

Clinical Trial of a New Device for Real-Time Muscle Pressure Measurements in Patients with an Upper or Lower Extremity Fracture at Risk for Acute Compartment Syndrome

Ross K. Leighton, MD; Mohammed Ali M. Balhareth, MD, MBBS

Nova Scotia Health - Halifax Infirmary, Halifax, Nova Scotia, CANADA

Purpose: Acute compartment syndrome (ACS) is an orthopaedic emergency. In this pilot study a continuous compartmental pressure monitor (“the device”) was assessed for its ease of use and ability to continuously reflect the intracompartmental pressure (ICP) in real time.

Methods: Patients with long bone trauma of the lower or upper extremity at risk for compartment syndrome were consented and enrolled in the study. The device was inserted in the compartment deemed most likely to develop ACS and ICP was continuously measured for up to 18 hours. Fractures were classified according to the AO/OTA classification. Patient clinical signs and pain levels were recorded by health-care staff during routine in-patient monitoring.

Results: 28 patients were enrolled from November 2020 through December 2021: 18 males and 10 females. The mean age was 40 years (range, 17-76). 18 patients received the device postoperatively and 10 received it preoperatively. Preliminary results show that postoperative ICPs tend to be significantly higher than preoperative ICPs but decrease quickly. The trend in this measurement appears to be more significant than absolute numbers, which is a real change from the previous literature. One patient preoperatively illustrated a steep trend upward with minimal clinical symptoms but required compartment release at the time of surgery that exhibited no muscle necrosis. The Δp , or difference between the diastolic blood pressure and the ICP, correspondingly decreased with the increasing ICP resulting with a final Δp prior to release that was negative, indicating blood circulation was compromised. The increase in ICP and decrease in Δp predated clinical findings of compartment syndrome.

Conclusion: Preliminary results suggest that this device is reliable and relatively easy to use. In addition it suggests that ICPs can be higher immediately postoperatively but decrease if the patient does not develop ACS. These results are in line with current literature of the difference between pre- and postoperative baselines and thresholds of ICP, but are much more striking, as continuous measurements have not been part of the data set in most previous studies. Further elucidation of the pressure thresholds and profiles are currently being studied in the ongoing larger multicenter study and will add to our understanding of the critical values. Continuous trends in the pressure provide an early warning signal of the absolute pressure to come in the compartment that is being assessed by the device and may aid in preventing muscle necrosis during our management of these difficult long bone fractures.