



Forgotten digital tourniquet: salvage of an ischaemic finger by application of medicinal leeches

C DURRANT, WA TOWNLEY, S RAMKUMAR, CTK KHOO

Wexham Park Hospital, Slough, Berkshire, UK

ABSTRACT

Individual finger tourniquets are appropriate to the management of a wide range of conditions presenting to an accident and emergency department. They are simpler and more comfortable to use than upper arm pneumatic tourniquets and commercially available digital tourniquets are not readily available in the accident and emergency unit. However, if a finger tourniquet is overlooked, ischaemia of the digit results, and gangrene may follow if the problem is not defused early enough, leading to potential disaster.^{1–3} We present one case where a digit was salvaged after 4 days of tourniquet application, using medicinal leeches.

KEYWORDS

Finger tourniquets – Gangrene – Medicinal leeches

CORRESPONDENCE TO

Charles Durrant, Wexham Park Hospital, Slough, Berkshire SL2 4HL, UK

M: +44 (0)7958 482284; E: cdextra@dsl.pipex.com

Case report

JB, a 16-year-old, right-hand dominant schoolboy attended our accident and emergency department having sustained a crush injury to the nail bed of his right little finger from a



Figure 1 The swollen and discoloured finger on second admission to accident and emergency department.

cement mixer. A roll-on finger tourniquet was fashioned with the finger stalk of a latex glove and the nail bed repair was then performed under a digital block. A finger dressing was applied following the surgery and the patient was sent home. Four days following the surgery, the patient returned to accident and emergency complaining of increasing pain in the little finger and requesting a change of dressing. On removal of the dressing, the tourniquet was discovered *in situ*. The finger distal to the tourniquet was swollen and discoloured (Fig. 1). A referral was made to the plastic surgery team on-call. On examination, the dorsal skin of the little finger was purple-black in colour, with fixed staining. The volar aspect was also similarly ischaemic, with no observable capillary refill. The finger was insensate to sharp touch save for a small patch at the volar base of the finger on the radial side, where sensation was greatly diminished. The finger tip did, however, bleed upon pinprick. There was no active movement at either the proximal or distal interphalangeal joints. X-ray showed a small undisplaced longitudinal fracture at the base of the middle phalanx, with no signs of osteomyelitis and no evidence of gas in the soft tissues. The epiphyses were fused. A diagnosis of venous ischaemia was made. A conservative plan of management was commenced, involving intravenous cefuroxime and metronidazole, and regular placement of medicinal leeches (*Hirudo medicinalis*), provided by Biopharm (Bryngelen House, Bryngwili Road, Henty SA4 1XB, UK) along the length of the little finger (Fig. 2). The hand was kept in a foil warming



Figure 2 Application of leech.

blanket and elevated. Ciprofloxacin was administered throughout the period of leeching. After 1 day, the finger started to improve clinically, appearing less congested and bleeding freely. Leech therapy was continued, and on day 3 he was referred to the physiotherapists for gentle mobilisation of the digit and commenced on low dose aspirin. After 3 days of leech therapy, *Pseudomonas* spp. was isolated from the finger. This was sensitive to the current ciprofloxacin treatment regimen. The leeches were stopped on day 4, and on day 7 there was evidence of returning sensation, with sensitivity to pinprick at the finger tip. There was a progressive improvement in the sensory and functional parameters of the finger. Two weeks post-treatment, the finger underwent epidermolysis of the volar and dorsal surfaces, exposing healthy, viable dermis. At this stage, it was noted that the finger had developed a Mallet deformity, doubtless as a result of the distal ischaemic challenge to the extensor apparatus (Fig. 3). This was treated conservatively using a Mallet splint and, at 6 weeks post-injury, the finger had healed, with good movement at

the proximal interphalangeal joint, evidence of restoration of the extensor mechanism, and continuing improvement in sensation.

Discussion

In this case, we can speculate as to why the tourniquet was overlooked. The accident and emergency department on that particular day assessed 156 patients, 56 of whom were minor injuries. How did we get away with salvaging the finger after an ischaemic time of 4 days? First, the tourniquet used did not exert a sufficient pressure to prevent arterial inflow of blood, which buys a little time before venous ischaemia takes over. Second, in the finger there is little in the way of muscle and other perishable tissues which are particularly susceptible to ischaemic insult and thence necrosis. Third, the tissues in a healthy, young non-smoker are physiologically robust. The use of leeches relies on the first of these points. The leech was indispensable in 19th century medicine for blood-letting, a practice believed to be a cure for anything from headaches to gout. It then went out of fashion, only to re-emerge as an adjunct to reconstructive surgery in the 20th century.⁴ Leeches are placed on the congested area and encouraged to feed. The actual volume of blood drawn off by a single leech is negligible. However, leeches secrete a substance in their saliva called hirudin which is a powerful anti-coagulant allowing the continuation of bleeding well after



Figure 3 .Finger showing a Mallet deformity.

the leech has dropped off. Leeches, therefore, need only be applied once every 8 h or so to have a beneficial effect. The disadvantage of leech therapy is the presence in their saliva of several pathogens, most notably *Aeromonas* spp., which can cause potentially fatal illnesses in the human host. Therefore, leeching should always be accompanied by appropriate antibiotic therapy; a good example is ciprofloxacin.

For a finger tourniquet to be both safe and effective, it needs to have a number of desirable properties: (i) exsanguination; (ii) bloodless field; (iii) ease of application; (iv) be cheap; (v) non-traumatic; and (vi) be conspicuous. One popular method, used in this instance, is a single finger of a surgical glove, rolled down the digit to exsanguinate it, and remaining at the base of the finger as a tourniquet.^{5,6} As long as the glove used is the correct size for the patient, the pressure under the tourniquet is not so excessive as to cause neurovascular damage.^{7,8} Several other methods have also been employed to prevent a tourniquet being overlooked.⁹⁻¹²

Any device used on humans should have a high element of safety. One of the problems of using constricting ring devices in the finger is the ease of availability and the lack of a clear protocol regarding what is permitted and what is not. Being a risk management issue, a clear guideline should be issued to those dealing with trauma with regards to the use of such devices. Clinical negligence can have medicolegal implications, making the life of the patient, the doctor and the trust more difficult.

Surgeons applying any of these tourniquets should ensure that they, or their assistant, have noted the time of

application and that the total ischaemic time is documented in the medical notes. This is not only good clinical practice, and will ensure that the tourniquet is not forgotten, regardless of the method employed. Since this case, we have implemented a protocol covering the use of tourniquets in finger surgery.

References

1. Sheng-Mou H, Tang-Kue L. Salvage of tourniquet-induced thumb necrosis by a modified wraparound procedure. *J Trauma* 1987; **27**: 803-5.
2. Dove AF, Clifford RP. Ischaemia after use of finger tourniquet. *BMJ* 1982; **284**: 1162-3.
3. Arci G, Akan M, Yildirim S, Akoz T. Digital neurovascular compression due to a forgotten tourniquet. *Hand Surg* 2003; **8**: 133-6.
4. Derganc M, Zdravic F. Venous congestion of flaps treated by application of leeches. *Br J Plast Surg* 1960; **13**: 187-92.
5. Shah A, Asivatham R, Ellis D. Tips of the trade 42: an improvised technique for creating a digital tourniquet. *Orthop Rev* 1992; **21**: 91-2.
6. Salem MZ. Simple finger tourniquet. *BMJ* 1973; **2**: 779.
7. Hixon FP, Shafiroff BB, Werner FW, Palmer AK. Digital tourniquets: a pressure study with clinical relevance. *J Hand Surg Am* 1986; **68**: 865-8.
8. Shaw JA, Demuth WW, Gillespy AW. Guidelines for the use of digital tourniquets based on physiological pressure measurements. *J Bone Joint Surg Am* 1985; **67**: 1086-90.
9. Aslan G, Sarifakioglu N, Bingul F. Simple and effective device for finger tourniquet: a rolled Penrose drain. *Plast Reconstr Surg* 2003; **111**: 1758-9.
10. Tucker S, Harris P. The unforgettable finger tourniquet. *Injury* 2002; **33**: 76-7.
11. Grant I, Hodgson E. The unforgettable finger tourniquet. *Injury* 2003; **34**: 556.
12. Barnett A, Pearl RM. Readily available, inexpensive finger tourniquet. *Plast Reconstr Surg* 1983; **71**: 134-5.