

IMPROVISED SKELETAL TRACTION IN THE MANAGEMENT OF BALLISTIC FEMORAL FRACTURES

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Abstract

Penetrating limb injuries are common during conflict, and in many there will be an associated fracture. Treatment of ballistic femoral fractures would usually be with an intramedullary nail; however, within the resource-constrained environment during conflict this is rarely possible. This report illustrates what can be achieved at a Role 2 facility to provide skeletal traction with the equipment and skills available. We discuss the history of skeletal traction and its use in ballistic femoral fractures, and believe that skeletal traction is still a valuable technique that we shouldn't ignore. Military surgeons should be able to use skeletal traction to manage ballistic femoral fractures in the spartan environment of a deployed forward hospital.

Introduction

It has been shown in previous studies that 70% of military wounds will involve the extremities [1] with the lower limbs predominantly involved [2]. These are often complex injuries with both soft tissue damage and an underlying fracture.

Despite modern advances, the principles of treatment of penetrating war wounds to the extremities have not changed significantly for many years [3]. These involve exploration of the wound, excision of necrotic or devitalised tissue and removal of foreign material, washout of the wound, immobilisation of fractures and appropriate antibiotics followed by a period where the wound is left open before delayed primary closure is undertaken [4,5].

Stabilisation with an intramedullary nail is the gold standard treatment in First World countries for femoral shaft fractures, where the injuries are usually caused by blunt trauma or low available energy handgun rounds [6-8]. However, in conflict zones and less developed countries, traction remains a common method of stabilisation.

When military surgeons deploy to treat service personnel they can also expect to treat the local population. The surgeon should be able to manage them with regard to local conditions, as most will be transferred to their own health system which may not be as well equipped as hospitals in the UK. Given this, there is a need for military surgeons to be able to manage femoral shaft fractures by skeletal traction.

We have previously demonstrated the utility of the Thomas splint in the management of femoral fracture in the military environment [9]. Its prime use is in immobilisation for transfer or evacuation, rather than continued treatment and, currently, deployed hospitals are not equipped to provide prolonged skeletal traction.

We report an illustrative case, demonstrating what can be done to provide skeletal traction using the local resources in Afghanistan, together with examples of other traction frames that have been used in military environment.

Illustrative case report

A 28 year old Afghan national was brought to the Role 2 (Enhanced) medical facility in Camp Bastion, Afghanistan having suffered a gun shot wound through his left mid-thigh.

Pre-hospital care included wound dressing, application of a Sager Splint (Minto Research + Development Inc, California, USA) and the administration of intravenous morphine and antibiotics.

On examination he had a small medial entry wound and a larger exit wound on the lateral side (Figure 1). Radiographs demonstrated a multifragmentary fracture of the femoral shaft (Figure 2).



Figure 1. Exit wound in his left mid thigh.

Under general anaesthetic the wounds were debrided, washed out with 6 litres of normal saline then dressed with gauze, wool and crepe. A Denham Pin was inserted in the proximal tibia to provide skeletal traction via a frame that had previously been constructed in the camp welder's workshop (Figure 3). An initial weight of 5 kg using standard water bottles was applied across the traction device.

The patient was recovered on the ward for two days then moved to a Role 3 hospital in Kandahar for definitive care of both fracture and soft tissues.

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Figure 2. X-ray of fractured femur with entry and exit wounds marked and Sager Splint in position.



Figure 3. 'DIY' traction frame in place.

Discussion

The options available for fracture immobilisation include splinting with plaster of Paris, traction, external fixation and internal fixation. As discussed, femoral fractures are usually best treated by internal fixation with an intramedullary nail [6-8].

However, in the austere military environment, with heavily contaminated wounds and lack of clean air theatres, current treatment regimes do not allow for internal fixation as this technique has been shown to have a high infection rate in military injuries [10, 11]. External fixation has also been shown to have a high complication rate when using the standard military pack for femoral fractures [12].

Plaster of Paris provides stability but results are generally poor with femoral fractures, especially in wounds with large amounts of bone loss and tissue damage [13]. Skin traction can be used for short term splintage for transport with such devices as the Thomas Splint or Sager Splint. However these devices are not designed for long term use [9] and skin traction produces poor long term results as reported by Lane in 1905 [13].

Skeletal traction is useful for long term treatment but further equipment is required that is not routinely held in a Role 2/3 medical facility. To enable the use of skeletal traction various devices have been designed and constructed by the engineers co-located with Role 2 facilities as previously described by Dharm-Datta and Hill [14].

The first report of skeletal traction was in 1907 when Steinmann used two pins through the femoral condyles. His interest in this technique was spurred on by the complications of skin traction and the poor result revealed by the use of X-Rays in the diagnosis and monitoring of fractures for the first time. Not long after this he moved on to a 'through-and-through' single pin technique which became widely used [13].

In 1949 Winant wrote of his experiences with skeletal traction for comminuted, compound femoral fractures suffered during the Second World War [15]. He used skeletal traction with good results, preferring traction through the femoral condyles as he thought that this allowed better knee movement, lessened skin necrosis around the pins and prevented loss of traction across the knee joints soft tissues. Winant tended, however, to leave his patients in traction for months; the mean reported time from injury to mobilisation was 6.1 months.

Skeletal traction continues to be used in the management of ballistic femoral fractures. Clasper and Rowley described its use in casualties from the conflict in Sudan, treated at the remote ICRC hospital in Kenya [16]. The patients all attended the hospital at least 24 hours after their injury and had received minimal pre-hospital treatment. They were treated in traction for an average of 58.7 days and needed to return to theatre an average of 4.9 times but had good results; of 53 patients 92.3% healed well. This hospital was resourced similarly to a Role 2 facility and the hospitals that any locals would be discharged to. The results can therefore be extrapolated to what could be expected to be achieved by UK military surgeons working at Role 2.

Role 2 facilities will commonly be deployed in situations where the local infrastructure has collapsed, and local medical care will be far below the level that would normally be delivered in the UK. This leads to restrictions on the techniques that can be used on local nationals who are brought to UK facilities. Local expertise will not be there to either follow-up or carry out further operations that may be needed to provide best care.

The frame used in our case was constructed to a design by the Orthopaedic surgeon at the hospital. It follows a simple idea to allow a dynamic traction to be applied along the length of the femur with counter traction provided by the patient's body weight. It is important that the rope attaching the weight to the horseshoe is kept clear of the toes to minimise discomfort and prevent skin damage. For prolonged skeletal traction it is advisable that the knee is allowed to bend to facilitate physiotherapy. Bottles of water used as the counterweight thus allow easy adjustment to traction requirements. These simple ideas have been used to create many different designs some of which also incorporate a Thomas Splint.

The frame in our report provides traction but does not provide traction directly in line of the femur and no knee bending is possible. However this is an acceptable situation in the short term while arrangements are made to evacuate the patient back to the UK or into the local system. The patient still has a Thomas splint fitted but no traction was provided with it. This allows for easy conversion to traction via the Thomas splint for transport or evacuation.

Dynamic traction can also be provided with a wooden A-frame (Figure 4), again with weight provided by water bottles or even sand. The end of the bed is raised to allow the weight of the patient to provide counter-traction. If the patient is going to remain in traction as their definitive treatment then modifications are required (Figure 5). This frame allows traction in the line of the femur and allows for knee flexion.



Figure 4. Another DIY wooden frame with the bed elevated.



Figure 5. An excellent example of locally constructed frame with in-line traction and elevation of the leg.

As illustrated by the pictures, these are not complicated pieces of equipment. They can be easily modified to provide traction at the different stages of the treatment process but they should be facility specific as they will need to fit the particular type of beds and stretcher trestles.

Summary

Skeletal traction is a useful tool to immobilise femoral fractures for the short time between initial surgery and definitive treatment at a Role 3 facility for soldiers who will be evacuated to expert definitive care. It is also useful for the transport of locals who will go through the local hospital system where it is also likely to become their definitive care.

Skeletal traction can be provided using very basic frames which can be constructed using materials and skills close to Role 2 facilities and therefore is a technique that military orthopaedic surgeons should be aware of despite it falling from use in standard UK practise and reminds us of the need to learn from the lessons of the past.

Acknowledgement

The authors are happy to acknowledge that they did not personally design most of the frames discussed here, but they have used them in deployed hospitals. We are not aware who the particular designers were, but wish to acknowledge both the designers and manufacturers of the frames. The authors are not aware of any patent or other intellectual rights to the designs.

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