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Treatment of Acute Proximal Interphalangeal Joint Palmar Plate Injury by Bone Channel Suture

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Abstract: Objective: Objective: To explore the surgical effect of suture through bone canal in the treatment of reconstruction of acute proximal interphalangeal joint metacarpal anchorage. Methods From July 2018 to August 2021, we retrospectively analyzed 9 cases of avulsion of metacarpal plate near interphalangeal joint, including 7 males and 2 females, aged 17-40 years, with an average of 34 years. There were 4 cases of index finger, 3 cases of middle finger and 2 cases of ring finger. Early flexion and extension exercises were performed after operation. The last follow-up included the range of motion of the proximal interphalangeal joint and joint pain. Results All patients were followed up (4-12 months) after operation. According to the TAM method, 7 cases were excellent and 2 cases were good. Conclusion Transosseous suture for acute proximal interphalangeal joint metacarpal reconstruction has the advantages of simple operation, safety, firm fixation and rapid postoperative recovery.

Keywords: Palmar Plate Injury; Avulsion Reconstruction

Introduction

Injury of the proximal interphalangeal joint of the finger is a common injury of the finger, which is often accompanied by injury of the metacarpal plate when the finger is overstretched violently. If the injury of the metacarpal plate is not handled in time, joint stiffness will appear in different degrees. The palmar plate is located below the flexor tendon, and it is often torn off from the stopping point when there is great violence. At present, the methods of micro-anchoring are mostly used to reconstruct the palm plate, but the cost of micro-anchoring is high. From July, 2018 to August, 2021, 9 cases of avulsion of metacarpal joint near interphalangeal joint in our hospital were reconstructed by suture through bone canal, and satisfactory clinical results were obtained.

1. Materials and Methods

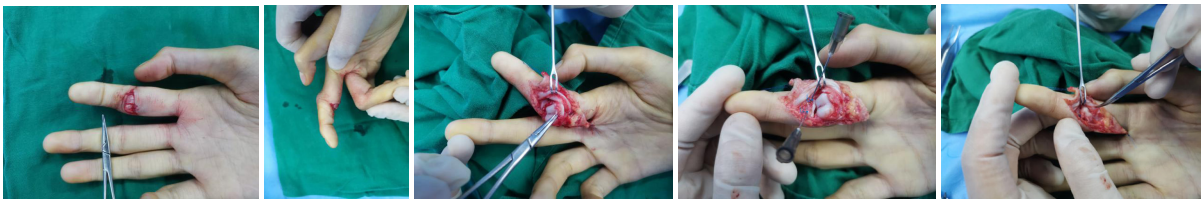
1.1 General information

There were 9 patients with 9 fingers, 7 males and 2 females, aged 17-40 years, with an average age of 34 years. There were 4 index fingers, 3 middle fingers and 2 ring fingers. There were 5 cases of sports violence injury, 3 cases of collision injury and 1 case of crush injury. All of them were open injuries. The time from injury to operation was 4-7 hours, and all patients underwent emergency surgery.

1.2 Surgical procedure

After successful brachial plexus block anesthesia, the patient takes the supine position, washes with normal saline and hydrogen peroxide, puts on a towel by routine disinfection, makes a "Z" incision on the palm side of the proximal interphalangeal joint of the affected finger, thoroughly debrides from shallow to deep, removes the contaminated tissue, explores the proper nerves and blood vessels of both fingers under a microscope, and repairs them together if there is any injury, cuts the sheath and A3 pulley, and pulls the flexor tendon to one side to expose the lower palmar plate, as shown in. Preserve the small piece of avulsion bone cortex connected with the metacarpal plate, rinse and soak it with normal saline, hydrogen peroxide and dilute iodophor again, and drill holes on both sides of the base of the middle phalanx (far from the articular surface) with a Kirschner wire with a diameter of 1.0mm from the palm to the back at an angle of 45 degrees to form a cross, and the cross point is located in the medullary cavity of the middle phalanx (try to complete it once to prevent fracture). 4-0 absorbable

suture was used to sew the joint capsule around the metacarpal plate, 5-0 sliding suture was used to sew the wound, and sterile dressing was used to bind and fix it. Plaster external fixation was performed at the position of slight flexion of the affected finger.



A B C D E

F G

Patient, female, volleyball player. A, B: External image of the patient's preoperative finger injury C: Intraoperative exploration of the palmar plate is completely broken at the point of insertion, and there is a small avulsion bone D: Kirschner needle parallel to the base at a and b, 45° angle cross punching, 3-0 Prolene's suture needle, from point A to point B, and then knotted at the suture proximal to the palmar plate. E: Firmly fix the palmar plate insertion point F: 1 year after surgery, left index finger front external image, left index finger fully extended, no obvious scarring G: 1 year after surgery, left index finger lateral external image, flexion function is normal.

1.3 Postoperative treatment and follow-up

Prophylactic antibiotics are used within 24 hours after surgery, patients are instructed to passively perform digital flexion and extension exercise after 1 week after surgery, routine stitch removal 2 weeks after surgery, external fixation of mild flexion cast of affected finger for 4 weeks after surgery, strenuous activities are strictly prohibited within 4 weeks, and the cast is removed for active flexion and extension activities after 4 weeks.

2. Results

After the postoperative follow-up was 4-12 months, all patients did not have infection of the postoperative wound and did not have skin necrosis. At the last follow-up, there were no joint contracture deformities, joint stiffness, limited flexion and extension movements, etc., and no pain in the affected fingers after surgery. According to the total active movement (TAM) [1]: 7 cases were excellent and 2 cases were good.

3. Discussion

The proximal interphalangeal joint is a synovial hinge joint with an active flexion-extension movement of 110°-0°, surrounded by a box-like complex, and the palmar side maintains the stability of the palmar side of the joint by the palmar plate. The palmar plate originates from the proximal phalangeal head, and its proximal part thickens laterally called the limiting ligament, and ends distally at the palmar side at the base of the middle phalange, and is composed of hard fibrocartilage. The palmar plate is an important structure for maintaining anteroposterior stability and preventing hyperextension of the proximal interphalangeal joint [2].

The palmar plate is typically avulsed at the distal insertion point, where fusion with the middle phalange is weak, while the proximal portion is confined to the proximal phalangeal bone where the confined ligament is firmly attached to the proximal phalange and rarely ruptures [3]. Clinically, palmar plate injuries are mostly classified by Eaton, type I is simple palmar avulsion injury, type II is an avulsion fracture

with a small mid-segment base, and type III is a larger fracture piece on the palmar side of the base of the middle phalange, often involving larger articular surfaces [4]. Clinically, type II is common.

For type II palmar plate injury, Adi M et al. [5] reported that the prognosis of proximal interphalangeal palmar plate injury does not depend on the presence of avulsion fracture. Thus, palmar injuries with closed stability can be managed conservatively [5]. The traditional brace external fixation, using flexion 30°, often causes the contracture of the palmar plate, further leads to joint contracture deformity, affecting the finger straightening function, therefore, Edward A. Stanley et al. [6] in the finger neutral dorsal splint treatment of palmar plate injury, can lead to less joint flexion deformity, less requirements for hand treatment, and faster recovery of daily activities. Paschos NK et al. [7] reported that stable palmar plate injury without fractures, orthodactyly fixation and aluminum orthosis are a safe and effective fixation method, and compared with aluminum orthosis fixation, orthodic fixation is associated with earlier recovery of activity, finger swelling and pain relief. Complications of conservative management of palmar plate injury are joint stiffness, proximal interphalangeal flexion deformity, and osteoarthritis. Failure of conservative management is associated with joint dislocation, fracture displacement, and possible rotation of bone fragments [8]. In order to minimize the occurrence of complications and achieve rapid recovery, it has become a clinical problem that needs to be solved. Therefore, the indications for surgery in this group: (1) open injury, there may be damage to blood vessels and nerves; (2) Type II palm plate injury

The traditional surgical treatment methods of palmar plate insertion reconstruction include steel wire suture dorsal withdrawal press fixation method, anchor fixation method, double-line compression fixation method, and improved suture anchor suture method. The tension strip wire fixation method [9] is simple and accurate to operate, but the steel wire is buried under the skin of the back of the finger, the steel wire irritates the skin, there is a risk of skin infection, and the steel wire needs to be withdrawn again. Anchoring is the most common method [10-11], but anchorage is expensive and difficult to place in the setting of multiple fractures at the base of the middle phalangeal bone. Double-line compression fixation has little damage to periarticular structures, but intraoperative procedures are more complicated. The transoskeletal suture fixation method used in this group has no compression on the skin of the back of the finger, little skin irritation, and no built-in remains, and there is no need for Kirschner needle to fix the joint after surgery, and no secondary surgery is required. After surgery, under the guidance of a physician, early finger flexion and extension exercise is performed. The effect was satisfactory during the follow-up, and the intraoperative operation was simple and easy to promote.

The key points of operation during the operation are to carefully clean up the small fracture block to prevent the small bone block from rotating, and to press and reset the small avulsion bone piece connected to the metacarpal plate. If it is difficult to handle, it can be removed. Fabrication of bone tunnel: drill holes on both sides of the metacarpal side at the base of middle phalanx, far away from the articular surface, with a Kirschner pin with a diameter of 1.0mm, showing an internal figure of eight, so as to avoid repeated drilling. Use 3-0 prolene thread to sew the stop point of metacarpal plate first, and then increase the arc of the sewing needle of 3-0 prolene thread appropriately, and pass through two bone holes. When tying the knot, the force should be moderate to prevent the suture from breaking.

Among the 10 patients, 9 patients have achieved satisfactory results, and 1 patient has a thicker proximal interphalangeal joint than the healthy finger, but the flexion and extension activities have recovered well. However, this operation method also has some limitations. When the avulsion fracture of the metacarpal plate is large, this method can not fix the fracture, and Kirschner wire internal fixation is needed at this time.

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