

Safe Aftercare of Foot and Ankle Surgery: Doing less is more: The Jones Dressing Cast

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Abstract

Aftercare of surgical procedures is not consensual in the community of foot and ankle surgeons. Although the incidence of infections following foot and ankle surgery is rare, soft tissue healing might be jeopardized after extensive and multiple approaches. Frequent follow-up with visual control of the operative wound is in part often thought to be the optimal wound care approach.

The clinical research about the Jones dressing cast showed: less frequent manipulation as well as strain limitation on the wound reduces the need of analgetics, the hospitalisation time, accelerates the mobilisation and helps to avoid complications.

Keywords: Foot surgery; Cast; Complications; Jones dressing cast; Post-operative

Introduction

The management of postoperative soft tissue healing is a keystone in elective foot and ankle surgery.

Due to its localization, postoperative edema is more relevant in foot and ankle surgery. Soft tissue healing might thus be longer and immobilization due to pain restricts function.

The incidence for infection in elective foot surgery is relatively low. Depending on the risk factors and tourniquet time, infection rate can be as high as 6% [1,2]. Miller et al. [3] showed that there is a higher rate of wound complications in foot and ankle surgery than in other orthopedic fields. This seemed to be caused by a lower perfusion rate and a higher degree of bacterial colonization compared to the rest of the body.

The potential risk factors should be recognized before surgery [4]. During the procedure, soft tissue trauma should be minimized to preserve the local vitality of biological structures. Vitality of the local tissues before and after the surgical intervention appears to be the most significant factor in the development of infection [5]. Staged open reduction and internal fixation may help reduce potential damage to the soft tissue envelope. Wound healing problems are usually associated with uncoordinated surgical practices within an unfavorable soft tissue environment [6].

Postoperative edema is a common sequela that contributes to unfavorable conditions for wound healing. Prolonged edema restricts motion in the extremity especially in small joints. It also compromises perfusion of the soft tissues and increases the risk of breakdown of the operative wound [7]. Edema is more likely to occur in the lower rather than the upper limbs due to the more difficult venous return.

During the postoperative period, special dressings and immobilization techniques may limit soft tissue edema and swelling.

Pathophysiology of Edema and Infection after Surgery

Surgical injury induces two basic mechanisms of increased vascular permeability. The first mechanism is short in duration and lasts about 15-30 minutes. It is linked to histamine and histamine-like permeability factors [4].

The small arteries undergo vasodilation and the endothelial cells change shape in a way that macromolecules can cross the cellular wall, thus penetrating the intercellular space. The osmotic pressure within this space in turn augments to a level causing extravasation of water. Histamine reaction accelerates this phenomenon by reducing the resistance of the vascular walls allowing increased permeability for reacting proteins [8,9].

The second mechanism, which increases the vascular permeability, is the injury itself. Surgical dissection and electrocoagulation lead to a prolonged leakage of blood, and lymph from the lymphatic vessels. More damage to the tissue during surgery leads to more edema of this type [5]. Generally, there is maximal vasodilatation 4 days after the surgical injury. The posttraumatic edema was shown to be maximal at 72 hours after a closed soft tissue injury [10].

The ultimate tensile strength of the skin is low (plantar skin: 0.86 kg/mm², glabrous skin: 0.89 kg/mm²). The values for the bones, tendons, fascia and nervous tissue are 10.9 kg/mm², 1.3 kg/mm², 1.4 kg/mm² [11] and 1.3 kg/mm², respectively [12].

The strain of the skin around the foot is different to that of other body regions. It was shown that the ultimate relative elongation of skin is lower within the foot compared to the rest of the body's skin surface [12].

The skin is thus the weakest and most vulnerable tissue in case of edema [12].

What can be done?

Regarding the above-mentioned mechanisms, the surgeon has the following possibilities to help minimize edema and its related complications:

1. Select the appropriate operation for the patient. Take into account the age, general health of the patient and the limb involved [4].
2. Perform gentle anatomic dissection; avoid extensive dissection or trauma
3. Immobilize and gently elevate the limb to reduce the intravascular pressure
4. Apply compression dressings to raise the interstitial pressure
5. Limit wound contamination during the healing period
6. Cryotherapy
7. Limit the histaminic reaction using short acting corticosteroids

However, the planning and decisions made before surgery as well as the surgical success depends on the skill and the personal experience of the surgeon. It should be realized that all damaged structures must heal. The greater the amount of damaged tissue, the more likely is the possibility for complications such as infection, hematoma and excessive scar formation. Essential structures such as nerves and vessels should be handled with meticulous care and preserved. Deliberate sharp dissection will minimize greater tissue damage, which may often be seen with blunt dissection and the use of scissors.

Systemic applied corticoids can have significant side effects, e.g. restriction of the local and systemic immune resistance, which further can trigger infection.

Reduction of intravascular pressure and therefore edema is best achieved in a horizontal supine position.

Techniques to immobilize and optimize intra-, extra- and interstitial pressure-ratio, limit wound contamination

Treatment of wounds enclosed in a plaster cast or in gauze and thick gauze dressings with the intention of safe soft tissue management was reported earlier in war-surgery literature [13,14].

Toward the end of World War I, the American surgeon Winnett Orr observed that soldiers who were admitted to his hospital with wounds enclosed in a plaster cast had generally better soft tissue condition than others who had been treated without cast [13].

In 1921 Sir Robert Jones already believed that edema increased tension between the wound edges, thereby jeopardizing wound healing. He and others also thought that swelling in and around joints contributed to long-term stiffness [14]. He recommended a specific technique to control edema of the upper and lower limbs, which was specifically designed to address edema associated with wartime injuries. He described the use of multiple layers of bulky cotton wool covered with calico bandages [14].

Charnley further modified the original "Robert Jones bandage". Three layers of wool and three layers of domette bandage were applied gently but firmly 6 inches above and below the joint up to a thickness of 2 inches [15].

Watson Jones refers to the Jones compression dressing as a "crepe bandage over copious wool dressings" applied after knee surgery [16]. He later described the application of an encircling plaster cast applied on the top of the soft layers, and used this dressing for splinting closed fractures of the lower leg. Special care was taken to apply additional

cushioning around the joints before the encircling turns of plaster bandage were applied [17].

Matsen and Krugmire [18] showed that externally applied compression on swollen soft tissue injury can limit the extent of swelling.

Lehnert et al. [19] noted that the wounds, which were dressed with compressing foam, had significantly less edema and ecchymosis.

Gerard et al. reviewed 18 years of treatment using a Jones compression bandage and concluded that it is an efficient tool to control edema after foot surgery [20]. They applied a compression bandage over a sterile surgical dressing on the operated foot. The whole dressing was removed after 5-7 days and a new dressing was applied if deemed necessary. The authors report the successful use of such a dressing cast up to 8-16 weeks without encountering any cast-related problems.

Matsen and Krugmire [18] warned that compression must be uniform to prevent peaks inducing a compartment syndrome. But Smillie indicated that the initial pressure remains for approximately 48 h [21]. The resulting compression after application of the Jones compression bandage following knee meniscectomy varies between 40-60 mmHg depending on the technique of the surgeon, but fell to a negligible amount of 2-10 mmHg in 48 h.

Despite this quite extensive clinical experience, the principles of long lasting closed dressings during soft tissue healing are not widely accepted.

Frequent follow-up with visual control of the operative wound is in part often thought to be the optimal wound care approach.

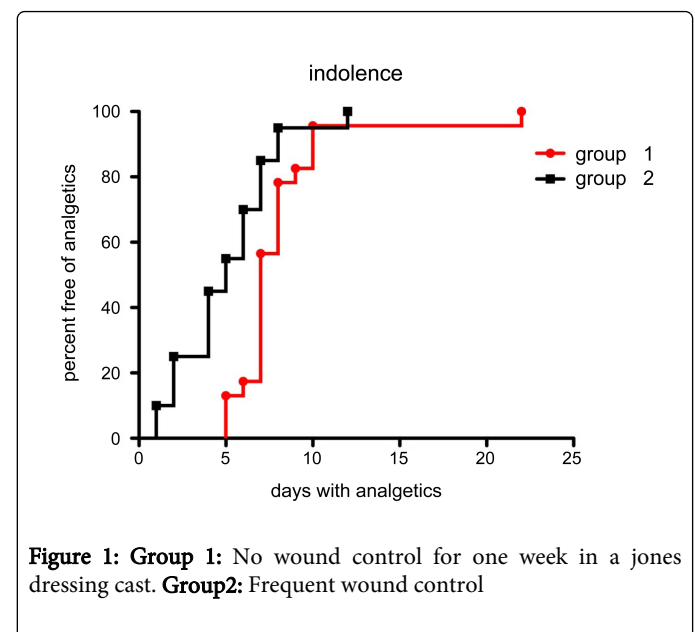


Figure 1: Group 1: No wound control for one week in a jones dressing cast. Group2: Frequent wound control

The Jones Dressing Cast

A single center study of the author [22] showed, that patient treated with a jones-dressing cast with no follow-up of the operative wound achieve significantly earlier their original mobility, their hospitalization time is shorter and the need for analgesics is less, even when the patients are elder and the surgery is more complex.

The Jones dressing cast is applied sterile, immediately post-operation in an encircling manner (no slit) and it is recommended that it remains in place for two weeks. There is no visual control or follow up in this period.

In this study 43 patients were divided in two groups. In group 1 the wound dressing was changed frequently (every second day) after complex surgery of the foot with no visual control. Patients in group 2 were treated with a jones dressing cast for 1 week.

Patients in the cast group were mobile using crutches and using stairs one day earlier than patients of group 1.

The patients treated with the cast spent a mean of 7.4 days in hospital compared to 11 days in the noncast group (p 0.012).

Patients in the cast group 2 were free of analgesics 2 days earlier than the patients in group 1, as demonstrated in figure 1 (p 0.003).

It was assumed that reduced strain to the soft tissue cover due to the cast might reduce the complications in the post-operative period. The Jones dressing cast provides a layer of higher tensile strength that helps to protect the skin. [12]

In this study the jones dressing cast facilitated deambulation. It protects the wound from the environment, allowing for a reduced hospitalization time and medical care of the wound was limited to the suture removal.

With the aid of this cast Klauw [23] kept the hospitalization time for patients that underwent reconstructive foot surgery (DRG ICD I20A/B) to 1/3 to 1/2 to that of Switzerland's average in 2013. The financial advantages are obvious.

A reduction in wound control doesn't raise the incidence of compartment syndrome or any kind of complication. However in case of any suspicious clinical presentation, the soft tissue condition should be checked. There always should be the possibility to slit a cast in case of prolonged pain. Thus hospitalization is recommended (Figure 2).



Figure 2: 2 weeks after Lisfranc-arthrodesis with TP-Augmentation. A: before cast removal; B: intra OP X-ray C: cast is removed, Sterile wound coverage still in place D: before suture removal.

Conclusion

For Safe aftercare of foot and ankle surgery it is evident to have limited wound manipulation and contamination, edema-prophylaxis, reduction of strain or motion on the wound edges and soft tissue. The Jones dressing cast is a very good tool to achieve all these conditions.

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