

Preoperative Transcutaneous Electrical Nerve Stimulation and Ultrasound: a Mapping Protocol to Minimize Cutaneous Nerve Damage During ACL Surgery



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Introduction

- Iatrogenic nerve injury is a common problem in procedures such as ACL surgery where there is little intraoperative regard for cutaneous innervation
- Damage to cutaneous nerves during ACL surgery leads to painful neuromas and general pain in the knee region, directly affecting patients whose profession requires kneeling
- There are few studies that investigate the precise locations of the femoral cutaneous nerve branches and infrapatellar branch of the saphenous nerve near the knee
- **Our goals:**
 - 1.) Accurately map cutaneous nerves in the anterior thigh/knee region
 - 2.) Develop a screening protocol to help surgeons avoid cutting nerves

Results

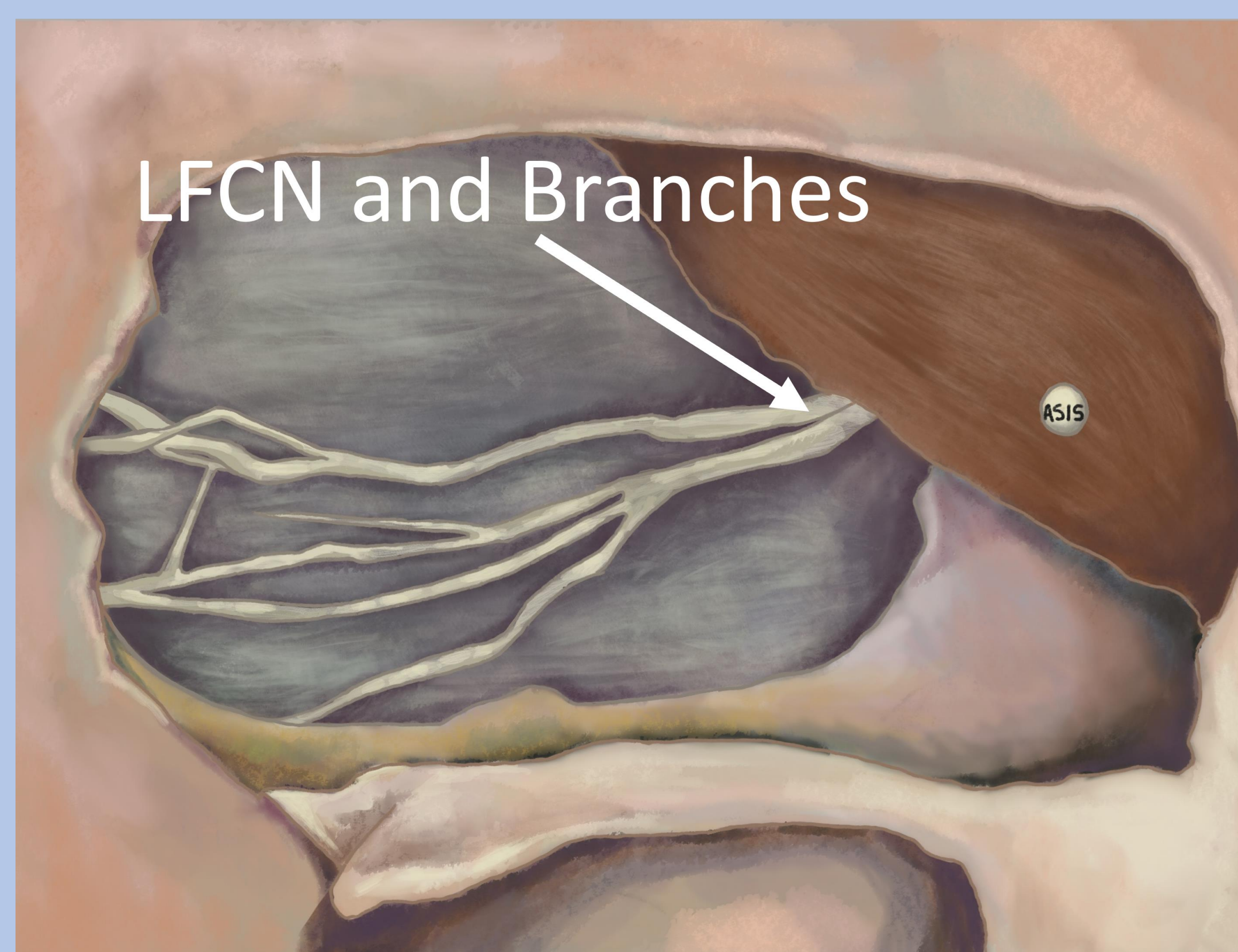


Fig. 4: Drawing of LFCN by Emma Schmidt

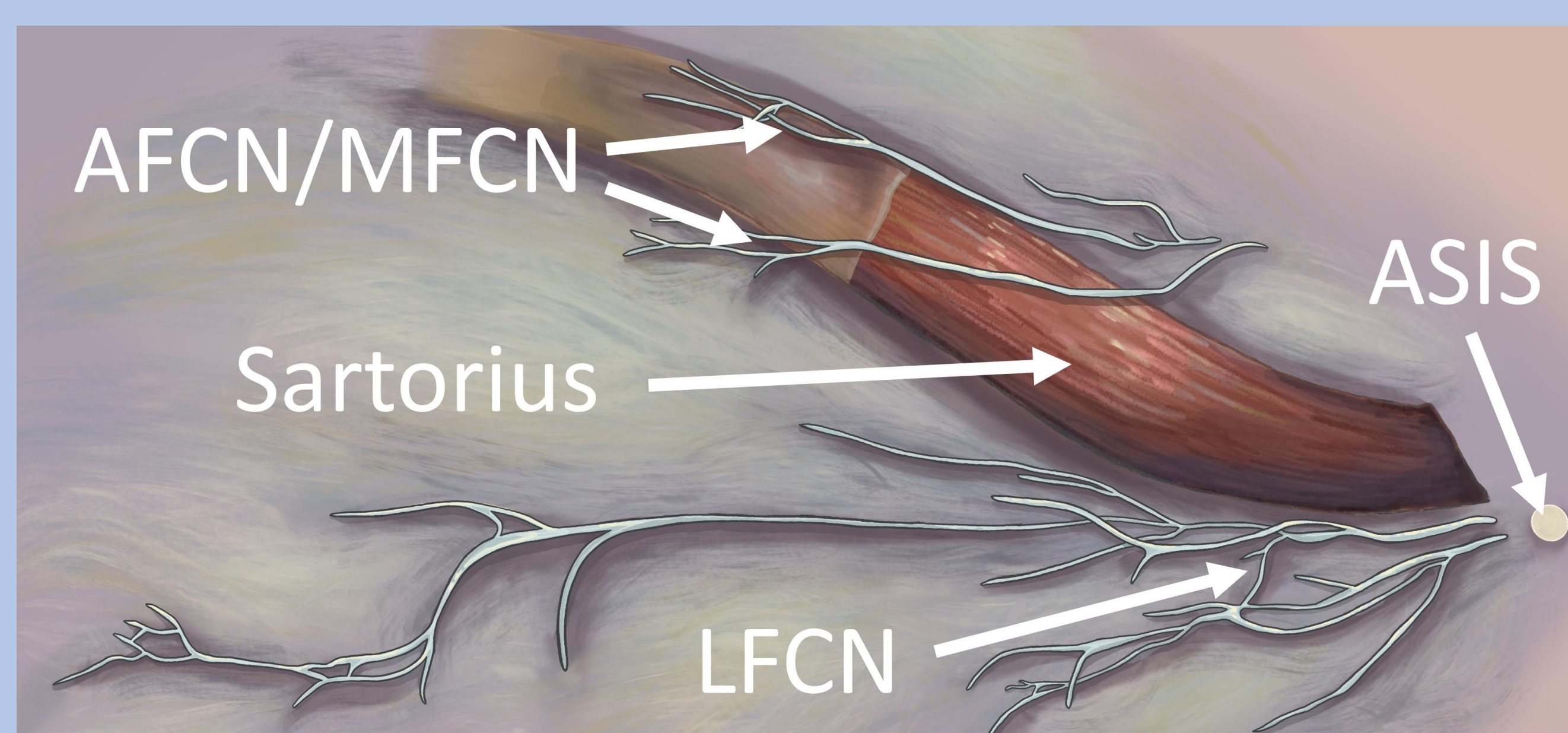


Fig. 5: Drawing of AFCN, MFCN, and LFCN by Emma Schmidt

Conclusion

- **Ultimately, we hope to:**
- 1.) Improve knowledge of cutaneous innervation in the anterior thigh/knee regions through drawings to inform future education of medical students, clinicians, and anatomists
- 2.) Provide a preoperative protocol that aids in avoiding iatrogenic nerve injury not only for ACL surgery but also other procedures

References

1. Hu, E.; Preciado, J.; Dasa, V. Development and Validation of a New Method for Locating Patella Sensory Nerves for the Treatment of Inferior and Superior Knee Pain. *J EXP ORTOP* 2015. <https://doi.org/10.1186/s40634-015-0032-2>
2. Natori, Y.; Yoshizawa, H.; Mizuno, H.; Hayashi, A. Preoperative Transcutaneous Electrical Nerve Stimulation for Localizing Superficial Nerve Paths. *J Plast Reconstr Aesthet Surg* 2015. <https://doi.org/10.1016/j.bjps.2015.08.018>.

Methods



Fig. 1: Cadaveric dissection of the lateral femoral cutaneous nerve (LFCN)

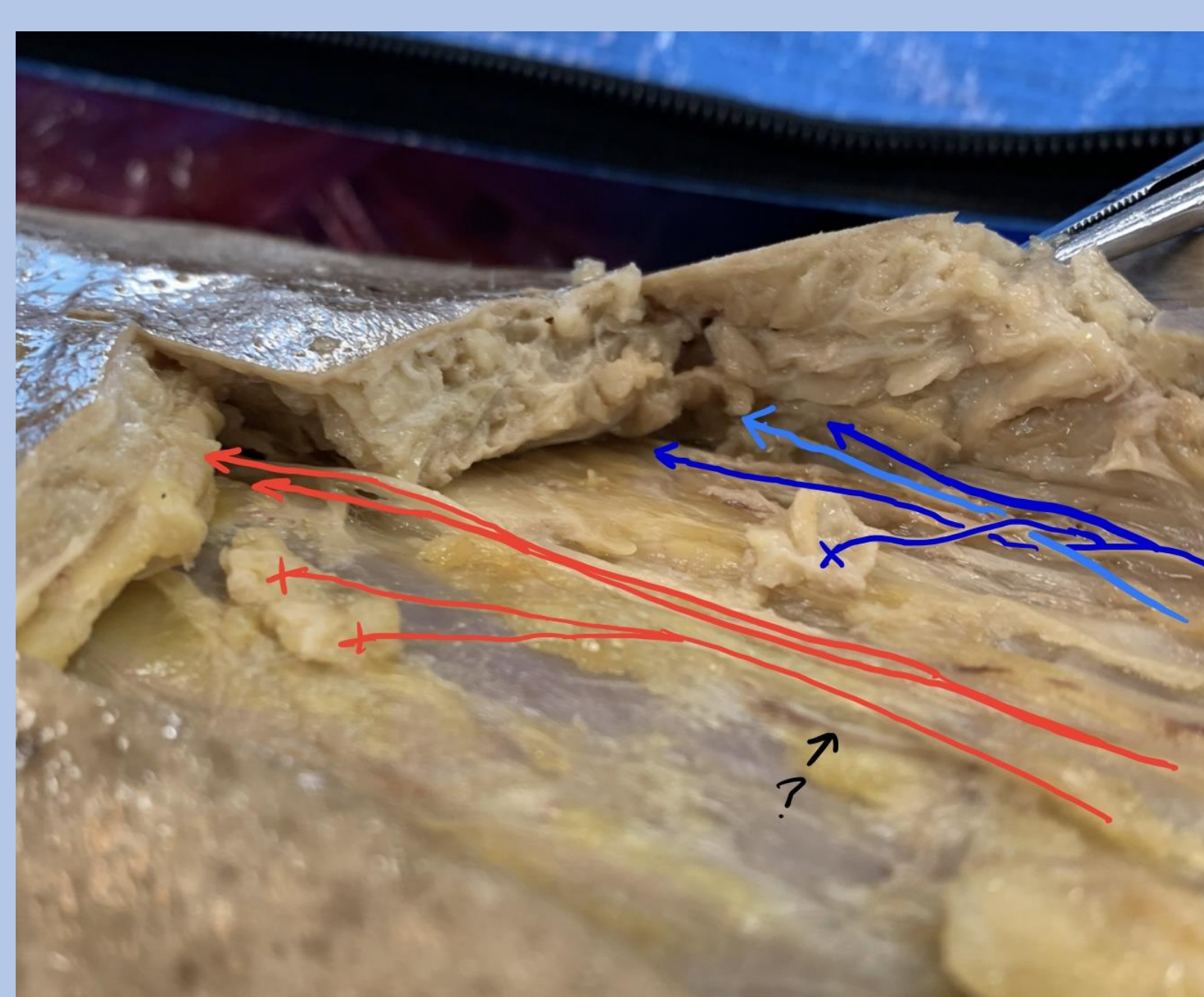


Fig. 2: Cadaveric dissection of the anterior femoral cutaneous nerve (AFCN) and medial femoral cutaneous nerve (MFCN)



Fig. 3: Stimuplex[®] HNS 12 TENS unit and application of electrode pen

- Based on techniques used in Hu et al. (2015)¹ and Natori et al. (2015)²
- We propose a combination of transcutaneous electrical nerve stimulation (TENS) and ultrasound (US)
- US would first be used to locate and mark the nerve paths
- A pen-type electrode connected to a TENS unit such as the Stimuplex[®] HNS 12 would then pinpoint sensory nerves based on patient feedback to confirm the US
- Topographic maps created from cadaveric dissection assist in selecting areas to employ the US/TENS screening method

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