CASE REPORTS

Anatomic Variation of the Median Nerve Associated with an Anomalous Muscle of the Forearm

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Documented anatomical variations are important not only for the study of the subject of anatomy, but also in clinical situation. This knowledge would aid surgeons in planning a preoperative strategy for surgical procedures and reconstructive surgery. The right forearm of a 35-year-old embalmed male cadaver present a splitting of the median nerve in the proximal 1/3 of the forearm to form medial and lateral divisions that accommodate an anomalous muscle. The split median nerve reunites at the distal 1/3 and continues as a single nerve. The anomalous muscle arises by muscle fibers from flexor digitorum superficialis and inserted by tendon into flexor digitorum profundus. There was no such variation in the left forearm. The knowledge of such anatomical variations is important to clinicians and surgeons in interpreting atypical clinical presentations and avoiding unusual injury during surgery.

INTRODUCTION

The median nerve is formed by the union of the lateral root from the lateral cord (C5-C7) and the medial root from the medial cord (C8-T1) of the brachial plexus (C5-T1) anterior or lateral to the third part of the axillary artery. In the arm, the median nerve runs lateral to the brachial artery, crosses in front of the artery and descends medial to it in the distal half of the arm. It has no branches in the axilla or arm but gives vascular branches to the brachial artery, articular branches to the elbow joint. In the cubital fossa, the median nerve lies medial to the brachial artery, deep to bicipital aponeurosis, and anterior to brachialis without giving out branches. The median nerve enters the forearm between the two heads of pronator teres. It then descends behind a tendinous bridge between flexor digitorum superficialis and flexor digitorum profundus muscles. The median nerve crosses the ulna artery to lie between it and the radial artery. Just proximal to flexor retinaculum, the median nerve emerges deep to palmaris longus, lateral to flexor digitorum superficialis, and medial

to flexor carpi radialis. In the forearm, the median nerve gives motor branches to the flexors (except flexor carpi ulnaris) and sensitive branches to the skin of the lateral side of the palm.¹⁻³

The flexor digitorum superficialis arises from two heads, the humeroulnar head and the radial head. The humeroulnar head constitutes the medial epicondyle, the tubercle on the medial border of the coronoid process of the ulna, and the radial head constitutes the whole length of the anterior oblique line of the radius. It is considered to be in an intermediate layer because its fleshy belly is partly hidden above by the other superficial flexors. Above the wrist, the tendons of this muscle appear on each side of the palmaris longus tendon. Beneath the flexor retinaculum, the middle and ring finger tendons lie superficial to index and little finger tendons of same muscle. These tendons insert into the middle phalanges of their corresponding fingers.³ Knowledge of the anatomic variations of nerves is important for clinicians in evaluating neuropathies and interpreting atypical clinical symptoms, and for

surgeons involved in the reconstruction of nerve plexuses and branches.

CASE REPORT

*During dissection of peripheral nerves and vessels in our gross anatomy laboratory, the right forearm of a 35-year-old male cadaver presented an anatomic variation of the median nerve and an anomalous muscle. In the proximal 1/3 of the right forearm of this cadaver, just after giving off muscular branches, the median nerve bifurcated into medial and lateral divisions (white arrowhead, **Figs. 1 & 2**) that accommodated an anomalous muscle. These divisions reunited at the distal 1/3 of the forearm (red arrowhead, **Fig. 2**) and continued as a single nerve. The distance between the point of bifurcation and reconvergence was about 12 cm. The anomalous muscle originates by muscle fibers from the radial side of flexor digitorum superficialis (red cycle delineations, **Figs. 1 & 2**), and crossed the medial division of the median nerve superficially as it pass between the divisions of the median nerve to its insertion. Its tendon inserted into the proximal part of the index tendon of the flexor digitorum profundus. The radial head of flexor digitorum superficialis was removed to uncover the aforementioned variation. However, there was no variation in the anatomy of the median nerve or flexor digitorum superficialis in the left forearm of this cadaver.*

Figure 1. Anatomical variation of the right median nerve and anomalous muscle of the forearm. Right forearm showing a bifurcated median nerve and anomalous muscle arising from flexor digitorum superficialis. Observe the point of bifurcation of median nerve (white arrow head) into anomalous medial and lateral branches. Mn: median nerve, LMn: lateral branch, MMn: Medial division and AMs: anomalous muscle, PT; Pronator teres, FDS; Flexor digitorum superficialis. Origin of anomalous muscle - delineated red.

DISCUSSION

The variations found in the study are quite interesting because of their significance to surgeons in preparing for surgical procedures. Only few literature sources have described the location of the radial head of flexor digitorum superficialis between the bifurcation of the median in the proximal 1/3 of the forearm, and the flexor digitorum superficialis penetrating the median nerve.⁴⁻⁵ In this study, we have described the bifurcation of the median nerve into medial and lateral divisions that accommodated an anomalous muscle and then unite in the distal 1/3 of the forearm. The anomalous muscle arises by muscle fibers from flexor digitorum superficialis and inserted by tendon into flexor digitorum profundus. This observation is unlike that of Skie and Ciocanel⁵ that described a penetration of the median nerve by flexor digitorum superficialis. Some of the reports on forearm median nerve variations described communications between the median nerve and ulna nerve⁶⁻¹⁰ and between the ulna nerve and median nerve.⁹⁻¹¹

The anatomic variation of the median nerve and anomalous muscle described in this study could be due to the random factors influencing the mechanism of formation of the peripheral nerves, especially the

Figure 2. Variation of the right median nerve and an irregular muscle of the forearm. Mn: median nerve, LMn: lateral branch, MMn: Medial division and AMs: anomalous muscle, PT: Pronator teres, FCR: Flexor carpi radialis, FCU: Flexor carpi ulnaris, FDS: Flexor digitorum superficialis, TFDP: Tendon of flexor digitorum superficialis, *: muscular branches of median nerve. Origin of anomalous muscle - delineated red.

altered signaling between the mesenchymal cells and the neuronal growth cones or circulatory factors during embryonic life.¹² Notably in humans, upper limb development is caused by the regional expression of five Hox D (Hox D 1 to Hox D 5) genes.¹³ The expression of chemoattractants and chemorepulsants in a highly coordinated site-specific fashion regulates the guidance of developing axons. The viability of the growth cones that take the right path is enhanced by tropic substances such as brain-derived neurotropic growth factor, c-kit ligand, neutrin-1, neutrin-2.¹⁴

The proper awareness of these kinds of anatomic variations found in the present study is important to both surgeons and clinicians when diagnosing peripheral neuropathies and performing surgical procedures on the upper limb and in trauma situations.

CONCLUSION

Detailed knowledge of anatomic variations of the median nerve and muscles of the forearm is important in order to avoid mistakes and injury which may cause unusual clinical symptoms.

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Анатомическая вариация срединного нерва (nervus medianus), связанного с аномальной мышцей предплечья

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Документированные анатомические вариации имеют важное значение не только для изучения анатомии, а и в клинических ситуациях. Эти знания помогают хирургам в планировании дооперационной стратегии проведения хирургических процедур и реконструктивной хирургии. В правом предплечье бальзамированного трупа 35-летнего мужчины обнаружено разделение срединного нерва в проксимальной трети предплечья, образующее промежуточные и боковые разветвления, в которые включается аномальная мышца. Разделенный срединный нерв объединяется в дистальной трети и переходит в один нерв. Аномальная мышца выходит из мышечных волокон поверхностного сгибателя пальцев и с помощью сухожилий проникает в глубокий сгибатель пальцев. В левом предплечье не обнаружено таких вариаций. Знание таких анатомических вариаций имеет важное значение для клинических медиков и хирургов в целях объяснения атипичических клинических проявлений и избежания наступления необычных травм во время операции.