

**Compartment Release in Austere Locations (CORAL):
A Pilot Study of Telesurgery for Compartment Syndrome**

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Purpose: Telesurgery for compartment release has the potential to improve limb salvage in austere environments. This pilot study was performed to establish the feasibility of this procedure and identify methodological issues relevant for future research.

Methods: Three anesthesiologists and one critical care physician were recruited as operators. The participants were directed to perform a two-incision leg fasciotomy on a Thiel-embalmed cadaver leg under the guidance of a remotely located military orthopaedic surgeon. The operating physician and the surgeon (mentor) were connected through Reacts Lite© software running on iPad Air2©, which allowed for real-time supervision and the use of a virtual reality pointer overlaid onto the surgical field. A critical care nurse without surgical experience performed as first assistant. Two experienced orthopaedic traumatologists independently assessed the adequacy of compartment decompression and the presence of iatrogenic complications. A questionnaire was administered to the physicians before and after the procedure to assess their level of confidence in performing this procedure.

Results: The average surgery lasted 56 min 12 sec (SD 244 sec) and consumed 1.3 GB (SD 0.47) of data. Both evaluators reported that 14 of 16 total compartments were completely released. The first evaluator considered that two deep posterior compartments were incompletely released at the soleus arch. The second evaluator considered that two superficial posterior compartments were incompletely released over the proximal gastrocnemius. There were no injuries to the saphenous nerve, saphenous vein, superficial peroneal nerve, tibial artery, or tibial nerve. The only complication was a large laceration to the soleus that occurred during a period of blurred video signal attributed to a drop in bandwidth. This resulted in the operator straying from the correct tissue plane while attempting to reach the deep posterior compartment. Once the video signal returned to normal, the deep posterior compartment was released adequately. The telementor reported the greatest challenges were visualization of the superficial peroneal nerve and release of the deep posterior compartment. The latter requires balancing full release at the soleus arch with the risk of injury to the popliteal vessels. Three of the four participants stated afterwards that they would feel confident or very confident to perform this procedure under the video guidance of a surgeon. We also observed a significant learning curve for the telementor.

Conclusion: Our results are promising and warrant further research. Both evaluators reported that all compartments were released with 87% of all compartments fully released. There were no iatrogenic neurovascular injuries. We noted interobserver variation in the

assessment of compartment release, which should be considered in the design of future research protocols. The deep posterior compartment is the hardest to adequately release during telesurgery. A head lamp would help visualization of deeper structures.