CASE REPORT

Operation 'Levante': pro radial sural nerve transplant on a 38-year-old civilian woman

Operazione Levante: trapianto nervoso del nervo surale pro nervo radiale su donna civile di 38 anni

Valerio Stroppa*

Abstract: Cases of nerve damage to the peripheral nerves of the upper limbs can be treated via transplant using sensory nerves taken from other sites. In the course of the humanitarian mission designated 'Operation Levante' at the Egyptian port of El Alarish, the surgical team aboard the Italian Navy's Vulcano Ship performed a complex procedure involving orthopaedic microsurgery, specifically a nerve transplant from the sural nerve to the radial nerve. This case report demonstrates that, even within the confines of an operating theatre and despite the presence of significant criticality, advanced specialist surgery can be performed and wounded patients can be treated with microsurgical techniques. It is noteworthy that such techniques are currently only performed in ultra-specialised centres in Italy.

Riassunto: In caso di lesioni nervose dei nervi periferici degli arti superiori è possibile provare ad effettuare un trapianto utilizzando nervi sensitivi prelevati da altre sedi. Durante la Missione Umanitaria "Operazione Levante" presso il porto egiziano di El Alarish, l'equipe chirurgica presente sulla Nave Vulcano della Marina Militare ha effettuato un intervento di microchirurgia ortopedica effettuando un trapianto di nervo da nervo surale pro nervo radiale. Questo case report dimostra che anche in Teatro Operativo, nonostante notevoli criticità, è possibile effettuare una chirurgia specialistica avanzata, trattando un ferito con tecniche microchirurgiche che in Patria vengono effettuate solo in centri ultraspecialistici.

Key words: hand surgery, orthopaedics, sural nerve, operating theatre.

Key messages:

- an inter-agency healthcare approach in terms of means, personnel and specialised and ultra-specialised clinical capacities allows surgical interventions of excellence and high surgical complexity in heterogeneous operational contexts.
- General surgery instruments can be adapted for ultra-specialised surgery.

Introduction

Peripheral nerve fibres are notably delicate structures, which renders them susceptible to damage from various forms of compression (1). The communication abnormalities that result from this process are manifestations of the damage. Nerve defects may have multiple origins, either iatrogenic (medical or surgical) or traumatic (2, 3). A significant proportion of peripheral nerve fibre injuries are associated with suboptimal functional outcomes, inadequate nerve recovery and loss of sensory and motor function. These are followed by partial recovery, muscle atrophy, chronic pain and profound weakness (4). It is evident that the regenerative process is a time-consuming process, particularly in the absence of external intervention (5, 6). Furthermore, there are other factors that impair nerve regeneration after injury, such as the loss of large

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amounts of nerve tissue and prolonged denervation of proximal nerves, which increase the likelihood of irreversible atrophy of innervated organs (5). The treatment approach primarily involves microsurgery, encompassing direct repair, end-to-end suturing without tension, and the gold standard technique of utilising autologous nerve grafts to repair larger lesions (3, 7, 8).

The utilisation of the latter mitigates the risk of immunological rejection and engenders a native tissue microenvironment that elicits a positive therapeutic effect. The utilisation of the sural nerve as an autologous nerve graft in peripheral nerve surgery is a well-documented practice in the relevant literature. The reasons for its prevalence are severalfold. Firstly, the harvesting process is both rapid and uncomplicated. Secondly, the available nerve length is sufficient for most purposes. Thirdly, the nerve course is largely linear with minimal branching. Fourthly, the sizing is appropriate for the task. Finally, there is a large number of fascicular groups (9, 10).

The surgical technique involves the removal of the nerve graft through a long skin incision from the distal to the proximal side of the leg. The utilisation of this incision facilitates the execution of the operation with minimal exposure and negligible risk of damage to the nerve graft (10).

In the aftermath of the 7 October 2023 outbreak of hostilities between Israel and Hamas, Defence has been called upon to contribute to efforts to manage a situation that portends potential escalation and necessitates an integrated approach. In this regard, the Italian Government deployed a Humanitarian Mission called «Operation Levant» at the Egyptian port of El Alarish, deploying a Role 2 hospital, with a joint military and civilian team afloat Nave Vulcano, a vessel of the Italian Navy. During the mission, a total of 80 patients were treated. Four of these patients underwent highly specialised surgery, despite the ship being equipped for Role 2 tasks.

Purpose

This case report illustrates the management of a highly specialised surgical clinical problem with instruments and a general surgery team in a complex operational context.

Clinical case description

The 38-year-old female patient sustained blunt trauma approximately 30 days prior, resulting in multiple injuries to the upper and lower limbs. A physical examination of the patient revealed the presence of two scar outcomes in the volar and dorsal regions of the distal third of the left arm. These scars were attributed to a penetrating foreign body injury. The patient exhibited a total sensory and motor deficit of the innervation region of the median nerve, accompanied by the distinctive 'monkey hand' posture. Two cicatricial areas were identified in the volar and dorsal regions of the distal third of the right arm and the distal third of the left arm. These areas were attributed to penetrating foreign body injury, resulting in a total sensory and motor deficit of the ulnar and radial median nerve innervation territory. The patient was not undergoing any therapeutic interventions and did not have any pre-existing medical conditions.

Materials and Methods

The patient underwent two surgical procedures within a short time period. The decision to perform the two surgeries at such close intervals was predicated on the premise that it would increase the probability of success, given the relatively recent nature of the traumatic event. In such cases, the temporal aspect of traumatic events with severe sequelae is a critical factor in determining a favourable prognosis. The surgical technique employed was designated as 'open'. In the absence of microsurgical instrumentation, general surgical instrumentation was utilised, with the configuration of said instrumentation adapted to the selected surgical technique in accordance with the principles of force majeure. The team comprised medical and nursing personnel, including an orthopaedic surgeon specialising in hand surgery, a thoracic surgeon, an anaesthetist, and two nurses, one of whom was an instrumentalist and a theatre nurse. The operation was successfully completed after approximately four hours, without encountering any significant complications.

Results

In the initial procedure, the patient was positioned in a supine decubitus position, and an incision was made in the distal third of the ulnar region of the left arm. The foreign body injury was identified, and subsequent investigation revealed the presence of scar tissue compressing the median nerve ***(Fig. 1)***. The surgical intervention involved the debridement of scar tissue and the neurolysis of the median nerve. The ischaemic fascia was not utilised in this instance.

In the second operation, performed two days later, the patient was positioned in supine decubitus. Subsequently, two inci-

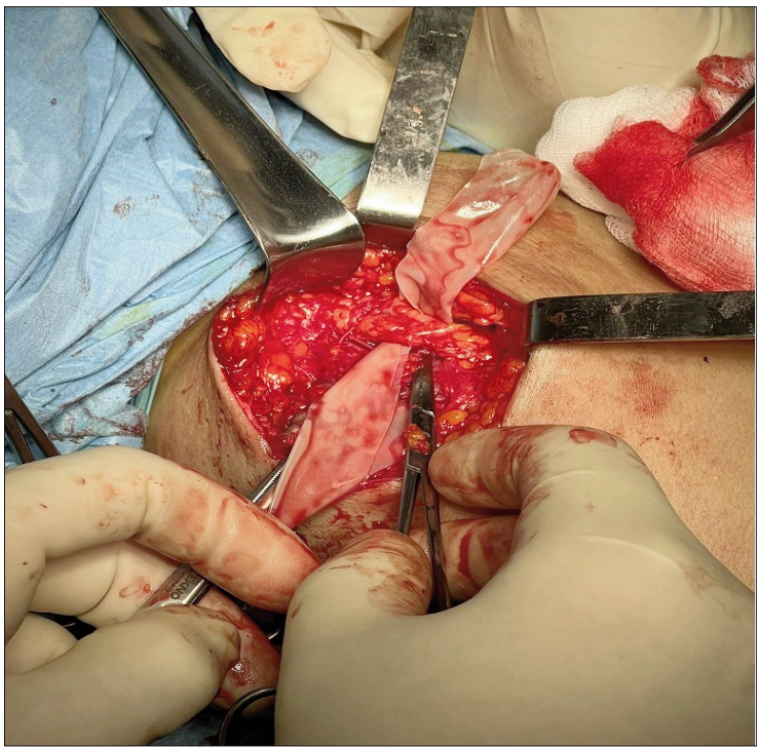

Fig. 1 - Left median nerve explored.

Fig. 3 - Injured radial nerve divided into branche

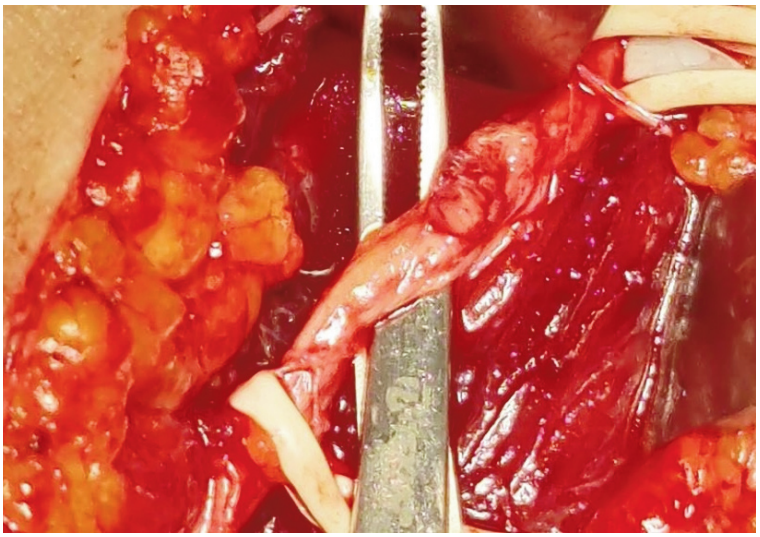

Fig. 2 - Injured radial nerve.

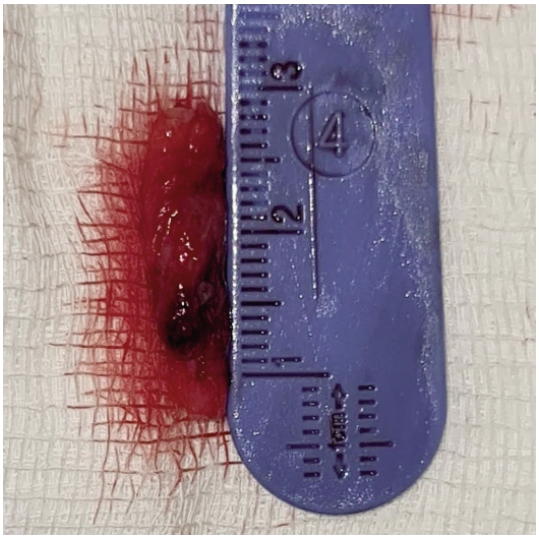

Fig. 4 - Severed radial nerve.

sions were made on the right arm: one median and one lateral. The scar of the foreign body was traced until the median and ulnar nerves were found to be compressed by scar tissue, and the radial nerve was completely injured. Following the neurolysis of the median and ulnar nerves, the radial nerve stumps were regularised, and a 4-centimetre gap was calculated ***(Figs. 2, 3, 4)***.

The second surgical step was then taken, involving the removal of the sural nerve. A longitudinal incision was made in the lateral median region of the leg. The sural nerve was isolated ***(Fig. 5)***, and 5 cm of the nerve was removed, with stump regularisation ***(Fig. 6)***.

The third surgical stage was performed with the transplant neurorrhaphy on the radial nerve performed with 5-zero nylon thread ***(Fig. 7)***.

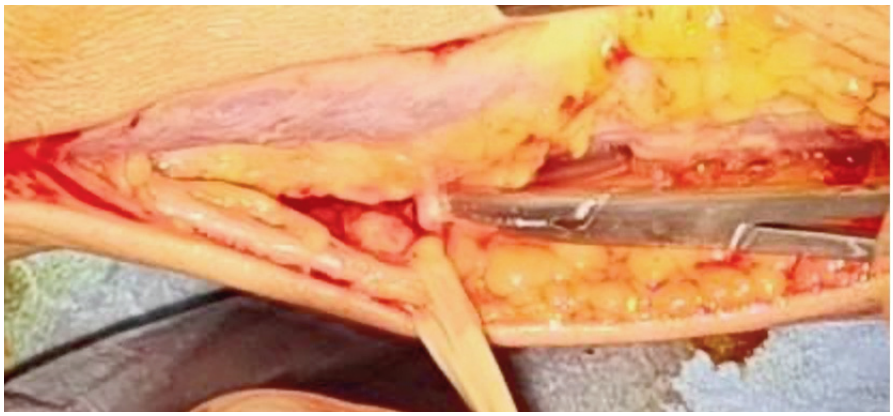

Fig. 5 - Sural nerve withdrawal.

Fig. 6 - Sural nerve transplant.

The arm was protected with a plaster cast for 20 days after surgery. An ischaemic bandage was not used.

On the first post-operative day, the patient immediately recovered sensitivity and mobility of the areas innervated by the median nerve of the left arm and ulnar nerves of the right arm. At 60 days, the patient began to recover mobility and sensitivity of the innervated territories of the radial nerve of the right arm. The follow-up was followed by direct contact with the patient who was transferred to a hospital and rehabilitation centre in Qatar.

The critical issues that emerged were related to the lack of specialised orthopaedic microsurgery devices including micro pliers, micro needle holders, Acland Micro sutures, Sigma Aldrich Micro dissection, and Guthrie skin retractor. This was due to the logistics of the health unit, which was not set up for high speciality surgery, as this was unpredictable.

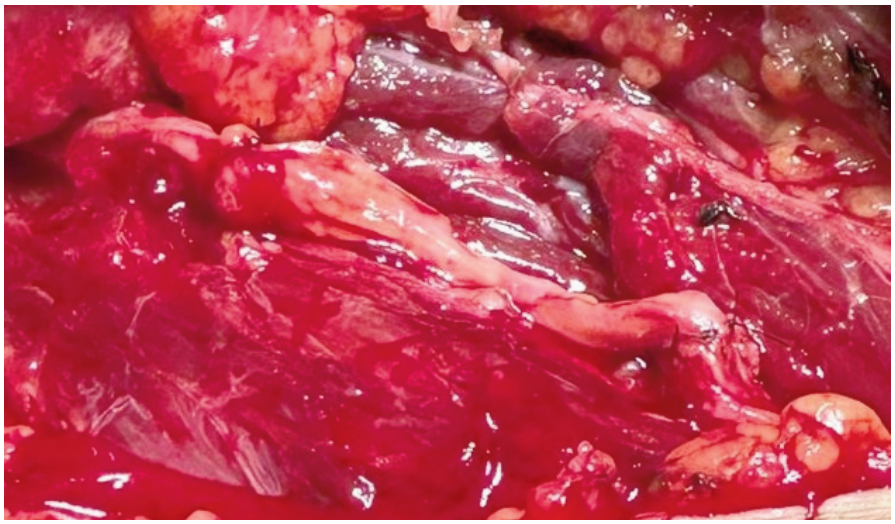

Fig. 7 - Neurorrhaphy of the sural pro radial nerve.

Discussion

The Role 2 setup helps deal with urgent cases for surgical and medical stabilisation of patients and subsequent evacuation to higher levels of care where they can receive ultra-specialised surgical, medical and rehabilitation treatments. The surgical instrumentation present is therefore adequate for this purpose but limited for a higher level of surgery; despite this, devices for traditional general surgery, such as Farabeuf retractors or Mayo Hegar needle holders, have been adapted to the surgical technique. The objective of this case report was to demonstrate that cases which come to the attention of doctors in a Role 2 setting do not invariably constitute an emergency. In our case, the patient had already been stabilised and the lesions were approximately 30 days old. Therefore, the preparation and experience of the medical and nursing staff was a fundamental factor in the treatment strategies and patient care. They compensated for the limited materials and means available, thus managing to cope with delicate and ultra-specialised surgical procedures, guaranteeing high standards and important results even under emergency conditions.

Conclusions

The clinical experience carried out on the Vulcano Ship has shown how a joint medical approach is necessary and

successful in terms of means, personnel, and specialised and ultra-specialised clinical capabilities. This approach has enabled the performance of complex surgical operations, such as nerve transplants, which are typically conducted in highly specialised hospital centres in Italy, even in critical and emergency situations.

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