



Commentary on Targeted Muscle Reinnervation in the Oncologic Population: A Literature Review and Current Practice

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I have been asked to comment on the comprehensive review of the procedure Targeted Muscle Reinnervation (TMR) written by Dr. Roubaud from the Department of Plastic Surgery at the University of Texas MD Anderson Cancer Center. Several concepts brought up in the manuscript regarding the performance of TMR in the oncologic patient are worthy of added emphasis.

Historically, amputation in the oncologic patient is performed as a last resort, when limb salvage is no longer possible. It has been regarded as a failure, rather than a “new beginning” [1]. New procedures including TMR, regenerative peripheral nerve interfaces (RPNI), direct skeletal attachment of prosthetics, and agonist–antagonist myoneural (AMI) tendon procedures all strive to optimize the limb that remains. As described in the manuscript, chronic local pain and phantom pain both cause decreases in limb function and quality of life for the patient trying to recover from cancer. Pain and phantoms are indeed a serious issue. In the community, the person with a major limb amputation has approximately a 25% chance of having no pain or phantoms, while the remaining report 25% mild, 25% moderate, and 25% severe pain and phantoms [2]. Procedures performed at the time of amputation surgery that serve to decrease pain and improve function are therefore necessary adjuncts in the care of the cancer patient.

It may be impossible to ever prove with level one evidence that immediate TMR at the time of amputation for oncologic patients is beneficial. Oncologic patients in need of amputation are often in severe preoperative pain from tumor growth and radiation therapy. Therefore, comparisons of pain for a single patient preoperatively and postoperatively will have numerous confounding variables. The 2019 study by Valerio and Dumanian compared 51 patients (71% with tumors or trauma) who underwent TMR at the time of amputation, and compared their long-term pain scores with 438 matched amputees in the community who did not have TMR [3]. The same pain outcome tool was used for both the TMR patients and the matched amputees. TMR, performed at the time of amputation, doubles to triples the chance of being pain free and phantom free. It moved the distribution of pain scores so that the majority of patients say that they have no pain or phantoms. There is no other treatment in the literature that has been documented to be effective long term for phantoms. The “price” for performing concurrent TMR is the overtreatment of the 25% of patients undergoing amputation who were not destined to develop pain and phantoms.

TMR can be performed at the time of amputation without significant extra morbidity. Technical debates on the best method to perform TMR will be solved in the next few years. Some surgeons will do their nerve transfers inside the wound, with the idea that there is minimal extra morbidity. Others (such as me) prefer to perform TMR more proximally where motor nerves can be more easily identified. This typically requires a position change for the patient. A benefit of a more proximal nerve transfer is to remain outside of radiation fields. In both cases, the TMR procedure can be performed in 60–90 min, and with minimal added morbidity that would otherwise already exist

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for the amputation itself. If TMR cannot be performed the day of amputation, it can be done with the same efficacy within 2 weeks, though it would require a return to the operating room and the additional risks of anesthesia and recovery.

An argument can be made to only perform delayed TMR for the 25% of patients who develop severe pain and phantoms after amputation. A point to be emphasized from Roubaud's manuscript is that "acute" TMR has better outcomes than "chronic" TMR performed for amputees with established pain and phantoms. The avoidance of pain and phantoms is more successful than its treatment. Lastly, Roubaud is on point when she writes that the surgical strategies to avoid painful cut nerve endings with TMR or RPNI should be a part of both limb salvage and amputation procedures.

In conclusion, the application of new surgical techniques such as TMR is welcome improvement in the care of the cancer patient. Education and training will allow these procedures to become widespread and the new standard of care.

References

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