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Original Article

Clinical repercussions of Martin-Gruber anastomosis: anatomical study☆

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ABSTRACT

Objective: The main objective of this study was to describe Martin-Gruber anastomosis anatomically and to recognize its clinical repercussions.
Method: 100 forearms of 50 adult cadavers were dissected in an anatomy laboratory. The dissection was performed by means of a midline incision along the entire forearm and the lower third of the upper arm. Two flaps including skin and subcutaneous tissue were folded back on the radial and ulnar sides, respectively.
Results: Nerve communication between the median and ulnar nerves in the forearm (Martin-Gruber anastomosis) was found in 27 forearms. The anastomosis was classified into six types: type I: anastomosis between the anterior interosseous nerve and the ulnar nerve ($n = 9$); type II: anastomosis between the anterior interosseous nerve and the ulnar nerve at two points (double anastomosis) ($n = 2$); type III: anastomosis between the median nerve and the ulnar nerve ($n = 4$); type IV: anastomosis between branches of the median nerve and ulnar nerve heading toward the flexor digitorum profundus muscle of the fingers; these fascicles form a loop with distal convexity ($n = 5$); type V: intramuscular anastomosis ($n = 5$); and type VI: anastomosis between a branch of the median nerve to the flexor digitorum superficialis muscle and the ulnar nerve ($n = 2$).
Conclusion: Knowledge of the anatomical variations relating to the innervation of the hand has great importance, especially with regard to physical examination, diagnosis, prognosis and surgical treatment. If these variations are not given due regard, errors and other consequences will be inevitable.

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Repercussões clínicas da anastomose de Martin-Gruber: estudo anatômico

Palavras-chave:
Anastomose arteriovenosa/anatomia e histologia
Nervo mediano
Nervo ulnar

RESUMO

Objetivos: Descrever anatomicamente a anastomose de Martin-Gruber e reconhecer suas repercussões clínicas.
Método: Foram dissecados 100 antebraços de 50 cadáveres adultos no laboratório de anatomia. A dissecção foi feita através uma incisão mediana em todo o antebraço e terço inferior do braço, dois retalhos incluindo a pele e subcutâneo foram rebatidos, para o lado radial e ulnar respectivamente.
Resultados: A comunicação nervosa entre os nervos medianos e ulnar no antebraço (anastomose de Martin-Gruber) foi registrada em 27 antebraços. Classificamos a anastomose em seis tipos. Tipo I: anastomose entre o nervo interósseo anterior e o nervo ulnar (nove membros); Tipo II: anastomose entre o nervo interósseo anterior e o nervo ulnar em dois pontos (dupla anastomose - dois membros); Tipo III: anastomose entre o mediano e o nervo ulnar (quatro membros); Tipo IV: anastomose entre ramos dos nervos mediano e ulnar destinada ao músculo flexor profundo os dedos, esses fascículos formam uma alça de convexidade distal (cinco membros); Tipo V: anastomose intramuscular (cinco membros); Tipo VI: anastomose entre ramo do nervo mediano para o músculo flexor superficial e nervo ulnar (dois membros).
Conclusão: O conhecimento das variações anatômicas em relação à inervação da mão tem importância relevante, principalmente quando se considera o exame físico, diagnóstico, prognóstico e tratamento cirúrgico. Se essas variações não forem valorizadas, erros e consequências serão inevitáveis.

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Introduction

The anatomy of the upper limbs is extremely complex. In addition to the complexity of the format of the brachial plexus and the existence of strategic anatomical zones such as the epitrochlear-olecranon groove (ulnar canal), carpal canal and Guyon canal, anomalous nerve branches can be found. These may form anastomoses in particular sites that have clinical and functional importance.

The innervation pattern that is most accepted in relation to the intrinsic muscles that act in relation to fine movements of the hand is that the opposing short abductor muscle, the superficial portion of the short flexor muscle and the first and second lumbrical muscles receive innervation from the median nerve. The deep portion of the short flexor muscle, the adductor muscle of the thumb, the muscles of the hypothenar region, the dorsal and palmar interosseous muscles and the fourth and fifth lumbrical muscles are innervated by the ulnar nerve. The great variety of clinical conditions observed in cases of isolated lesions of the median or ulnar nerve led us to investigate this.

Clinically, variations of the innervation of these small muscles are very important, in that even if the median or ulnar nerve is completely torn, some of these muscles may not necessarily be paralyzed. This could lead to the wrong conclusion that the nerve had not become completely torn.

The studies that we consulted showed many divergences, and these became more marked when the authors used different investigative methods. The methods used included electroneuromyography, selective anesthetic blockage of nerves and anatomical dissection. Clinical reports and electroneuromyographic studies have suggested that these muscles may receive double innervation from the median and ulnar nerves. Highet[1] analyzed 45 patients with completely torn median or ulnar nerves and found that the short flexor muscle of the thumb was totally paralyzed in only five of them. Forrest[2] drew attention to this and stated that communication between the median and ulnar nerves in the hand might be more frequent than is imagined and that the muscles located close to this communication (nerve anastomosis) might be receiving innervation from both nerves (double innervation).

Reports on clinical cases have often suggested that double innervation of these muscles exists. Nerve communication (anatomical variations) between the median and ulnar nerves may occur in the forearm (Martin-Gruber anastomosis), between the thenar motor branch of the median nerve and the deep motor branch of the ulnar nerve in the palm of the hand (Cannieu and Riché anastomosis) or between the sensory branches of the two nerves, also in the palm of the hand (Berretini anastomosis or superficial sensory communicating branch). Thus, the variety of clinical conditions observed in cases of isolated lesions of the median and ulnar nerves is discordant with the classical innervation pattern of these muscles that is suggested by treatises on anatomy. Better knowledge of the anatomical variations in the innervation of these muscles is important with regard to diagnosing nerve injuries.

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