

A chance to cut is not always a chance to cure- fasciotomy in the treatment of rattlesnake envenomation: A retrospective poison center study[☆]



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ABSTRACT

Background: Fasciotomy has been described in the treatment of rattlesnake-envenomation. We sought to compare the characteristics of patients undergoing fasciotomy with those where fasciotomy was discussed but not performed.

Methods: A retrospective case-series constructed from a single-statewide-poison-system electronic database for cases of fasciotomy discussion or completion in rattlesnake-envenomation between January 2001 and May 2012. Age, gender, bite location, antivenom administered, compartment pressure measurements, Snakebite Severity Score (SSS) and length of hospitalization (LOS) were recorded. Comparisons were made between fasciotomy completed and where fasciotomy was only discussed.

Results: One-hundred-five cases of fasciotomy discussion or completion were identified. Fasciotomy was performed in 28 cases (27%). There was no statistically significant difference ($p > 0.05$) between groups in age, gender, bite site, SSS, and total number of vials of antivenom administered. Only 2 of 28 (7%) had compartment pressure measurements. Patients undergoing fasciotomy spent an additional 2 days in the hospital.

Conclusions: Fasciotomies continue to take place, without compartment pressure measurements, and without repeat dosing of antivenom. In the absence of clear objective evidence that limb-threatening compartment syndrome occurs despite adequate antivenom administration, fasciotomy does not favorably impact morbidity and may be associated with increased costs for care following rattlesnake envenomation.

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1. Introduction

Twenty species of venomous snakes are found in the United States. These include members of the families Viperidae (subfamily Crotalinae: “rattlesnakes, water moccasin and copperhead”). Rattlesnake (genera *Crotalus* and *Sistrurus*), water moccasin and copperhead (genera *Agkistrodon*) envenomations are responsible for the majority of the roughly 7000 venomous snakebites occurring per

year in the United States (Centers for Disease Contr, 2012).

Rattlesnake envenomations may mimic the symptoms of compartment syndrome and fasciotomy has been advocated by some clinicians in the treatment of rattlesnake bites; true compartment syndrome from North American crotalid envenomation is rare (Stewart et al., 1989; Glass, 1969; Shaw and Hosalker, 2002; Hardy and SrZamudio, 2006). Compartment syndrome is a condition in which a muscle swells but is constricted by the surrounding fascial planes. This constriction elevates tissue pressures and may impair vascular supply. We sought to compare the clinical characteristics and demographics of patients who underwent fasciotomy with those where fasciotomy was discussed by treating provider but not performed.

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2. Methods

A search of a state-wide poison system electronic database (Visual Dot Lab, Madera, CA) was performed for all cases of fasciotomy discussion or completion in rattlesnake envenomation occurring January 2001 through May 2012. This study was approved by the institution Committee on Human Research. All cases coded with rattlesnake envenomation as the substance and the term “fasciotomy” in the free-text area were identified. Data collected included date of occurrence, age, gender, location of bite (finger, hand, foot, shin, arm), whether antivenom was administered and the amount, compartment pressure measurements, and length of hospitalization. A validated severity instrument, the Snakebite Severity Score (SSS) was calculated during analysis using data recorded in the free-text (Dart et al., 1996 Mar).

All abstracted data was transcribed into a standardized Microsoft Excel 2008 (Microsoft, Redmond, WA) spreadsheet. Cases not followed to a known outcome, with coding errors, or in which it was impossible to determine whether or not antivenom was administered were excluded from further analysis. Three data abstractors reviewed each case to ensure that a discussion between the treatment team and poison center took place with regard to fasciotomy. Cases in which it was determined that no discussion took place were excluded. Abstracted data discrepancies were discussed between data abstractors, free-text notes were reviewed to corroborate all coded data, and consensus was agreed upon. Continuous data was tested for normality using Kolmogorov–Smirnov Test. Student T Test or Mann Whitney U test for categorical variables, Chi Square and Z test for proportions for categorical variables was performed. P-values (two-tail) less than 0.05 were considered statistically significant. All statistics were completed using SPSS software (v20, IBM Corporation, Armonk, New York).

3. Results

A total of 443 cases of rattlesnake (Crotalidae) envenomations occurred during the study interval. The 105 cases in which fasciotomy was discussed by treating provider or performed for rattlesnake (Crotalidae) envenomation were identified. In one case, it was not possible to determine whether antivenom was administered. An additional two patients were lost to follow-up. One-hundred-two cases were included for review.

Fasciotomy was performed in 28 cases. These were performed prior to or concurrently with poison center contact in 24/28 cases (86%). In the remaining four cases, fasciotomy was performed despite recommendations to the contrary from poison control system staff. The majority of patients undergoing fasciotomy were male (79%) and had upper extremity bites (68%). Compartment pressures were documented in only two cases in which fasciotomies were performed with measured values of 70 mm Hg and 36 mm Hg. The exact method of intra-compartment measurement was not recorded. Neither patient in which compartment pressures were measured had any documentation of vascular or neurological compromise prior to fasciotomy. Vascular or neurological compromise was not recorded in any of the patients who underwent fasciotomy in the current series.

In contrast, fasciotomy was discussed but not performed in 74 cases. The majority of these patients were also male (77%) and had upper extremity bites (68%). Compartment pressures were recorded in 6 cases (60 mm Hg, 20 mm Hg, 18 mm Hg, <15 mm Hg, “ok”, and “normal”).

Histograms of SSS in those patients who underwent fasciotomy and those in which fasciotomy was not performed are in Fig. 1. See Table 1 for descriptive statistics and comparisons between groups.

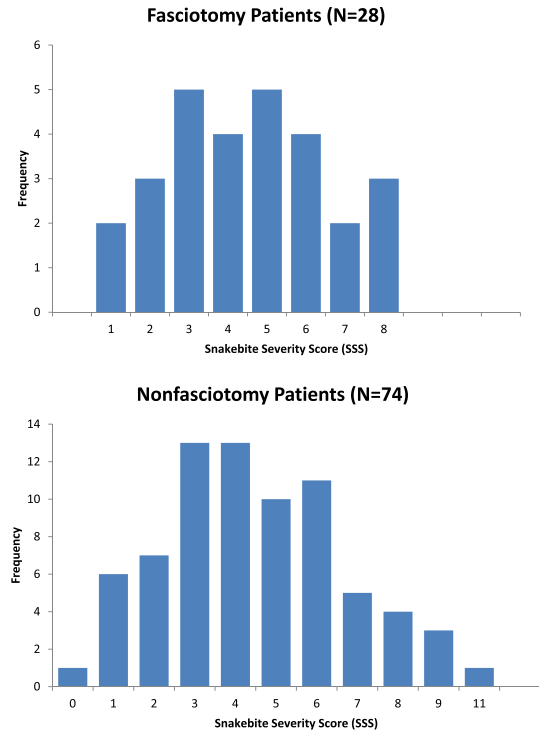


Fig. 1. Snakebite severity score (SSS) Histograms.

4. Discussion

In our series, 443 rattlesnake envenomations were reported to a state poison control system over an 11-year interval. The majority of these envenomations were managed without surgical intervention. Fasciotomies were still performed however, despite recommendations to the contrary from poison centers, decades of research demonstrating adverse effects, and in the absence of documented elevated compartment pressures. Among the 102 cases in which fasciotomy was discussed or performed, there was no statistically significant difference ($p > 0.05$) in age, gender, bite location site, total number of vials of antivenom administered, SSS, or number of vials administered post-fasciotomy and total number of vials administered in non-fasciotomy cases. There was however a statistically significant difference in the hospital LOS between cases in which fasciotomy was discussed but not performed and cases in which fasciotomy was performed. Patients undergoing fasciotomy spent an additional 2 days in the hospital.

Fasciotomies have historically been advocated in the treatment of rattlesnake envenomations due to concerns about the development of compartment syndrome. True compartment syndrome resulting from crotalid envenomation is uncommon in North America (Hardy and SrZamudio, 2006). The great majority of snakebites result in subcutaneous and not subfascial deposition of venom (Norris et al., 2012; Walker et al., 2013). In addition to edema, pain, and echymosis, envenomation may produce distal paresthesias, soft tissue swelling with local compartments feeling tight, pain on stretching of muscles, and muscle weakness. However, these symptoms reflect venom effect on non-compartmentalized tissue and not necessarily arterial compromise. Previous studies have demonstrated an increase in pulsatile arterial blood flow, including distal to the bite site, following rattlesnake envenomation (Curry et al., 1985).

Diagnosing true compartment syndrome in an envenomated extremity without directly measuring the compartment pressures is unreliable and the use of compartment pressure measurement is

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