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ASPECTS OF THE HUMAN SUPERFICIAL PALMAR ARCH FORMATION IN NEWBORNS

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Introduction: The superficial palmar arch is believed to be the main in the hand circulation. Changes in the superficial palmar arch formation are of great clinical interest, especially in hand surgery.

Aim of study: to examine principles of the superficial arch formation in newborns.

Material and methods: the study included 120 hands of newborn human cadavers. Topography of the superficial palmar arch was studied by macro- and micropreparation and variations were noted.

Results: among the observed cadavers 55.9% of hands had the classic anatomy of the superficial palmar arch and the variant patterns were revealed in 44.1%. 22.5% of cases showed complete variant palmar arch and in 21.6% of hands it was incomplete.

Conclusions: the present study had provided details about the newborn superficial palmar arch formation.

Keywords: *superficial palmar arch, artery, newborn*

Introduction

The superficial palmar arch (SPA) is usually formed by the terminal part of the ulnar artery and the superficial palmar branch of the radial artery. The arch is above to the flexors tendons and extends across the palm at the bases of the metacarpals. It gives origin to the common palmar digital arteries, which supply fingers by proper digital palmar arteries [1]. It is well known, that each human body possesses a unique configuration and has its complement of variations [2]. A basic law of vascular anatomy is that the only thing which remains constant is its variability [3]. Several researchers found that only in 1/3 of cases the superficial palmar arch is formed by union of the ulnar artery and the superficial palmar branch of the radial artery. Sometimes people have the so-called “ulnar palmar arch”, when the structure of the arch consists only of the ulnar artery, few articles discuss contribution of the a.princeps pollicis in the superficial palmar arch formation [4].

The median artery is the axis artery of the upper extremity during early embryonic life. It maintains the superficial palmar arch while the radial and ulnar arteries are developing. When the ulnar and radial arteries are fully developed the median artery disappears, but sometimes it can persist as a. commitans n.mediani [5]. Its frequency in the superficial arch formation was found to be from 4% to 16% [6, 7, 8]. Median artery in the human adult has been recorded in 2 different patterns: as a large, long vessel (palmar type) that reaches the hand; or as a small and short vessel (antebrachial type) that ends before reaching the wrist joint [5].

According to the Coleman S.S. and Anson B.J. (1961) classification there are two types of the SPA: complete and incomplete, each divided into 4-5 subtypes [9,10]. This classification was simplified by Gellman H. et al. (2001) and has been widely used by clinicians. An arch is said to be complete, if an anastomosis is found between the vessels contributing to it. An incomplete arch has an absence of a communication between the vessels constituting the arch [11].

The further development of the reconstructive hand surgical procedures made researches to deepen the knowledge about variations of the SPA. In 2005 Loukas M. et al. described five types of the superficial palmar arch. The first type corresponds to the classic way of arch formation (40%), the second – ulnar arch (35%), the third – anastomosis of the ulnar artery with a. commitans n.mediani (15%); the fourth type – anastomosis of the ulnar artery, radial artery and a. commitans n.mediani (6%); the fifth type – anastomosis of the ulnar artery and the branch of the deep palmar arch (4%) [7].

The amount of the common palmar digital arteries is discussed among researches, and is connected with the type of the arch. Only in 20% of cases the SPA gives four aa. digitales palmares communes [12].

Double superficial palmar arch represents the coexistence of two palmar arches that supply fingers and has been reported by K. Vijaya Laksmi and B. Narasinga Rao (2012) [11].

Recent studies of the superficial palmar arch variations are based on data obtained from sporadic cases, systemic descriptions are rare, especially concerning newborn anatomy. Each other day paediatric surgeons require more detailed knowledge about the complex anatomical structures in the hand anatomy in order to fulfill the need for verifying the validity of various surgical procedures under practice and to define new [11].

Aim of study - to examine principles of the superficial arch formation in newborns.

Material and methods

The study included 60 embalmed and formalin fixed neonatal cadavers (120 cases of upper limbs) (female - 26, male - 34). All the cadavers were selected randomly from the Normal Anatomy Department’s collection of Grodno State Medical University. The study was approved by the university Bioethics commission and corresponds to the principles of the Helsinki Declaration of the World Medical Association (the 7th revision).

Dissection of all extremities was carried by means of macro- and micropreparation. The obtained data were recorded in protocols, providing information about the course of the forearm and hand arteries. The vascular patterns were sketched

and photographed.

The statistical value was done by Microsoft Excel'2007 and Statistica 6.0. We used parametric and non-parametric criteria.

Results and discussion

Careful dissection of the 120 upper extremities revealed changes in the classic superficial palmar arch formation in 53 cases (44.1%): 26 left-sided hands and 27 right-sided hands (χ^2=0,00, p=1,0000). Female neonates showed variations of the SPA anatomy more often (29 cases, χ^2=4,21, p=0,04).

We found a. commitans n.mediani as a small branch of the common or anterior interosseous artery posterior to the median nerve in 94.2%. This artery participated in the blood supply of m.flexor digitorum superficialis, m.flexor digitorum profundus and median nerve and gave terminal branches in the distal third of the forearm (antebrachial type).

In 7 cases the median artery was of greater diameter, and in 71.4% participated in the superficial palmar arch formation (palmar type).

Only 22.5% of neonates obtained complete palmar arch. We found that in 3 cases it was formed by union of the ulnar artery and median artery and in 24 cases it was ulnar palmar arch (figure 1,2).

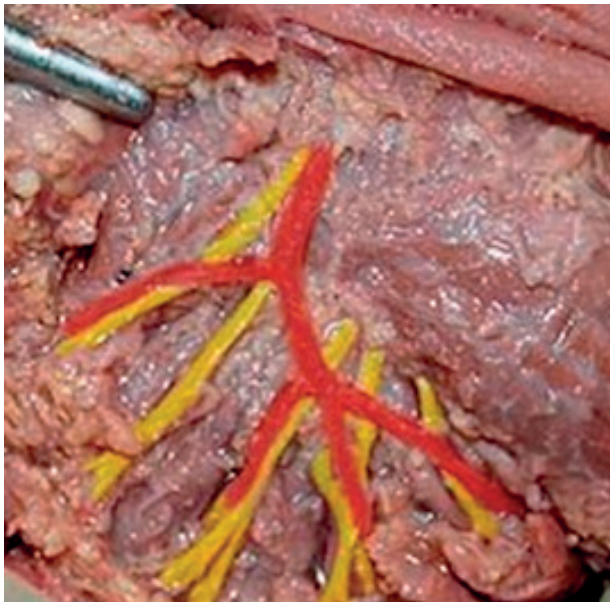

Figure 1. – Photograph, anterior view of the left palm, showing complete superficial palmar arch, formed by the ulnar artery

In cases when complete superficial palmar arch was formed by the ulnar artery in 8 specimen this artery also gave radialis indicis artery (χ^2=6,58, p=0,0103) (figure 2).

The incomplete form of the superficial palmar arch was observed in 26 upper limbs (21.6%) and the common palmar digital arteries originated directly from the radial, ulnar or median arteries, without any anastomosis. Herewith, in 61.5% of cases the common palmar digital arteries were branches of the radial and ulnar arteries. Figure 3 demonstrates the hand, when princeps pollicis artery, radialis

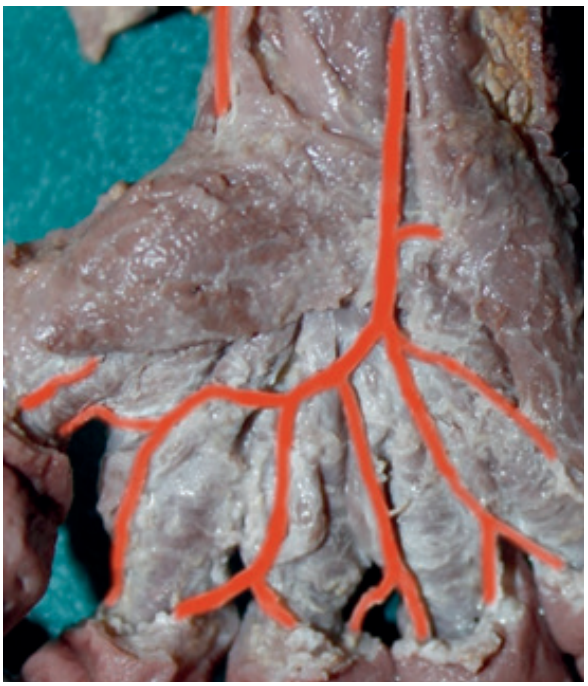

Figure 2. - Photograph, anterior view of the right palm, showing complete superficial palmar arch, formed by the ulnar artery. The radialis indicis artery is a branch of the ulnar artery

indicis artery and the first common digital palmar artery arise from a .radialis, and the second and third common digital palmar arteries – from a. ulnaris.

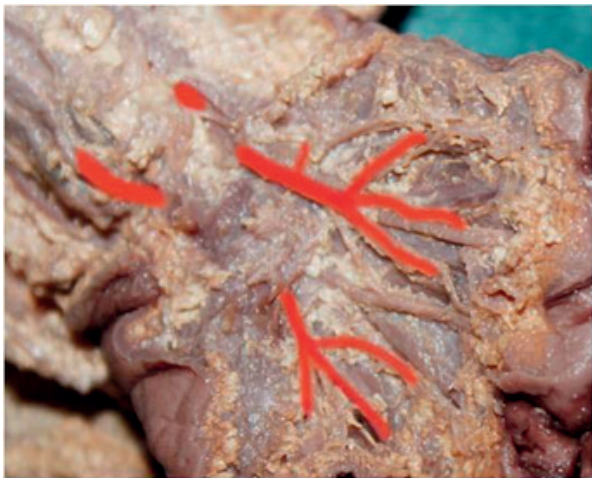

Figure 3. - Photograph, anterior view of the right palm, showing incomplete superficial palmar arch

Sometimes the first, second and third common digital palmar arteries were branches of the ulnar artery, and the radial gave only princeps pollicis and radialis indicis arteries.

We found incomplete palmar arch, formed only by branches of the ulnar artery in 30.8% of limbs (figure 4). In this case the first, second and third common palmar digital arteries originated from the ulnar, but we can not identify it as complete ulnar

arch because the princeps pollicis artery and radial indicis artery were not detected. We suppose that the supply of the first and second fingers is provided by means of the deep palmar arch in this variation.

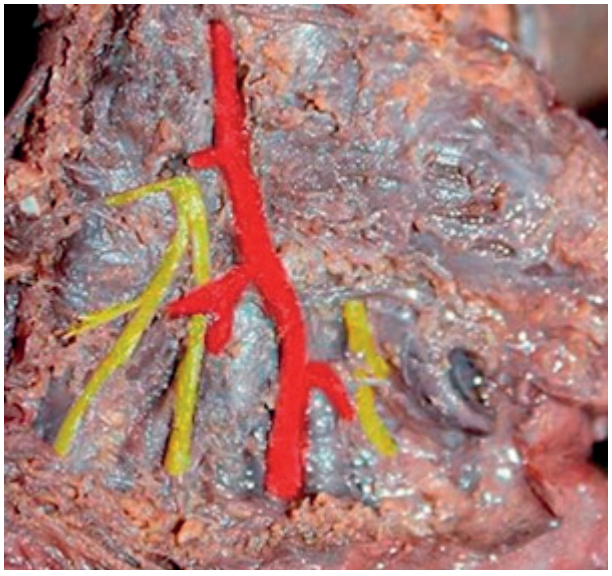

Figure 4. - Photograph, anterior view of the left palm, showing incomplete superficial palmar arch formed by the ulnar artery

In two cases (7.7%) blood supply of the hand was carried with the median artery participation (figure 5).

Figure 5. Photograph, anterior view of the left palm, showing incomplete superficial palmar arch formed by the ulnar artery and palmar-type median artery

Conclusions

Superficial palmar arch variations recognized during the research offer a great learning potential in the field of neonatal hand anatomy and yields insight into prospective medical, radiological and surgical implications of these variations. Most of the described changes of the palmar arch formation can be explained from the embryology patterns. The latest findings suggested that the arterial network of the upper limb develops from an initial capillary plexus by a proximal to distal differentiation, due to the maintenance, enlargement and differentiation of certain capillary vessels, and regression of others [5]. One group of variations may represent persistent fetal forms of circulation (median artery), whereas another group demonstrates individual variations of arterial regression (incomplete palmar arch).

The peculiarities in the formation and topography of the superficial palmar arch can be used in traumatology (when performing reconstructive operations), coronary artery bypass surgery (insertion of radial arterial grafts for myocardial revascularization) and vascular surgery.

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ОСОБЕННОСТИ ФОРМИРОВАНИЯ ПОВЕРХНОСТНОЙ ЛАДОННОЙ ДУГИ У НОВОРОЖДЕННЫХ

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Введение. Главная роль в кровоснабжении кисти принадлежит поверхностной ладонной дуге. Вариации поверхностной ладонной дуги имеют большое клиническое значение, особенно в хирургии кисти.

Цель исследования: установить особенности формирования поверхностной ладонной дуги у новорожденных.

Материал и методы. В исследование были включены 120 рук от трупов новорожденных. Топография и варианты формирования поверхностной ладонной дуги были изучены макро- и микропрепарированием.

Результаты. В 55,9% случаев наблюдалась классическая форма поверхностной ладонной дуги, изменения зафиксированы в 44,9%. В 22,5% случаев выявлена полная форма ладонной дуги и в 21,5% – неполная.

Выводы: данное исследование расширило представление об особенностях формирования поверхностной ладонной дуги у новорожденных.

Ключевые слова: *поверхностная ладонная дуга, артерия, новорожденный*

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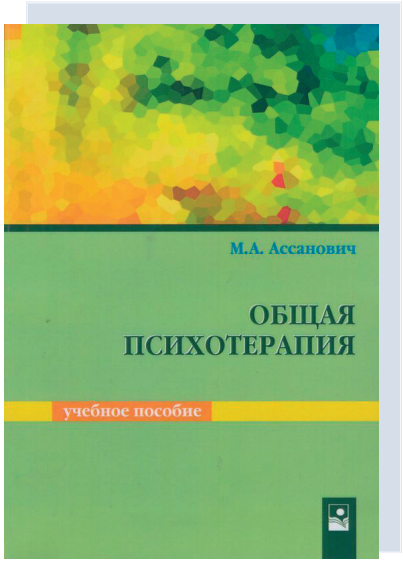

Общая психотерапия : учеб. пособие / М. А. Ассанович. – Минск : Новое знание, 2017. – 272 с. – ISBN 978-985-475-905-0.

В учебном пособии подробно освещаются общие вопросы психотерапии, касающиеся лечебных действующих факторов, нейробиологических эффектов, факторов эффективности психотерапии, терапевтических отношений. Изложены исторические вехи становления и развития психотерапии как сферы лечения и научной дисциплины. Рассмотрены важнейшие понятия индивидуальной и групповой психотерапии. Представлены методы краткосрочного вмешательства. Детально описаны базовые навыки психотерапевта, проведен обзор наиболее популярных и эффективных психотерапевтических техник.

Для студентов медико-психологического факультета. Может быть полезно практическим специалистам: психиатрам, психотерапевтам, психологам и всем интересующимся вопросами психотерапии.