Cost Benefit Analysis Of Suture-Button Versus Screw Fixation Of The Distal Tibiofibular Syndesmosis.

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Citation

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Abstract

The aim of the paper is to discuss and evaluate the cost effective use of the suture-button device as an alternative to screw fixation for the use of distal tibiofibular syndesmosis for the purpose of anatomical reduction of posttraumatic disruption in association with ankle fractures. While the medical consumables remain more expensive per unit cost, the relative cost savings to the organisation through a combination of length of stay, procedural cost, and the risk of operative and post operative complications, provides strong evidence that the suture-button technique, if adopted, may result in significant savings to the health care providers while at the same time not increasing the risk profile to the patient- that is, provided that the organisation's practice is to remove the Diastasis Screw fixation prior to mobilisation.

INTRODUCTION

The aim of the paper is to discuss and evaluate costs and benefits associated with the use of the suture-button device as an alternative to screw fixation for the distal tibiofibular syndesmosis reduction of posttraumatic disruption, in the setting of ankle fractures.

A review of the literature has indicated that the suture-button technique has similar clinical outcomes to the traditional screw fixation in patients who have syndesmotic injuries associated with ankle fractures.

While the medical consumables remain more expensive per unit cost, the relative cost savings to the organisation- through a combination of length of stay, procedural cost, and the risk of operative and post operative complications- clearly demonstrates that the suture-button technique if adopted may result in significant savings to the health care providers, while at the same time not increasing the risk profile to the patient.

MATERIALS AND METHODS

The Toowoomba Hospital is a 280 bed public hospital located in the Darling Downs Health Service District of Queensland Health, Australia. It provides acute secondary care to a regional population of approximately 280,000 dispersed throughout South-West Queensland. It has a Level two ICU, providing general and specialist surgical services. Due to its location, it acts as the main referral centre for multiple smaller rural hospitals- many up to 1000 kilometres away.

Costing data has been compiled from Queensland Health specific supply costs and associated procedural billing costs as published Patient charges as of the 20 th of March 2011. It is accepted that through state wide purchasing arrangements the figures quoted for medical consumables may vary from other states and the private sector; however, the bulk purchase arrangements through Queensland Health are designed to reduce cost, illustrating that a cost saving on this basis could be extended to greater savings overall in other markets.

Within the Toowoomba Hospital the Arthrex "TightRope® plus" syndesmosis repair kit has been introduced as an alternative to screw fixation for the distal tibiofibular syndesmosis. The cost per unit is approximately $589.00 AUD per unit.

Alternative standardised practice utilising screw fixation is based on the following consumable costs:

Cortex Hex screws 4.5 x 45-85mm $50.00 AUD ea.

Cortex Hex screws 3.5 x 26-40mm $21.30 AUD ea.

Cortex Hex screws 3.5 x smaller than 26mm $12.20 AUD.

The size that is used frequently is usually a 4.5mmCortex Hex Screw between 50 and 65 mm in length.

Queensland Heath Patient bed day costs have been published as the standard bed cost $1190.50 AUD, and ineligible patients were published as costing $1006.00 AUD.

Simple cost modelling suggests that the minimum cost of diastasis screw repair of distal tibiofibular syndesmosis, inclusive of:

(A) The standard admission plus

(B) A second same day readmission for removal of the diastasis screw plus

(C) the associated medical consumables.

This amounts to a total a total of A + B + C approximately $2431.00 AUD.

Cost modelling of the suture button alternative involves:

(D) TightRope® consumable $589.00 AUD per unit plus

(E) Standard admission cost

This amounts to a total of D+E, which is approximately $1779.50 AUD.

This clearly demonstrates a potential cost saving of $651.50 per case.

The trend at the Toowoomba Hospital, in the majority of patients , is to remove the diastasis screws routinely before increasing the patient's weight bearing status. This requires a second admission, anaesthetic and procedure.

At our hospital, 89 Ankle fractures were treated operatively between January 2011 and Jan 2012. During the same period, 33 diastasis screw removals were performed. Based on the above cost saving, an amount of $21,499.50. AUD could have been potentially saved at our institution.

The use of the suture button technique has only recently been introduced at our institution and no post operative complications have been experienced, however the above cost savings are based only on the consumable and the two admission costs, a full economical comparison should include other data such as costs of treating complications and the cost of rehabilitation that is outside the scope of this paper.

DISCUSSION

Foot and ankle surgeons agree that anatomic reduction and stable fixation of the acutely unstable distal tibiofibular syndesmosis is critically important for restoration of maximum long-term ankle function. 1. 6. However, the indications and optimum techniques for stabilisation of the syndesmosis remain controversial. 1. Disruption of the tibiofibular syndesmosis occurs in 10- 15% of patients with ankle fractures. 4.

The Arthrex TightRope® is a non-absorbable fibrewire suture between two metal cortical buttons. It is implanted across the syndesmosis using a minimally invasive technique. It is claimed that the TightRope® offers the potential for simple and secure repair of the tibiofibular syndesmosis. Potential advantages of this device include more rapid return to weight-bearing, maintenance of physiologic micro motion between the tibia and the fibula, and elimination of the need for device removal. 1. 4. 6. 7. The premise of the demonstrated cost saving is dependent on the second operation for screw removal. However, the physiological benefits of the suture-button technique may ultimately lead to the conclusion that the procedure is superior, savings aside.

There is a paucity of randomised controlled trials on the absolute need for removal of the syndesmotic screw. However, current literature suggests that it might be reserved for intact screws that cause hardware irritation or reduced range of motion after 4–6 months. 9. Level 2 evidence suggests that the Arthrex TightRope® is a valid option for the foot and ankle surgeon to use in syndesmotic injuries and may offer a method that is as effective as traditional AO screw fixation. 6. As stated above, the trend at the Toowoomba Hospital is to remove the diastasis screws before increasing the patients weight bearing status in the majority of patients. This requires a second admission, anaesthetic and procedure.

Cadavaric studies have demonstrated that suture-button fixation maintained reduction after cycling with submaximal loads that compared favorably to the intact syndesmosis. It also allowed more physiologic movement of the fibula in the sagittal plane when compared to tricortical screw fixation. A less rigid fixation method provides a more physiologic type of healing of the syndesmosis. 8.

Normal tibiofibular motion may lead to better objective ankle motion as well as a decreased subjective stiffness and discomfort following fixation. 10. Allowing earlier ankle range of motion, earlier return to work and obviating the need for a second surgery to remove the implant, points towards the conclusion that performance is improved when

compared to traditional methods of fixation. 1.9.There is evidence of rapid recovery and improved outcome scores with suture-button fixation versus screw fixation. 2. A published study comparing screw and TightRope® fixation found that patients who received TightRope® fixation had higher functional scores both at 3 months and at 12 months, with no loss of reduction on computed tomography examination. 3.

In addition, the device may be advantageous in patients who are non-compliant with non-weight bearing or who have osteoporotic bone in which screw loosening may be an issue. 5.

Clearly the TightRope® is not without complications; the literature we reviewed contained a number of case reports where by TightRope® fixation required removal. In each case this was due to a problem with the soft-tissue overlying either the medial or lateral button. There was no evidence of infection in either case, and the histological appearance of granuloma formation is suggestive of soft-tissue irritation as the underlying problem. In these reported cases, the TightRope® was placed directly through the fibula and not through a plate. This could be due to mechanical irritation of the overlying tissues. The metal buttons are made of stainless steel, so it is unlikely that this would inherently induce an inflammatory response. Debris may be created by micro movement of the suture material against the button leading to giant cell activation, stimulating granuloma formation. 7. Stimulation of a chronic inflammatory response appears to be the underlying problem reported in these case studies. 7. Osteolysis and subsidence of the suture button appear to be more likely with longer follow up, and may cause local irritation. 1.

We have not observed any complications in the small number of patients in whom we used a TightRope® at our institution.

TightRope® hardware removal may still be required in a certain number of patients, even after years have passed. 1. 4.

Heterotopic ossification may be observed in patients with syndesmotic injuries, regardless of fixation technique. 1.

The literature reviewed also stated that the suture button technique could be of benefit as an adjunct to traditional methods of fixation in certain circumstances. Anderson et al. stated that their preferred method of fixation in the elite athlete includes the use of a small plate incorporating one syndesmotic screw as well as one suture button. 2. The syndesmotic screw is removed at 10 to 12 weeks, but the suture button is left in place as an adjunctive fixation tool that affords protection while allowing motion between the tibia and fibula. The retained fibular plate protects against stress fracture through the empty screw hole. 2.

CONCLUSION

It can be clearly demonstrated that the use of the suture-button device as an alternative to screw fixation for the distal tibiofibular syndesmosis for anatomical reduction posttraumatic disruption is a cost effective model.

The literature reviewed provides strong evidence that the method is both acceptable in relation to clinical outcomes and complication profiles. Since the currant practice at the Toowoomba hospital is to remove the diastasis screw prior to mobilising and increased weight bearing, it is clearly evident from the cost modelling that the TightRope® suture-button fixation at the Toowoomba Hospital may be a cost effective option for treatment.

The cost saving demonstrated could potentially be extended to other heath services in the region. The magnitude and significance of the cost benefit would be more clearly demonstrated if the suture button technology were chosen over screw fixation all over Queensland.

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