

Early Functional Outcomes Following Targeted Muscle Reinnervation for Hip Disarticulation

Iulianna C. Taritsa, BA¹, Cristin Coquillard, MD¹, Joseph Ippolito MD³, Rushmin Khazanchi, BA², Terrance Peabody, MD², Samer Attar, MD², Gregory Dumanian, MD^{1,2}, Jason H. Ko, MD MBA FACS¹

¹Division of Plastic & Reconstructive Surgery, Northwestern University Feinberg School of Medicine. ²Department of Orthopedic Surgery, Northwestern University Feinberg School of Medicine. ³Department of Orthopedics and Rehabilitation, University of Chicago

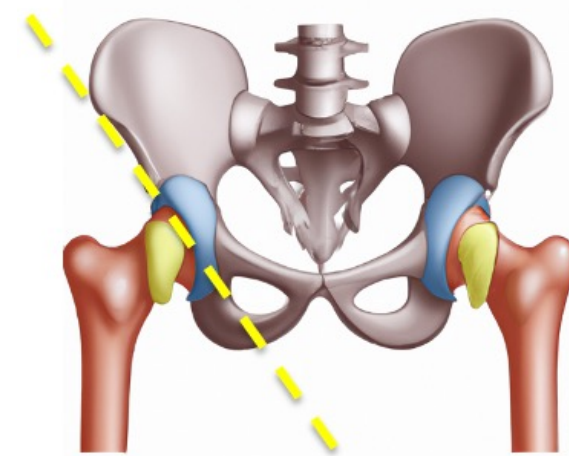
Background

Hip disarticulation is a surgical procedure reserved for extreme cases, representing only 0.39% of all amputations. It can be necessary for cancers (most often due to sarcoma), trauma, infection, and ischemia where limb salvage no longer remains an option. Hip disarticulation is a procedure performed most frequently by orthopedic oncologists. Following this amputation, poor outcomes related to pain and return to activities of daily living have been reported in the literature. Reports show near-total numbers of patients struggling with prosthetic limb use post-operatively and phantom limb pain. Many require chronic opioid use. Targeted muscle reinnervation (TMR) is effective alongside amputation for phantom limb pain and improving patient quality of life. Targeted muscle reinnervation (TMR) at the time of amputation at the extremity has been previously shown to improve phantom limb pain and quality of life.

Research Objectives

Describe operative technique of TMR done concomitantly with hip disarticulation
Describe peri- and post-outcomes for patients receiving TMR with hip disarticulation, including:

- Operative time
- Complication rate
 - Hematoma
 - Seroma
 - Wound dehiscence
 - Infection
- Opioid dependence (preoperatively vs postoperatively)
- Qualitative functional outcomes



Methods

A single-institution retrospective chart review was performed between March 2018 and March 2023. Patients were included in the study if they underwent hip disarticulation and had concurrent TMR surgery. Operative and post-operative outpatient notes were reviewed. The anatomy of the relevant nerves in the hip and leg and operative techniques were described. Data extracted included demographic information, indication for surgery, symptoms prior to operation, relevant nerve coaptation, operative time, peri- and post-operative complications (hematoma, seroma, need for re-operation, etc.), and long-term functional outcomes.

Results: Patient Demographics

- 9 patients included
- Median Age: 64 years
 - Median BMI: 27.7 kg/m²

Indication for Surgery

- Malignancy: 5
- Infection: 4

Median Operative Time: 6.5 hours
Median Follow-up Time: 5.42 months

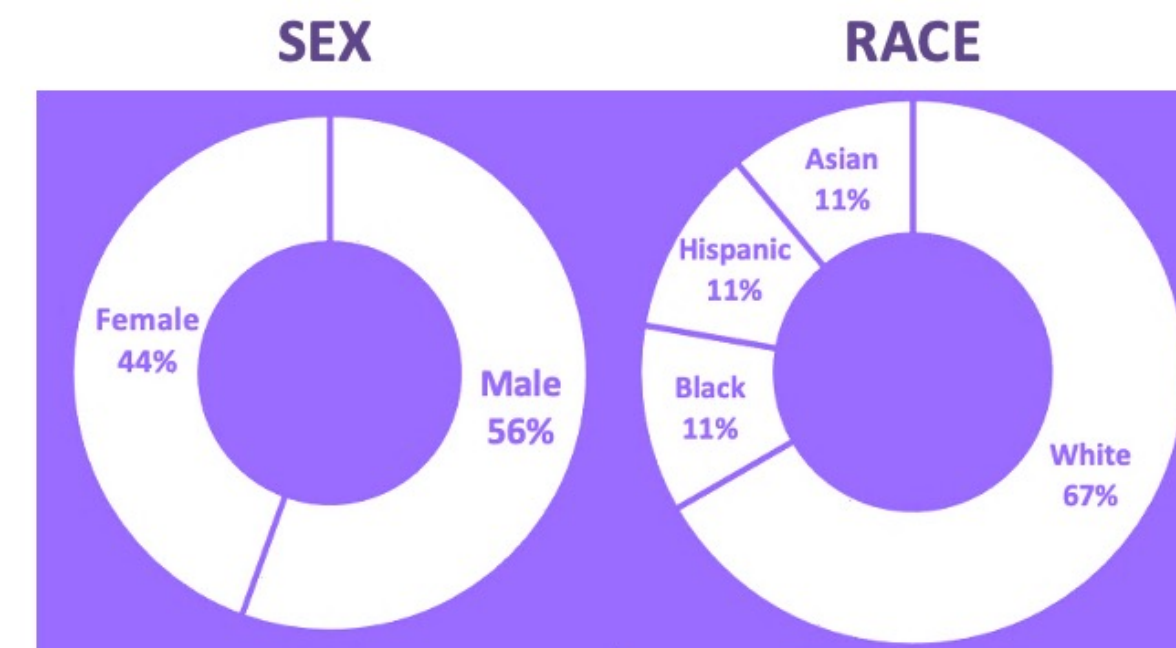
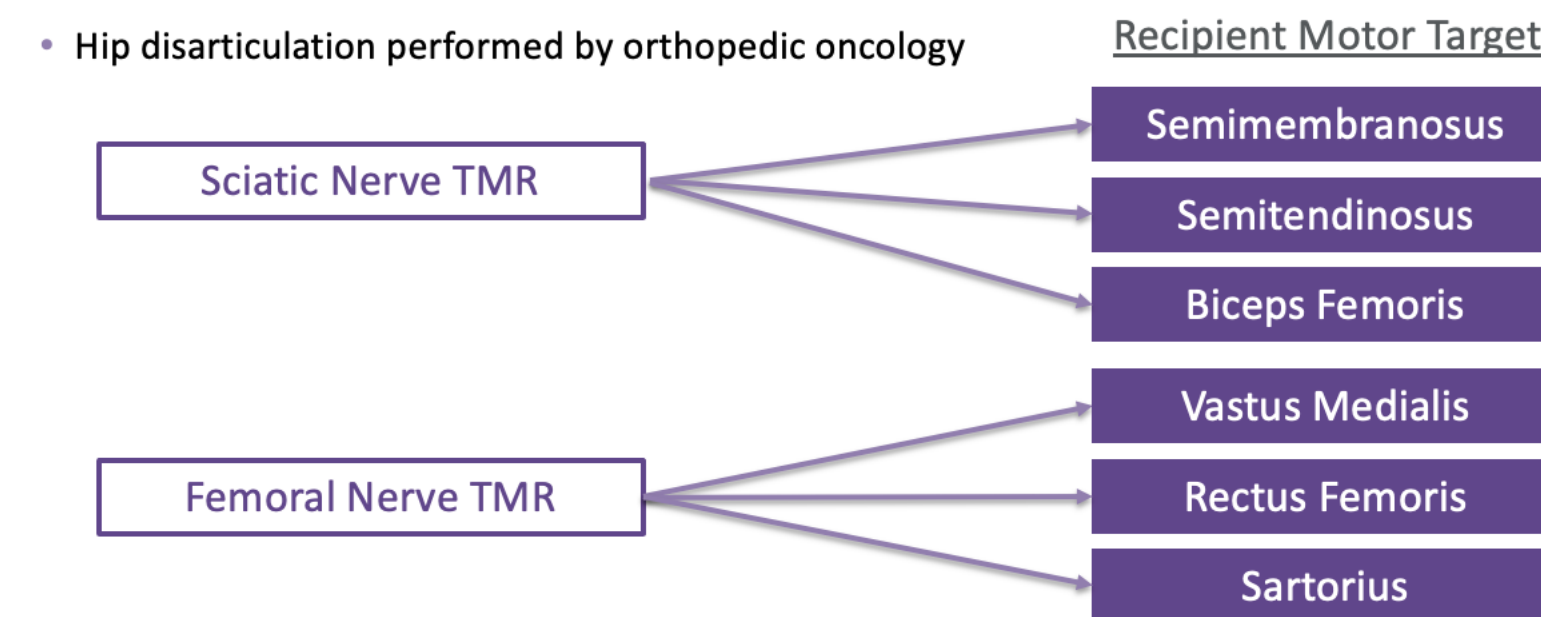


Figure 1: Patient race and sex characteristics

Operative Technique



Donor	Sciatic Nerve: Tibial Component	Sciatic Nerve: Peroneal Component	Femoral nerve	Saphenous Nerve	Lateral Femoral Cutaneous Nerve	Sciatic Nerve: Sural Component
Targets	<ul style="list-style-type: none"> Semimembranosus (x4) Semimembranosus and semitendinosus (x3) Semitendinosus Rectus femoris 	<ul style="list-style-type: none"> Biceps femoris (x7) Adductor unspecified 	<ul style="list-style-type: none"> Sartorius (x2) Vastus medialis (x2) 	<ul style="list-style-type: none"> Sartorius Vastus medialis 	<ul style="list-style-type: none"> Adductor longus Rectus femoris 	<ul style="list-style-type: none"> Semitendinosus Semimembranosus
Instances Coapted	9/9	8/9	4/9	2/9	2/9	2/9

Table 1. Nerve coaptation instances with muscle targets.

References

Moura, D. L., & Garruço, A. (2017). Hip disarticulation - case series analysis and literature review. *Revista brasileira de ortopedia*, 52(2), 154–158. <https://doi.org/10.1016/j.rboe.2016.09.008>

Jain R., Grimer R.J., Carter S.R., Tillman R.M., Abudu A.A. Outcome after disarticulation of the hip for sarcomas. *Eur J Surg Oncol*. 2005;31(9):1025–1028.

Dumanian, G. A., Potter, B. K., Mioton, L. M., Ko, J. H., Cheesborough, J. E., Souza, J. M., Ertl, W. J., Tintle, S. M., Nanos, G. P., Valerio, I. L., Kuiken, T. A., Apkarian, A. V., Porter, K., & Jordan, S. W. (2019). Targeted Muscle Reinnervation Treats Neuroma and Phantom Pain in Major Limb Amputees: A Randomized Clinical Trial. *Annals of surgery*, 270(2), 238–246. <https://doi.org/10.1097/SLA.0000000000003088>

Results: Postoperative Outcomes

Surgical Complications	Instances (n out of 9)
Fat Necrosis	1
Seroma	1
Hematoma	0
Infection	0
Wound Dehiscence	0

Table 2. Postoperative outcomes including hematoma, seroma, infection, fat necrosis, and wound dehiscence after hip disarticulation with concurrent TMR.

Results: Qualitative Functional Outcomes/Opioid Use

- Of 7 patients with data, 6 reported zero to rare phantom limb pain post-operatively
- Of 6 patients with data, 6 returned to weight-bearing with prosthetics/wheelchair
- No patients on long-term opioids 60 days after TMR

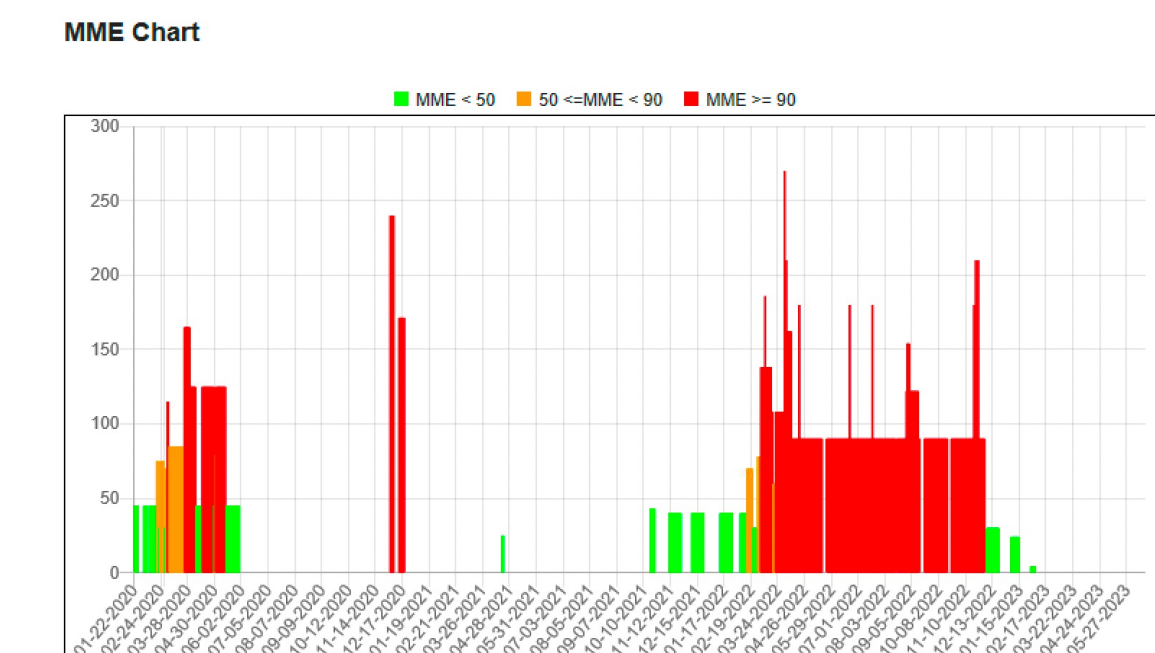


Figure 2. Representative opioid use chart illustrating cessation of use postoperatively.

Conclusions

- Patients who underwent TMR concurrently with hip disarticulation had excellent pain outcomes, low complication rates, and better functional outcomes than previously reported
- Future studies needed to compare outcomes of hip disarticulation with and without TMR (may be challenging due to low number of hip disarticulations performed and potentially differing indications)