is positive. Incisions as long as 25 to 30 cm have been recommended for optimal decompression [8]. But at the same time toxins of Habu-Snake and stonefish are water-soluble and there is a chance of detoxification by irrigation and aspiration if diagnosed sooner.

For example, 30 to 60% of Habu-Snake toxins injected into the subcutaneous tissue is reported to be eliminated by irrigation and aspiration [9]. Different from the compartment syndrome caused by other mechanisms such as trauma, there is a possibility that compartment syndrome following animal envenomation can be relieved by fasciotomy through small incisions.

The effectiveness of negative pressure wound therapy using 14Fr suction tube through a small wound is already reported [10]. In the cases presented, 14Fr suction tubes were used to aspirate the foams on the incisions or the wound themselves through side holes made on the suction tube beforehand and some foams were suctioned one after another through side holes of the same 14Fr suction tube. All the wounds were maintained uneventfully without recurrence of compartment syndrome, or without complications such as contracture or infection. One should not be too careful when applying this method to the compartment syndrome caused by trauma or other causes, because cases presented here are in the special situation where the water-soluble toxins are playing significant roles without direct muscular injury and compartment syndrome can be released successfully with less chance of recurrence. This method should be considered as an option to treat compartment syndrome caused by animal envenomation and may allow victims to avoid large scars that they should carry for the rest of their life.

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