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Original article

Evaluation of emergency nerve grafting for proper palmar digital nerve defects: A retrospective single centre study

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ABSTRACT

Hypothesis: Finger trauma often results in discontinuity of the proper palmar digital nerves. The goal of this study was to retrospectively evaluate the clinical outcomes of emergency nerve grafting and the resulting donor site morbidity.
Material and method: Three women and 13 men who had been operated between 2008 and 2012 were reviewed. The average patient age was 39 years (range 18–78). All were operated on an emergency basis. The average defect was 38 mm long (range 15–60). The nerves were harvested from four sites: lateral antebrachial cutaneous nerve (12 cases), banked finger (2 cases), terminal portion of posterior interosseous nerve (1 case) and anterior interosseous nerve (1 case). The evaluation consisted of patient questioning and clinical examination of the treated finger and donor site. An objective sensory exam was also performed. The results were expressed according to the British Medical Research Council (MRC) classification.
Results: There was little donor site morbidity (2 cases of symptomatic hypoesthesia, 1 case of scar hypersensitivity). Sixty-nine percent of patients stated that their grafted finger did not cause them any trouble during activities of daily living. Three patients required job retraining. Pain in the grafted finger was 0.6 (range 0–5) on the VAS. Normal sensation was restored in 31% of cases based on the monofilament sensory test; 25% had a slight decrease in touch sensitivity and 25% had reduced protective sensations. Weber's two-point discrimination test found 50% normal sensibility (threshold < 6 mm) and 6% with mediocre sensibility (threshold of 6–10 mm). On the MRC grading scale, 50% of patients were at S4, 6% at S3+, 19% at S3, 12% at S2 and 12% at S1.
Conclusion: There were 56% good results in this patient series (S3+/S4) and no patients at S0. Donor site morbidity was rare. Thus use of nerve grafting is still a relevant option in an emergency setting.
Level of evidence: Level IV.

1. Introduction

Injuries to the proper palmar digital nerves are very commonly observed in an emergency setting following hand trauma. If not treated, these injuries can result in neuroma development and/or lead to altered sensation in the injured finger; these conditions have a functional impact on the injured finger and the hand itself [1,2]. These nerve injuries can result in a nerve defect, either immediately or after injured tissue is resected to expose healthy tissue. In these cases, suturing the nerve under tension leads to poorer results than nerve grafting, which remains the gold standard procedure [3,4]. In a time where the use of nerve regeneration guides is increasing, our goal was to retrospectively assess the clinical results of nerve grafts performed on an emergency basis in a series of adult patients.

2. Material and methods

This was a single-center, multisurgeon, retrospective study involving all the patients presenting hand injuries with proper palmar digital nerve defects treated with a nerve graft on an emergency basis between 2008 and 2012. In all, 24 patients were contacted again and invited to return to the facility for a consultation.

Every patient was treated on the same day as the injury occurred (D0) or the day after (D + 1). Surgical loupes were used to provide magnification during nerve suturing. In every case, the length of the nerve graft was the same as the length of the nerve defect, which allowed for tension-free suturing. End-to-end

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suturing was performed using epiperineural interrupted sutures with non-resorbable synthetic 9–0 or 10–0 monofilament suture. Every procedure was performed under regional anesthesia with a proximal tourniquet inflated after the upper limb was exsanguinated with an elastic band. After the surgical procedure, most patients underwent 15 days of immobilization; this period could be shortened or extended depending on the type of associated lesions. No specific sensory rehabilitation protocol was carried out by a physical therapist or rehabilitation center, only home rehabilitation exercises were given. These consisted of desensitization through deep scar massage and simulation by fingertip contact, which were demonstrated to patients during the follow-up visits.

Every patient was reviewed by an observer who was independent of the surgeon who had performed the procedure. Donor site morbidity and sensory outcome of the treated finger were evaluated. The patient was asked about subjective discomfort during work and recreational activities, activities of daily living and sleep. This parameter was evaluated on a 4-point scale: no discomfort, slight discomfort, moderate discomfort or severe discomfort. Pain was assessed using a Visual Analog Scale (VAS). Return to work was evaluated. Donor site morbidity was also evaluated: pain, scar appearance and cosmetic sequelae, neuroma, hypoesthesia. The patient was also asked about the donor site and injured finger. An objective sensory exam was carried out; this consisted of the monofilament test and Weber's two-point discrimination test. The results were expressed according to the Möberg, Alnot and British Medical Research Council (MRC) classification.

Results are presented as averages with minimum and maximum values. An independent Student's *t* test was used to analyze quantitative variables. Significance threshold was set at 5%.

3. Results

Of the 24 eligible patients, 16 were reviewed (3 women, 13 men). The average age at the time of injury was 39 years (range 18–78). All the patients were operated on an emergency basis on the day of or the day after the injury event. The average follow-up time was 27 months (range 6–56 months).

The dominant hand was injured in 63% of cases. The nerve injuries mainly occurred in the long fingers on the radial side (76% of cases) (Fig. 1). In 56% of cases, the dominant side of the finger pad was injured. The nerve defect was proximal to the PIP joint in 38% of cases, distal to the PIP joint in 44% and affected both sides of the joint in 18%. The defect was 38 mm long on average (range 15–60). In 94% of patients, the ipsilateral proper palmar digital artery was also lacerated; it was repaired in 19% of cases. In 56% of patients, there was also an injury to tendon, bone or skin (Table 1).

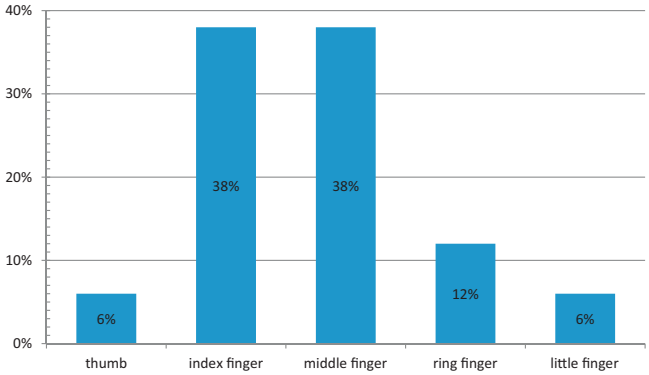

Fig. 1. Distribution of injured digits.

The initial injury occurred during use of a tool in 56% of patients and due to a wire mesh in 25% of cases. The injury was work-related in five patients (31% of cases). Among the 13 patients were working at the time of injury, 8 were able to return to the same occupation. Adjustment to the job or retraining was needed in the five other patients. In three patients, this retraining was directly related to a sensory disorder and in the two other patients it was due to one of the associated injuries.

The nerve graft was harvested from one of four donor sites: lateral antebrachial cutaneous nerve (12 cases), banked finger (2 cases), terminal portion of posterior interosseous nerve (1 case) and anterior interosseous nerve (1 case).

Evaluation of the donor site found a relative low morbidity rate. Three patients indicated discomfort with the site. These patients were among the 12 who had a portion of the lateral antebrachial cutaneous nerve harvested. In two cases, the discomfort was caused by symptomatic hypoesthesia in the sensory territory of the lateral antebrachial cutaneous nerve. In the other case, hypersensitivity existed in the scar over the harvest site. These three patients classified donor site problem as slight and non-disabling. None of the patients stated that the harvested site had an unsightly appearance. The objective clinical exam found no cases of symptomatic neuroma and no wound healing problems. However, clinically

Table 1
Characteristics of the study population.

Case	Age (years)	Gender	Injured nerve	Injury level	Defect (mm)	Dominant side	Digital artery injury	Other structures injured	Site Donor	Follow-up (months)
1	78	M	D3 U	D	20	No	NR	No	NACL	6
2	48	M	D3 R	P-D	60	Yes	R	Yes	NACL	11
3	33	F	D2 R	P	30	Yes	NR	Yes	AIN	13
4	26	M	D3 U	P-D	60	Yes	NR	No	NACL	13
5	59	M	D3 U	D	25	Yes	NR	Yes	NACL	15
6	18	M	D4 U	D	40	Yes	NR	No	NACL	15
7	36	M	D3 U	P-D	60	No	R	Yes	BF	17
8	23	M	D1 U	P	50	Yes	No	No	NACL	18
9	48	F	D2 R	P	50	No	NR	Yes	NACL	27
10	55	M	D2 R	P	60	Yes	NR	Yes	NACL	30
11	65	M	D5 U	P	30	No	NR	No	NACL	32
12	46	M	D3 U	D	15	No	NR	Yes	BF	34
13	24	F	D2 R	D	30	No	NR	Yes	NACL	37
14	26	M	D4 R	D	20	Yes	R	No	NACL	51
15	34	M	D2 U	P	20	Yes	NR	No	PIN	56
16	42	M	D2 R	D	30	Yes	NR	Yes	NACL	56

M: male, F: female, D3 U: proper palmar digital nerve on ulnar side of 3rd digit, D3 R: proper palmar digital nerve on radial side 3rd digit, D: distal to PIP joint, P: proximal to PIP joint, P-D: both proximal and distal to PIP joint, NR: not repaired, R: repaired, LACN: lateral antebrachial cutaneous nerve, AIN: anterior interosseous nerve, PIN: posterior interosseous nerve, BF: banked finger.