

Original article

Complete section of proper palmar digital pedicles: Correlation between arterial patency and sensory recovery

Section des pédicules digitaux palmaires : corrélation entre perméabilité artérielle et régénération nerveuse

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Abstract

Wounds to proper palmar digital (PPD) pedicles are frequent surgical emergencies. A correlation between arterial patency and nerve regeneration, however, has never been demonstrated.

Forty-seven patients presenting complete section of a PPD pedicle and having undergone surgical repair of both elements were followed-up at a minimum of one year postoperatively. Doppler ultrasound examination studied arterial patency as well as the degree of stenosis. Neurological examination determined the BMRC score and the existence of cold intolerance, symptomatic neuroma and neurogenic pain.

In 32 cases, the artery was permeable; in the remaining 15, arterial thrombosis was identified. In 14 out of the 32 permeable-artery subjects, stenosis had no significant effect; in the remaining 18 cases, circulation was reduced. BMRC scores showed 11 S4 cases, 16 S3+, 16 S3 and 4 S2. Twenty-nine cases of intolerance to cold were identified, along with two cases of neurogenic pain and 17 cases of symptomatic neuroma. A statistically significant correlation was shown between arterial patency and BMRC scores (Chi-square, $P = 0.0221$) and neurological symptoms appeared to be linked to the degree of stenosis.

Favorable BMRC scores were observed where the artery was permeable, notably where blood flow was not modified below the repair site. This observation also seemed valid regarding disabling neurogenic symptoms.

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Keywords: Pedicle; Patency; Nerve; Doppler

Résumé

Les plaies des pédicules digitaux palmaires propres sont une urgence fréquente. La corrélation entre la perméabilité artérielle et la régénération nerveuse des pédicules digitaux n'a jamais été démontrée.

Quarante-sept patients présentant une section complète d'un pédicule digital avec une réparation des deux éléments ont été revus à un minimum de l'intervention. Un examen écho-Doppler étudiait la perméabilité de l'artère et le degré de sténose. Une évaluation neurologique déterminait le score BMRC, l'existence d'une intolérance au froid, d'un névrome symptomatique, et de douleurs neurogènes.

L'artère était perméable dans 32 cas, et une thrombose artérielle était identifiée dans 15 cas. Dans 14 cas, il n'était pas trouvé de sténose significative. Dans 18 cas, il existait un retentissement de cette sténose. L'évaluation du score BMRC trouvait 11 S4, 16 S3+, 16 S3, et 4 S2. Vingt-neuf cas d'intolérance au froid ont été identifiés, deux cas de douleurs neurogènes, et 17 névromes symptomatiques. Une corrélation statistique existait entre la perméabilité artérielle et le score BMRC (Test du Chi 2, $p = 0,0221$). L'apparition de symptômes neurologiques semblait liée aux degrés de sténose de l'artère.

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Les scores BMRC favorables sont observés lorsque l'artère est perméable, et notamment en l'absence de modification du flux en aval de la réparation artérielle. Cette constatation semble également valable pour l'expression des symptômes neurogènes invalidants. La perméabilité de l'artère après réparation des sections des pédicules DPP améliore significativement la régénération nerveuse.

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Mots clés : Pédicule ; Perméabilité ; Nerf ; Echo-Doppler

1. Introduction

Sectioned proper palmar digital (PPD) pedicles are common emergencies in hand surgery, but despite modern-day microsurgical advances, this injury still compromises the prognosis of palmar digital wounds. Emergency repair of PPD pedicles is now routine practice, but if the need for nerve suture is self-evident, PPD artery repair appears to be less so [1–7].

Many arguments support this lack of systematic repair, such as substitution by the contralateral artery, the complexity of the microsurgical procedure, and the lack of reported superiority, according to current literature, of the quality of nerve regeneration. The fate of the PPD arteries, then, is rapidly sealed when only the corresponding nerve is repaired.

The principal aim of this study is thus to explore a possible correlation between arterial patency and regeneration of the PPD nerves after PPD pedicle repair. Our secondary objectives are to explore a possible correlation between the degree of stenosis of the arterial lumen at the site of the anastomosis and nerve regeneration as well as to disabling neurogenic symptoms.

2. Materials and methods

Our retrospective, monocentric study was carried out between December 2011 and April 2013 after a minimum follow-up of 12 months. Patient selection was driven by a keyword search of surgical reports from our service over the target period. One hundred and seventy one patients presented PPD pedicle injury, 66 of whom met our inclusion criteria. These included a complete PPD pedicle section occurring between the metacarpal neck and the distal interphalangeal joint. The wounds had to have been treated as emergencies, presenting as clean cuts from glass, pottery, a knife or a cutter. Patients with additional injuries associated with the complete PPD pedicle section were excluded, as well as those presenting bipediced injuries and trauma-related tissue attrition. Minors and protected adults were also excluded, as were patients with a history of neurovascular trauma on the same finger.

For the entire sample, the criterion of complete section was checked in the surgical reports, as well as the repair techniques used on the artery and the nerve. Direct end-to-end arterial anastomoses had to have been performed using 6–8 stitches of non-absorbable 10-0 sutures (Ethilon[®]). Nerve repair had to have been tensionless, with no telescoping of extremities, using 3–4 epiperineural stitches of non-absorbable 9-0 monosutures (Ethilon[®]).

Over the target period, only 47 patients were actually followed up (Table 1). The sample was predominantly male,

with a mean age of 45 years. Mean follow-up since time of injury was 19 months. Active smokers accounted for one third of the cases; the same proportion covered those patients whose dominant hand was injured. Most damage involved the radial digits, particularly the index finger, and was primarily proximal, according to the extensor apparatus topographical zones as classified by the International federation of societies for surgery of the hand. An equal number of injuries involved ulnar and radial pedicles.

The follow-up consultation included both clinical and ultrasound examination. To avoid possible vasoconstriction during examination—a potential distortion of data collection—, active smokers were asked to abstain for 2 h before consultation. Moreover, prior to examination, all patients soaked their injured hand in room-temperature water for 5 min. In order to gain maximum benefit from this immersion, ultrasound exploration was conducted before neurological examination.

Evaluation of arterial flow was performed with a Sonosite Edge[®] ultrasound scanner, using a 15 MHz linear probe. Firstly, we identified the PPD artery above the anastomosis and then followed it until the fingertip, to check its permeable nature on both sides of the anastomosis. Secondly, the color mode was used to determine the direction of arterial flow on both sides of the anastomosis, thereby identifying all cases of

Table 1
Sample population.

	Patients (n = 47)
Sex ratio	33/14
Age (years)	45.1 (18–76)
Mean follow-up (months)	19.3 (12–31)
Active smokers	17
Dominant hand (R/L)	45/2
Dominant side injured	11/36
Fingers	
F1	8 (17%)
F2	18 (38.2%)
F3	9 (19.1%)
F4	8 (17%)
F5	4 (8.5%)
Levels	
1 (DIP)	3 (6.3%)
2 (P2)	5 (10.6%)
3 (PIP)	8 (17%)
4 (P1)	15 (31.9%)
5 (MCP)	16 (34%)
Pedicles	
Ulnar	25 (53.1%)
Radial	22 (46.8%)

DIP: distal interphalangeal joint; MCP: metacarpophalangeal joint; PIP: proximal interphalangeal joint; P1: proximal phalanx; P2: middle phalanx.

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