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Review Article

Neuronal Regeneration Potential of Facial Nerve for Compound Wound in an Elderly Patient

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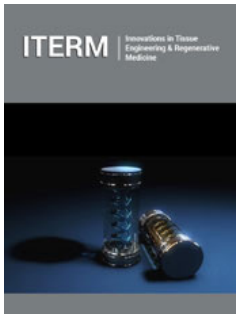

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Submission: January 12, 2021

Published: January 28, 2021

Volume 1 - Issue 4

How to cite this article: S Cox, R Hossain, SGJ Ng, M Mani and EK Tan. Neuronal Regeneration Potential of Facial Nerve for Compound Wound in an Elderly Patient. Innovations Tissue Eng Regen Med. 1(4). ITERM.000519.2021.

Introduction

The capacity of axonal regeneration and reinnervation in peripheral nerves are maintained throughout life but tends to be delayed and less effective with aging [1]. In complex and compound facial wounds, specifically where significant contamination and soft tissue loss is ensued, it can be a dilemma to decide between performing staged reconstruction of an injured facial nerve against primary repair especially in cases of heavily contused and/or divided facial nerve at multiple levels. We wish to share our experience of performing primary repair of facial nerve's branches in a compound facial wound with underlying fracture in a 70-year-old male patient. A significant recovery of all 5 branches of his facial nerve was observed 21 weeks after surgery.

We would advocate primary repair of a severely injured facial nerve in an older patient with a complex compound facial as a preferred option whenever deemed clinically possible as it can potentially yield good clinical outcomes and remove the need for further staged revisional surgery.

Background

A 70-year-old man presented to the Emergency Department (ED) within two hours of sustaining an equine related facial wound. He remembered being kicked in the right side of his face and developed a complex compound facial wound. The wound extended from his right nasolabial superiorly to his right outer canthus. His Glasgow Coma Score (GCS) was 15/15. His past medical history included significant ischaemic heart disease with an ejection fraction of 52% after an angioplasty nine years previously. A pan Computed Tomography (CT) revealed a right zygomatic body, infraorbital rim and parasymphisis fractures of the mandible but no other concomitant injury beyond his head. His right eye visual acuity was limited to counting fingers. His right pupil was fixed and dilated, and the intraocular pressure was measured at 50mmHg. He underwent an emergency canthotomy & cantholysis to decompress the orbit, which improved the intraocular pressure to 25mmHg.

He was attended by Maxillofacial team for emergency wound exploration, washout and internal fixation of his facial fractures. All his facial nerve branches were identified as divided within the wound and the on-call Plastic Surgery team was contacted. On upon further exploration, there was segmental loss of the zygomatic branch of facial nerve including the distal end. Branches to orbicularis oculi, risorius and main trunk of buccal branch were 100% divided; however, both proximal and distal ends were identified, albeit heavily contused.

The zygomatic branch was placed within zygomaticus major muscle substance and primary repair of other branches with 8'0 and 9'0 Ethilon were performed with minimal tension across repair sites where possible. A single drain was inserted into wound bed and overlying skin was closed with 5'0 Prolene. The drain was removed five days post-surgery and skin sutures removed seven days later. On week 21 post surgery, he was reviewed in Plastic Surgery Outpatients and observed to have adequate dynamic upper eyelid closure of his right eye and function of the buccal branch of the facial nerve. There was a mild ectropion of his right lower eyelid and he was listed for revisional lateral tarsorraphy.

Patient expressed satisfaction with his facial symmetry both at rest and on animation (Figure 1-4).

Figure 1: Pre-operative 3D CT of facial injury (left) and post fixation (right).

Figure 2: 5 months post-surgery.

Figure 3: Eye opening (left) and ability for full closure (right) 5 months post-surgery showing functional orbicularis oculi.

Figure 4: Cheeks at resting (left) and puffing out (right) 5 months post-surgery showing functional buccal branch of facial nerve.

Discussion

Peripheral nerve regeneration growth is around 1mm/day and is affected by a variety of different variables [2]. In order to reconstruct a peripheral nerve, there needs to be a stable skeletal framework, coverage of soft tissue over the nerve, an end organ to innervate as well as no infection [3,4]. Poor prognosis of nerve regeneration is associated with advancing age, more proximal injuries, delayed repair, scarring, smoking, nerve repair under tension, crush injuries with associated bony and soft tissue injury, and medical comorbidities such as diabetes, hypothyroidism and peripheral vascular disease [4,5]. Direct end to end repair of traumatically injured nerves has been found to be associated with better functional outcomes than other surgical techniques such as end to side, conduit or grafting options.4 Despite attempts to improve functional outcomes of peripheral nerve repairs, there has been little improvement over the last 50 years; in part due to relates to difficulties conducting RCT's and also lack of understanding basic human biology of nerve regeneration [6,7].

Advancing age is correlated with poorer outcomes of nerve regeneration, much of this is thought to be associated with reduced "robust regenerative response" but largely poorly understood [4,5]. The term advancing age defined as 65 years and older based on chronological age and socioeconomic constructs is not in itself a homogenous group due to difference in genetics, lifestyle and health. In this case, there was significant contamination of the wound bed from the traumatic nature of the injury and the options considered with regards to his facial nerve injury at the time of surgery were:

1. Immediate direct repair of all nerve branches with burying of the proximal end of nerve that has distal segmental loss directly into muscle.
2. Delayed primary repair of the nerve within 72 hours following further wound irrigation.
3. Staged reanimation of his facial nerve after patient has recovered from the acute injury.

There are distinct advantages and disadvantages with all of these options. For example, the first option is associated with highest chance of nerve regeneration potential with reduced need to return to theatre for surgery of the facial nerve, but high risk of inherent wound infection associated with presence of suture materials. A review of literature revealed no obvious universally accepted gold standard in the situation of the current case. Many centers managing such injuries have caseloads of two per year, making long term follow-up and statistically analysis challenging. Repair within 24 hours and 72 hours were advocated in separate centers [8-10]. Two centers reported no difference in technical methods used for nerve repair but one included nerve injury in oncological setting instead of acute trauma [7,8].

Conclusion

The management of facial nerve injury in a compound facial wound can be challenging in an elderly patient and there is limited evidence to support different approaches. Our experience suggests that whenever possible, repair/reconstruction of the facial nerve in elderly patients is a worthwhile consideration that can produce a clinical good outcomes in protection of the eye and restoration of facial symmetry.

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