



Theodoros Bouras is a dedicated Knee Surgeon. He works currently as a Senior Clinical Research Fellow in Knee Surgery for the Cardiff and Vale University Health Board. He has been appointed as the BOA clinical leadership fellow in Knee surgery from August 2019.



Brian Andrews is a Global Marketing Manager with Molnlycke Healthcare, responsible for the company's negative pressure wound therapy devices developments. A nursing, biological sciences and business graduate, Brian has worked in the field of advanced wound care for more than 20 years. He is motivated by the need to provide adequate healthcare to all members of society, regardless of social or economic status.



Rhidian Morgan-Jones is a Fellowship trained Knee Surgeon working at the University Hospital Llandough, Cardiff. Having trained in the UK, South Africa and Australia he now provides a tertiary referral service for complex and infected Revision Knee Replacements and Chronic Osteomyelitis. He has lectured nationally and internationally and is widely published. Rhidian is currently an elected BOA Trustee.

Closed incision negative pressure wound therapy in orthopaedic surgery

Theodoros Bouras, Brian Andrews and Rhidian Morgan-Jones

Over the last two decades the vast success of negative pressure open wound treatment (NPWT) in orthopaedic and trauma surgery led in the use of this emerging technology over closed incisions. The aim was to reduce risk of surgical site infection, formation of haematoma or seroma and dehiscence. Depending on the orthopaedic procedure, surgical site infections (SSIs) can be as high as 30%.

Major risk factors are obesity, diabetes mellitus, smoking and prolonged surgical time. The risk of SSI is significantly higher in high energy trauma and more specifically in open fractures of the lower extremity compared to elective procedures such as primary total hip replacement (THR) or total knee replacement (TKR). Slightly higher rates are seen in revision arthroplasty cases. However, an infected prosthetic joint can result in a series of reoperations for the patient hence bigger overall costs compared to the cost of closed incision negative pressure dressing treatment (ciNPT).

Since its first application in 2006, using a traditional negative pressure pump coupled to a home-made dressing, fashioned from open cell reticulated foam, and polyurethane thin film, smaller more portable devices have been developed. The first of them, Prevena[®] developed and manufactured by KCI USA, Inc, San Antonio, TX., has been designed specifically for use in the management of closed surgical incisions and embraces some of the desirable attributes of the early pioneer clinician engineered systems (Figure 1).

Most notable, the Prevena system dressing is constructed around an open cell reticulated foam that is bonded to a skin-friendly fabric. Together, the foam and fabric form the core of the dressing that is enveloped in a loosely fitting polyurethane film skin. Coupled to a portable battery operated pump creating a vacuum of -125mmHg, the dressing can be observed to contract and compress around the core of the reticulated foam imparting a contractile force that reduces stress in tissue at the insertion point of sutures or staples.



Figure 1



Figure 2

Other benefits said to result from the compressive force derived from the vacuum dressing include lower incidence and faster clearance of haematoma/seroma, lower incidence of dehiscence and less surgical site infections (Figure 2). A second system that is increasingly being used in similar applications is PICO® developed by Smith & Nephew (Figure 3). With this system, in an effort to reduce bulk and further improve portability, developers have forgone the use of a canister in favour of a multilayer dressing that serves the dual purposes of manifolding a vacuum, and managing incision drainage. The result is a highly portable and small pump that uses one less battery than Prevena, although it only generates a vacuum of -80mmHg. However, for an attached soft vacuum port, the multilayer dressing is not dissimilar to a conventional post-operative dressing in appearance, and is very easy to apply, but must be secured with secondary fixation strips to maintain an effective vacuum seal (Figure 4).

In respect of the conveyance of a vacuum and associated benefits and for the observation of a slight settling or compression of the absorptive pad, there are no gross changes to the dressing that confirm the effects of the vacuum as seen with the Prevena dressing.

“Benefits said to result from the compressive force derived from the vacuum dressing include lower incidence and faster clearance of haematoma/seroma, lower incidence of dehiscence and less surgical site infections.”

One explanation for this could be that the layer of the dressing required to convey a vacuum to the tissue interface, the spacer layer, is required to be a relatively firm open celled structure that will naturally resist compression in order to maintain patency. Despite this apparent contradiction, researchers conclude that FEV modelling confirms that the multilayer

dressing produces a similar effect in respect of reduced tissue stress reduction as observed with the Prevena system. Despite differences in appearance and apparent mode of action, there is a growing body of evidence supporting the effective application of negative pressure therapy to closed surgical incisions. This treatment modality provides stabilisation and sterilisation of the wound environment with contraction, diminished tensile forces, decreased edema by removal of exudate as well as increased blood and lymphatic flow.

The World Health Organisation in 2016 released the first ever global guidelines for SSIs, recommending closed incision negative pressure prophylactic treatment in high risk patients. However, it was highlighted that in low-resource settings other interventions should be prioritized over the use of ciNPT considering its poor availability and associated costs. The same year, an international multidisciplinary consensus panel recommended ciNPT for patients with one or more comorbidities or in patients with historical high risk for developing surgical site complications. Though established for orthopaedic trauma cases, latest evidence has reported that the use of ciNPT for primary joint

replacement can be considered since significant reduction in length of stay and postoperative wound complications have been documented. However the cost-effectiveness of the modality is still a considerable issue. Reducing the incidence of surgical events such as dehiscence, haematoma/seroma formation and SSI, ciNPT systems will no doubt evolve as understanding of cause and effect are more clearly understood through continued research. ■

References

References can be found online at www.boa.ac.uk/publications/JTO.

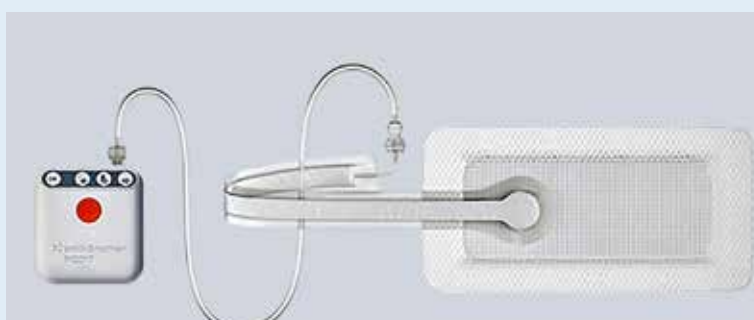


Figure 3



Figure 4