



Treating a subtotal degloving ring avulsion with leeches: an unusual case report with review of the literature

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Abstract

Subtotal deglovement injuries with delayed presentation give rise to the question: how to treat the mangled soft tissue to best keep the digit alive and functioning. We hereby present a case of a 59-year-old woman who was referred to our clinic 7 h after initial trauma from a peripheral hospital where an instant repositioning of a subtotal degloved skin envelop of her left middle finger had taken place with only minimal adhesion and circulation at the top of the finger left intact. On X-ray, a small avulsion fracture of her distal interphalangeal joint was visible but flexion and extension was intact at proximal interphalangeal (PIP) joint level on examination. On arrival, we saw a finger with minimal reconstituted blood circulation and livid skin. Further treatment consisted of onsite debridement and primary suturing of the involved skin, followed by leech therapy the next week, and consecutive split-skin grafting 6 weeks later to cover minor residual defects. Further clinical course was uneventful and showed good clinical and esthetic results. We hereby present the patient's clinical outcome and review of the literature for further evidence of our treatment regime.

Level of evidence: Level V, therapeutic study.

Keywords Ring avulsion · Deglovement · Degloving injury · Leeches · Finger reconstruction

Introduction

Ring avulsion injuries are often challenging to treat including a broad spectrum of varying clinical presentations and ongoing discussion regarding the best treatment modalities. We hereby describe a therapeutic option using leeches for ring avulsion cases with a minimally intact arterial blood circulation. Leech therapy is well known as a salvage option for tissue otherwise regarded impossible to save. Literature review provides only two other reports describing three ring avulsion injuries treated by leeches with good clinical outcome. In selected cases, treatment with leeches may be an easy and helpful additional therapeutic option without extensive surgery.

Case report

On first presentation at our emergency department, we saw a 59-year-old woman with a subtotal ring deglovement injury of her left non-dominant middle finger as a result of an unfortunate use of a slide (Fig. 1). The patient initially presented at a peripheral hospital without the expertise to treat the injury. They did perform a repositioning of her subtotally degloved skin and made X-ray's showing a small avulsion fracture at the distal interphalangeal (DIP) joint level. The patient was then referred to our hospital with a total of 8 h after trauma. According to the oral information from the referring hospital and the information given by the patient on arrival at our unit, the almost totally degloved finger was completely ischemic until the repositioning had taken place. The skin envelop had only contact with the bony structures distal of the DIP joint of the mangled finger. With slow reconstitution of a weak arterial circulation after a long warm ischemia period, we discussed further treatment options with the patient. She opted for a simple procedure for her degloved finger followed by leech therapy. The wound was explored circumferentially at the level of the P1 phalanx and showed no suitable vessels to reconstruct and a complete disruption of the two digital nerves. No

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Fig. 1 Appearance on delayed arrival at our emergency department with X-ray imaging



further distal exploration was made because we thought that the weak arterial circulation was along the almost intact tendon sheath of the flexor and extensor tendons and we were scared to disrupt them. Local debridement (Fig. 2) of the mangled soft tissue envelop was performed with loose suturing of the skin circumferentially, after which she was taken to the ward for further observation and leech therapy for 1 week with supportive splinting. Leeches were applied every 1–2 h for 7 days with prophylactic ciprofloxacin 500 mg orally twice a day. After 3 days, a minor superficial epitheliolysis was observed and treated conservatively with resection of the blisters. Blood count showed a slight decrease in hemoglobin (Hb) to 7 mmol/l ([4–9], 9 mmol/l) 4 days after initiation of leech therapy without further decrease or need of transfusion. Physiotherapy was started 2 weeks postoperatively. A superficial skin necrectomy at the outpatient clinic was performed 2.5 weeks after discharge, and 6 weeks later for split-skin grafting was performed. The further clinical course was uneventful with intensive hand therapy. At 4-month follow-up, the patient was satisfied with the achieved result at that time. There was a slight swelling of her finger with complete range of motion in all finger joints despite a 10° extension lag at the distal interphalangeal joint. Active range of motion in her left wrist was unimpaired. Blood perfusion had returned to normal level. Additional compression therapy was started at this point. At 6 months after trauma, the patient returned for final

evaluation with good esthetic and functional results (Fig. 3). Distal two-point discrimination was around 10 mm and 6 mm on the radial and ulnar side, respectively.

Discussion

A five-finger hand without an interdigital gap is important to achieve normal appearance of the upper extremity. Not only the esthetic aspect but also function is impaired following an amputated finger. A wide range of differing types of defects exist due to varying mechanism and duration of injury, shear forces, the mechanical stability of the soft tissue [1], and the characteristics of the ring or similar structure around the finger [2]. From simple partial circumferential skin brake down to complete deglovement injuries with or without bone and tendon lacerations/amputations, the available options to treat are discussed. Depending on the classification systems, the treatment approach varies and depends even on socio-cultural factors. The two most used classifications in ring avulsion and deglovement injuries are the modified Urbaniak and the Kay classifications, but several other classifications are also encountered in literature making direct comparison of the treatment results complicated. The first classification of Urbaniak [3] is purely based on perfusion status. The modified Urbaniak classification by Nissenbaum adds injuries with isolated

Fig. 2 Immediate appearance after debridement on skin closure



Fig. 3 Seven weeks post-trauma after split-skin grafting



arterial disruption (a subdivision class IIA) [4]. Weil added an extra subclass with disruption of venous drainage [5]. The Kay [6] classification puts emphasis more on skeletal injury and the predictable functional results. Adiani [7] subdivided Class IV further in IVd, amputation distal to the insertion of the FDS tendon; IVp amputation proximal of the FDS tendon; and IVi, complete degloving injury with intact tendon (Fig. 4).

All different classifications treatment depend on the grade of injury which often demands a microsurgical approach to rescue amputated parts or to close defects which occur during trauma. From simple skin suturing or split-skin grafting to more complex procedures as local or distant pedicled flaps or microsurgical repair or even different sorts of amputation like ray resection, the list of options is wide. However, treatment with leeches has not gained much attention in this sort of injuries. Up to now, there are only 2 reports with a total number of 3 patients with a successful treatment of a ring avulsion using leeches in literature and a fourth case report with a similar lesion. The first successful report from 2001 stated a ring avulsion lesion of a ring finger with an intact radial artery and nerve with a near-complete division of the venous drainage and a Mallet deformity [8]. The author of that publication rated this trauma between Urbaniak class I and II or Kay class II. Treatment period with leeches was 5 days with leech replacement every 4 h, showing a drop in Hb 14.3 to 8.7 g/dl without further need for transfusion. Supportive antibiotics were administered. Thermoplastic mallet splinting was done for 6 weeks. Range of motion was normal at the level of MCP and proximal interphalangeal (PIP) joint. The second report

stated two Class IIC injuries which were successfully treated with leech therapy [9]. The first patient underwent leech therapy initiated 3 days after trauma with a duration of 10 days showing a mild total drop of hemoglobin of 2 g/dl without need for further treatment. The outcome was rated excellent according to Strickland classification after a 17-month follow-up. Total digital range of motion was 150°. The second patient with a class IIC avulsion lesion underwent direct surgical exploration after trauma but refused further surgical treatment and underwent only leech therapy with supportive conservative treatment including as prophylactic antibiotics. Duration of leech therapy was 7 days with a minor drop in Hb of 1 g/dl. Clinical follow-up was 1 year with a total digital range of motion of 135°.

In a rare case of a forgotten digital tourniquet 4 days after surgery for a crush injury of a finger nail bed resulting in venous congestions, the application of leech therapy ended up with complete healing with a good mobility at the PIP joint level [10]. Ciprofloxacin was given during the 5-day leech therapy but there was no information regarding any blood testing.

Our patient was referred 8 h after trauma. Direct surgical exploration revealed no suitable vessels to reconstruct and a complete rupture of both digital nerves; thus, the patient opted for leech therapy with supportive prophylactic antibiotics. We believe that the subtotally degloved ischemic skin envelop was nourished via small capillaries which had contact with the tendon sheath of the injured finger and were opened again after repositioning of the soft tissue and gave weak arterial



Fig. 4 Six months follow-up after compression therapy showing good functional and esthetic results

flow into the skin envelop which resulted in venous congestion at our emergency department [11]. Another unproven theory could be arterial perfusion via intraosseal capillaries with interconnections along the capsular joint structures but there is nothing known in literature.

Administration period of the leeches was 7 days. After 4 days, a blood sample testing showed stable Hb levels of 7 mmol/l and therefore no further need for blood cell packs. Follow-up was 6 months with intensive hand therapy, and the patient achieved a good functional and cosmetic outcome and was satisfied with daily usability. The two-point discrimination was in the normal range of reconstitution after 6 months with a complete disruption of a digital nerve with average neural sprouting.

Conclusion

Leech therapy seems to offer a potential way to treat ring avulsions associated with a minimal arterial flow showing good clinical outcomes. In our opinion, the indication for leech therapy is a situation where no microsurgical expertise or equipment is available or the patient is not willing or capable to undergo extensive operations. Leech therapy may also be tried as a last resort if the finger is thought to be lost. To our knowledge, this is the first case of a subtotal deglovement injury of a finger which was successfully treated with leech therapy.

Conflict of interest T. Wagner, O. Kloeters, and DJ Ulrich declare that they have no conflict of interest.

Ethical approval For this type of study, formal consent from a local ethics committee is not required.

Patient consent Informed consent was obtained from all individual participants included in the study.

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References

1. Kupfer DM, Eaton C, Swanson S, McCarter MK, Lee GW (1999) Ring avulsion injuries: a biomechanical study. *J Hand Surg [Am]* 24(6):1249–1253
2. Mitchell GM, Morrison WA, Papadopoulos A, O'Brien BM (1985) A study of the extent and pathology of experimental avulsion injury in rabbit arteries and veins. *Br J Plast Surg* 38(2):278–287
3. Urbaniak JR, Evans JP, Bright DS (1981) Microvascular management of ring avulsion injuries. *J Hand Surg [Am]* 6(1):25–30
4. Nissenbaum M (1984) Class IIA ring avulsion injuries: an absolute indication for microvascular repair. *J Hand Surg [Am]* 9(6):810–815
5. Weil DJ, Wood VE, Frykman GK (1989) A new class of ring avulsion injuries. *J Hand Surg [Am]* 14(4):662–664
6. Kay S, Wemtz J, Wolff TW (1989) Ring avulsion injuries: classification and prognosis. *J Hand Surg [Am]* 14(2 Pt 1):204–213
7. Adani R, Castagnetti C, Busa R, Caroli A (1996) Ring avulsion injuries: microsurgical management. *J Reconstr Microsurg* 12(3):189–194
8. Guven H, Akbas H (2002) The use of leeches in the management of a ring avulsion injury. *Eur J Plast Surg* 25(3):162–164
9. Tuncali D, Terzioglu A, Cigsar B, Aslan G (2004) The value of medical leeches in the treatment of class IIC ring avulsion injuries: report of 2 cases. *J Hand Surg [Am]* 29(5):943–946
10. Durrant C, Townley WA, Ramkumar S, Khoo CT (2006) Forgotten digital tourniquet: salvage of an ischaemic finger by application of medicinal leeches. *Ann R Coll Surg Engl* 88(5):462–464
11. Armenta E, Lehrman A (1980) The vincula to the flexor tendons of the hand. *J Hand Surg [Am]* 5(2):127–134

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