Clinical Toxicology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/ictx20

Harm due to the use of pressure bandage immobilisation in patients bitten by snakes in Australia

Mark Little

To cite this article: Mark Little (2023) Harm due to the use of pressure bandage immobilisation in patients bitten by snakes in Australia, Clinical Toxicology, 61:8, 611-612, DOI: 10.1080/15563650.2023.2252586

To link to this article: https://doi.org/10.1080/15563650.2023.2252586

CLINICAL TOXICOLOGY
2023, VOL. 61, NO. 8, 611–612
https://doi.org/10.1080/15563650.2023.2252586

Taylor & Francis
Taylor & Francis Group

SHORT COMMUNICATION

Harm due to the use of pressure bandage immobilisation in patients bitten by snakes in Australia

Mark Little

Emergency Physician & Clinical Toxicologist, Cairns Hospital, Cairns, Queensland, Australia

ABSTRACT

Background: Pressure bandage immobilisation has remained the recommended first aid treatment for more than 40 years in Australia. However, whilst it is used in most people bitten by a snake, it is often applied poorly, and patients have been envenomed despite good pressure bandage immobilisation. We report two patients who suffered harm from this procedure.

Case reports: Two men, a 35-year-old and a 44-year-old, were bitten by snakes. Both had a prompt application of pressure bandage immobilisation, and both reported significant pain requiring opioid analgesia whilst being transferred from remote Australia to Cairns Hospital, Queensland. There were substantial delays (9.5 h and 7.5 h) before the pressure bandage immobilisation was released. As a result, both patients developed severe rhabdomyolysis (33,600 U/L and 16,800 U/L [normal < 171 U/L], respectively); there was no evidence of systemic envenoming. The 35-year-old developed a compartment syndrome that required urgent and repeated surgery. The 44-year-old has ongoing foot paraesthesia two years after the bite.

Conclusion: With limited good evidence of benefit, and many issues with its use, I recommend that pressure bandage immobilisation as a first aid measure for snakebite in Australia needs to be re-examined.

ARTICLE HISTORY
Received 12 April 2023
Revised 12 June 2023
Accepted 20 July 2023

KEYWORDS
Snakebite; first aid; pressure bandage immobilisation

Background

Pressure bandage immobilisation has been the standard of first aid care for snakebite in Australia and Papua New Guinea since Sutherland et al. [1] demonstrated the application of a firm crepe bandage and immobilisation of a monkey's limb resulted in delaying tiger snake venom movement into the body.

However, Sutherland et al. [1] applied a crepe bandage within 60–90 s of the venom being injected, and the experiment only went for 1 h. The pressure of the applied bandage was *estimated*, not measured, to be 55 mmHg, and the outcome was reported in only 11 monkeys when 25 were enrolled. It is unclear how this study relates to real-world snakebites in which the time to apply pressure bandage immobilisation is considerably longer than 60–90 s.

Although pressure bandage immobilisation is currently recommended by the Australian Resuscitation Council [2], there are many reports of patients being envenomed despite the use of pressure bandage immobilisation [3,4].

We report two patients in whom pressure bandage immobilisation caused harm.

Case reports

A 35-year-old man farm worker was bitten by a snake 1–2 cm below the left elbow lateral epicondyle. The farm staff applied two crepe bandages within 10 min and a further two bandages were applied over the top of the original bandages by the ambulance service 5 min later. En route to Cairns Hospital, he complained the bandage was tight and received oral oxycodone 10 mg and intravenous fentanyl 75 μg.

In the emergency department, he complained of pain, but no numbness in his immobilised limb. His initial investigations and examination were normal with a creatine kinase activity of 459 U/L (normal < 171 U/L). Pressure bandage immobilisation was then removed, 9.5 h after it was applied. Within 20 min of the removal of the pressure bandage, the patient complained of increasing pain. Examination of the proximal forearm showed there was a board-like swelling with pain on palpation and on passive movements of the fingers, with reduced sensation in the distal limb. Compartment pressures were markedly elevated (dorsal 150 mmHg and volar 74 mmHg [normal < 8 mmHg]; pressures > 30 mmHg indicate compartment syndrome [5]). Fasciotomy was performed, showing some dusky muscles in the dorsal compartment. The patient's creatine kinase activity peaked at 33,600 U/L, approximately 23 h after the bite. The patient did not demonstrate any signs of systemic envenoming during his admission. The patient was in hospital for 15 days and required three further operations for wound and muscle debridement, as well as split skin grafts.

CONTACT Mark Little Mark.little@health.qld.gov.au Emergency Physician & Clinical Toxicologist, Cairns Hospital, Cairns, Queensland, Australia.

A 44-year-old man was bitten by a snake on his left midshin whilst camping. Fellow campers immediately applied an elasticised bandage. He subsequently complained to the ambulance crew that the bandage was too tight, and that he had marked limb pain. His foot was noted to be cool and numb and he received morphine 12.5 mg intravenously to control his pain. His limb remained painful during his transfer by air and he required a further dose of morphine 12.5 mg intravenously.

At Cairns Hospital he was found to have a dusky limb, with altered sensation and no pulse detected on doppler. The pressure bandage immobilisation was loosened (approximately 7.5 h post application), and this improved his limb colour as pulses were detected on doppler. He did not demonstrate any clinical or biochemical signs of systemic envenoming and his creatine kinase activity peaked at 16,800 U/L approximately 24 h after the snake bite. He was in hospital for two days and all investigations were normal 10 days after discharge. Two years later he still had some ongoing paraesthesia in his foot.

Discussion

It is likely that pressure bandage immobilisation was applied too tightly and for too long in both patients. It may have acted as an arterial tourniquet, as both needed opioid analgesia to control their limb pain.

The largest series of snakebite in Australia had 1,548 patients enrolled with 835 envenomed; 1,304 (84%) had pressure bandage immobilisation [3]. Of those envenomed, 733 (87.7%) had pressure bandage immobilisation applied and there were no reports of any adverse effects. This suggested pressure bandage immobilisation was safe to apply. Currie et al. [4] reported seven patients who were envenomed despite full pressure bandage immobilisation, including a 7-year-old child who had pressure bandage immobilisation applied within 5 min of the bite. The rapidity of onset of symptoms in this case, and in other cases reported by Allen et al. [6] in which collapse occurred within minutes of the bite, suggests venom may also travel in the vascular circulation.

Other studies have also raised concerns. A simulation study found that the median pressure derived by the application of crepe bandage immobilisation by health professionals to a lower limb was 28 mmHg (IQR 17–42mm Hg) [7]. When elasticised bandages were used, the median pressure was 47 mmHg (IQR 26–83 mmHg). Only 17% of health professionals achieved the correct pressure on the first application of the pressure bandage. About 10% produced more than 100 mmHg pressure with elasticised bandages, with one person achieving approximately 230 mmHg. Furthermore, crepe bandages did not maintain pressure during a 30 min ambulance ride [7].

There has been very little clinical research into the effectiveness of pressure bandage immobilisation in preventing venom uptake. Anker et al. [8] reported that applying pressure bandage immobilisation (pressure 55 ± 5 mmHg) on three patients with mock venom did not prevent "venom" from reaching the systemic circulation.

In another mock study, 24 subjects received either intradermal or subcutaneous injections of ^{99m}technetium antimony sulfur colloid in both hands/fore-arms and feet/legs [9]. Fifteen of the subjects had firm bandages and splints applied to an upper and a lower limb immediately after injection. Bandaging was found to be very effective when applied with pressures ranging from 40 to 70 mmHg in the upper limb and 55 to 70 mmHg in the lower limb. Strict limb immobilisation was necessary to minimise lymphatic flow.

Conclusions

We report two patients who suffered harm due to the inappropriate use of pressure bandage immobilisation. With limited good evidence of benefit, and many issues with its use, I recommend that pressure bandage immobilisation as a first aid measure for snakebite in Australia needs to be re-examined.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

The authors reported there is no funding associated with the work featured in this article.

References

[1] Sutherland SK, Coulter AR, Harris RD. Rationalisation of first aid measures for elapid snakebite. Lancet. 1979;1(8109):183–185. doi: 10.1016/s0140-6736(79)90580-4.

[2] Australian Resuscitation Council. Envenomation – pressure immobilisation technique. Guideline 9.4.8. August 2011; [cited 2023 Feb 23]. Available from:https://resus.org.au/the-arc-guidelines/.

[3] Johnston CI, Ryan NM, Page CB, et al. The Australian snakebite project 2005–2015 (ASP-20). Med J Aust. 2017;207(3):119–125. doi: 10.5694/mja17.00094.

[4] Currie BJ, Canale E, Isbister GI. Effectiveness of pressure immobilisation first aid for snakebite requires further study. Emerg Med Australasia. 2008;20:267–270.

[5] Tornlincasi AM, Lopez RA, Waseem M. Acute compartment syndrome. Stat Pearls. 2022; [cited 2023 Feb 23]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK448124/.

[6] Allen GE, Brown SGA, Buckley NA, et al. Clinical effects and antivenom dosing in brown snake (pseudonaja spp) envenoming – Australian snakebite project (ASP14). PLoS One. 2012;7(12): e53188. doi: 10.1371/journal.pone.0053188.

[7] Canale E, Isbister GI, Currie BJ. Investigating pressure bandaging for snakebite in a simulated setting: bandage type, training and the effect of transport. Emerg Med Australas. 2009;21(3):184–190. doi: 10.1111/j.1742-6723.2009.01180.x.

[8] Anker RL, Stratton WG, Loiselle DS, et al. Retarding the uptake of 'mock venom'. Med J Aust. 1982;1:212–214.

[9] Howarth DM, Southee AE, Whyte IM. Lymphatic flow rates and first aid in simulated peripheral snake or spider envenomation. Med J Aust. 1994;161(11–12):695–700.