

LESIONS OF THE NEUROVASCULAR BUNDLE DURING SURGICAL TREATMENT OF DUPUYTREN'S CONTRACTURE

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Summary. With this article we want to focus the reader's attention on lesions of the neurovascular bundle that occur during the surgical treatment of Dupuytren's contracture, which represent relatively rare, but associated with serious consequences intraoperative complications. We present our clinical experience with these complications and compare it with the available publications in English literature. We present a clinical case of a rare anatomical variation, including dislocation of the common palmar digital artery in a patient with Dupuytren's contracture.

Key words: *complications, lesions of the neurovascular bundle, Dupuytren's contracture*

INTRODUCTION

The Dupuytren's contracture is a disease, known for almost two centuries. It is described by Baron Guillaume Dupuytren in 1833 [23]. Even today, there are still unsolved problems in the treatment of this disease. Many authors have suggested variable surgical methods, including the Matev's two-stage fasciectomy [24]. At present, a preferred operative method for the treatment of Dupuytren's contracture is the partial fasciectomy, due to its low risks and good predictable outcome [4, 12, 16, 18, 20]. Although recurrence after surgery may appear in up to 50%, reoperation is needed only in 15% of the cases [3]. However, this method also hides risks for intraoperative and postoperative complications. A multicenter study of 990 operations by Mc Farlane revealed that the serious complications of Dupuytren's contracture surgery were up to 19% [14].

A recent study by Bulstrode et al. (2005) on 235 patients (Skoog technique for partial fasciectomy was performed) showed that complications occurred in 46 patients, or in 18.18% of them [2]. Denkler made a retrospective analysis of all

studies which have investigated the complications of Dupuytren's contracture surgery, published in the English literature for a 20-year-period (1988-2008) [6]. The results revealed a widely variable frequency of the intraoperative and postoperative complications – between 3.6% and 39.1%. The complications are classified as intraoperative – nerve and arterial injury and postoperative – haematoma, wound infection, reflex sympathetic dystrophy, skin necrosis, digital gangrene or scar contraction [1, 5, 9, 10, 11, 17].

Mc Farlane et al. in their study analyzed the surgical complications in 1339 clinical cases [13]. They concluded that iatrogenic lesions of the proper palmar digital nerves were 1.5% and these of the proper palmar digital arteries – 0.8%. Bulstrode et al. in their study including 253 patients reported a nerve injury in 6 patients (2.37%) and an arterial injury in 1 patient (0.39%). According to Denkler's comprehensive review of the literature (Table 1), the nerve injuries in patients operated for Dupuytren's contracture for the first time are averagely 3.4% and the arterial injuries – 2%.

Table 1. Summary of the early postoperative complications after partial fasciectomy in patients operated for Dupuytren's contracture (data from K. Denkler)

Author	Number of patients	Percent of injuries	Number of nerve injuries
Coert 2006	558	7.7	43
Rijssen 2006	78	1.2	1
Denkler 2005	102	2.9	3
Bulstrode 2005	253	2.0	5
Leclercq 2003	245	2.0	5
Leclercq 2000	183	2.2	4
Foucher 1995	54	1.9	1
Geldmacher 1994	2160	2.82	61
Foucher 1992	140	2.9	4
Sennwald 1990	98	8.2	8
McFarlane 1990	1339	1.5	20
Hout 1988	326	5.2	17
Allieu and Tessier 1986	77	36	28
Rodrigo 1976	230	0.4	1
Tubiana 1967	195	7.7	15
Total	6,038	3.6%	216

Complications	Number of studies	Average % (n/N)	Range %
Injury of digital artery	4	2.0 (20/989)	0–2.6
Injury of digital nerve	15	3.4 (51/1510)	0–7.7

MATERIALS AND METHODS

In the Hand Surgery Department of the University Orthopedic Hospital "Prof. B. Boychev" in 2011 52 operative corrections of Dupuytren's contracture in 46 pa-

tients were performed. Reoperations because of postoperative adhesion corrections and development of contracture in different locations of the same hand were done in three patients. Three patients had both hands operated due to bilateral Dupuytren's contracture. We used a standard zigzag incision over the affected parts of the palm proximal to the distal palmar crease and Z-plasty flaps over the fingers, using the flexion creases. The approach was modified depending on the severity of the contracture and the skin accretion with the perpendicular cords of the fascia. After separation and protection of the neuro-vascular bundles, partial segmental fasciectomy was performed, including all accessible pathological knots and cords. The skin was closed with direct suture, but in cases with skin lesions we made a skin plasty with triangle flaps or a free skin graft.

In our study we recorded 3 cases of injury of a digital nerve in patients, previously operated in other clinics, who came to us for reoperation due to development of adhesions or recurrence of the Dupuytren's contracture. In these cases we performed intraoperative restoration of the damaged nerves with direct sewing. Sensitivity in the affected fingers recovered entirely in the postoperative period. In patients operated primarily by us, we found no lack of sensitivity in the postoperative follow-up. No patients had arterial injuries.

CLINICAL CASE

A man going under partial fasciectomy of the right hand because of Dupuytren's contracture presented to our clinic. The clinical examination revealed flexion contracture of the metatarsophalangeal (MP) joint of about 10 degrees and flexion contracture of the proximal interphalangeal (IP) joint of 45 degrees (second grade according to the Tubiana and Michon classification, 1961) [21]. During the operation, we found a common palmar digital artery with unusual atypical transverse position under the distal palmar crease, embraced by cords (Fig. 1). Before doing the fasciectomy, we had to release it carefully from proximal to distal from the fibrous tissue and explore it to find the proper digital nerve. In the area of the proximal phalanx and the PIP joint we didn't find displacement of the neurovascular bundle.



Fig. 1. Atypical transverse position of the common palmar digital artery

DISCUSSION

Iatrogenic injuries of the neurovascular bundle are relatively rare. However, they cause the most severe and unpleasant complications for the patients. The main cause of these injuries is the altered anatomy of the hand found in Dupuytren's disease. The normally existing bands and ligaments change into cords, which causes contractures of the fingers, skin lesions and formation of nodules. The main cords are as follows: central cord – formed from the pretendinous band and the palmar fibromatous fascia; spiral cord – from the pretendinous band, spiral band, lateral digital sheet, vertical band and the Grayson ligament; lateral cord – from the lateral digital sheet; retrovascular cord – from the digital fascia dorsally from the neurovascular bundle; a cord, formed from the tendon of the digital abductor muscle of the little finger; natatory cord. These cords may exist alone or in combination, causing complicated structures that spread around the nerves and arteries. The most common combinations are between the central cord and lateral cord, central cord-spiral cord, central cord-natatory cord, spiral cord-natatory cord. They cause flexion deformities and dislocate the neurovascular bundles. This increases the risk for its injury during surgical interventions [7]. This happens most frequently in the area of the PIP joint. There the neurovascular bundle goes over the spiral band, then settles between the Grayson's ligament and the Cleland's ligament midline along the fingers. When a spiral cord forms, the bundle is displaced proximally, medially and superficially, and often is placed directly under the skin. Moreover, the spiral cord is the main cause for strong flexion contracture of the PIP joint. That's why, when operating patients with severe contracture of the PIP joint, the volar incisions must be made extremely carefully.

A study by Umlass et al. revealed the high value of the flexion contracture of the PIP joint in predicting the presence of spiral curved and medialized neurovascular bundle in the area of the PIP joint [22]. They reported that the presence of contracture has 88% sensitivity and 62% specificity as a predictor used in the preoperative assessment of neurovascular displacement. They accept the displacement of the bundle as a developing condition in time, which is found most commonly in hands with severe contracture of the PIP joint. Their results confirm data from a previous study by Short and Watson [19].

An area of specific interest is the ulnar side of the fifth finger, where the medialization of the neuro-vascular bundle is caused by a cord, formed from the tendon of the abductor muscle of the little finger. Besides, in this area very close lies the dorsal ulnar nerve, which also can be damaged [15].

Injuries of nerves or arteries in the region of the palm are rare. There they lie deeper and are protected by more fatty tissue. The main risk is related with the use of the Luck's operative technique for subcutaneous fasciotomy. Attention should be paid to the fact that the anatomical division of the nerves and the arteries in the palm occurs at different levels. The arteries divide more distally, which is why they are more vulnerable to damage, especially in cases with massive fibrous accretions.

The injury of an artery leads to nutrition disturbance of the finger, as well as formation of postoperative haematoma. That's why we recommend during the operation, after fasciectomy is done and before skin closing, a release of the circulation and an inspection of the condition of the blood vessels to be executed. The injury of both digital collateral arteries is a very rare, but emergency condition. It leads to ischemia of the finger, necrosis of the distal part of it and, eventually, finger amputation. An urgent microsurgical operation for blood vessel recovery by either direct suturing or via venous transplant should be immediately performed. Jones et al. reported a case with multiple digital arteries injuries during reoperation of a patient with disease recurrence. A critical ischemia of the fourth and fifth finger occurred. The patient was transported to a microsurgical center for arterial operation. Amputation was avoided [8].

The consequences in cases of nerve injury include loss of sensitivity, paresthesia and formation of painful neuroma. The lesion must be distinguished and repaired. Direct suture of the nerve leads to good functional outcome.

CONCLUSION

We find the presented clinical case a good example of how atypical location of the nerves and arteries in the palm, even though a rare finding, becomes of particular importance when surgery in this area is planned, because of the potential danger for accidental injuries. Therefore, we think that every surgical intervention in Dupuytren's contracture must be done from proximal to distal, with careful releasing of the cords and nodules and localizing, tracing and protecting the common arteries and nerves of the hand, from the palm to the fingers. Thereby, when reaching the PIP joint, it would be clearly visible if any medialization of the neurovascular bundle exists, so that it can be carefully liberated and protected. Thus, in cases with severe contracture (grade 2-4 according to Tubiana and Michon classification), with nodules and skin affection, a full or almost full reducing of cases with neurovascular injuries may be accomplished.

In cases of operation due to recurrence, especially when the first procedure was performed from other operator, the surgeon can never be sure in the blood supply of the affected finger and if there was an arterial injury during the previous operation. In those cases, we recommend performing preoperative angiography.

The results of our study as well as our previous experience shows high frequency of complications in patients, that come to our clinic after surgical intervention, done in other clinics, non-specialized in hand surgery operations. This proves the fact that for the proper surgical treatment of Dupuytren's contracture, the presence of a skilled hand surgeon and a well-prepared clinic is a must.

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