ID Design Press, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2019 Jun 30; 7(12):2006-2009.
https://doi.org/10.3889/oamjms.2019.561
eISSN: 1857-9655
Case Report

Unusual Splitting of Medial Cord of the Right Brachial Plexus and Its Relation to the Axillary Artery and Subscapular Artery: A Case Report

Adegbenro Omotuyi John Fakoya[1*], Emilio Aguinaldo[2], Natalia M. Velasco-Nieves[2], Zachary T. Vandeveer[2], Nannette Morales-Marietti[2], Shannon Mathew[2], Abayomi Gbolahan Afolabi[1], Thomas McCracken[1]

[1]Department of Anatomy, University of Medicine and Health Sciences, Basseterre, St. Kitts and Nevis; [2]University of Medicine and Health Sciences, Basseterre, St. Kitts and Nevis

Citation: Fakoya AOJ, Aguinaldo E, Velasco-Nieves NM, Vandeveer ZT, Morales-Marietti N, Mathew S, Afolabi AG, McCracken T. Unusual Splitting of Medial Cord of The Right Brachial Plexus and Its Relation to The Axillary Artery and Subscapular Artery: A Case Report. Open Access Maced J Med Sci. 2019 Jun 30; 7(12):2006-2009. https://doi.org/10.3889/oamjms.2019.561

Keywords: Brachial plexus; Medial cord; Axillary artery; Subscapular artery

***Correspondence:** Adegbenro Omotuyi John Fakoya. Department of Anatomy, University of Medicine and Health Sciences, Basseterre, St. Kitts and Nevis. E-mail: afakoya@umhs-sk.net

Received: 30-Apr-2019; **Revised:** 22-Jun-2019; **Accepted:** 23-Jun-2019; **Online first:** 30-Jun-2019

Funding: This research was supported by the administration of the University of Medicine and Health Sciences, Basseterre, St. Kitts and Nevis

Competing Interests: The authors have declared that no competing interests exist

Abstract

BACKGROUND: Variations in human anatomy have been associated with numerous clinical correlations that may affect patient care. In this article, we present a unique variation of the medial cord of the brachial plexus about the axillary artery and subscapular artery. The precise assessment of this unique morphology was performed during a cadaveric dissection.

CASE PRESENTATION: Contrary to the general course of the medial cord of the brachial plexus, this report demonstrates a rare splitting of the medial cord around the axillary artery and a second abnormal communication between the posterior and medial cords that show a “nutcracker-like” syndrome involving the subscapular artery.

CONCLUSION: Such variations could make surgeries challenging. We also infer that these anatomical variations could make gliding therapy inefficient in any motor dysfunction initiating from the brachial plexus.

Introduction

The brachial plexus is a continuation of nerves from the spinal cord and are separated into roots, trunks, divisions, cords, and branches. Lesions and malformations in each different section of the brachial plexus can have severe and different consequences [1].

The brachial plexus is a continuation of nerves from the spinal cord that normally exits four cervical vertebrae and one thoracic vertebra. The cervical vertebra involved are C5, C6, C7, C8, and the thoracic input is from T1 [1]. The combination of nerves exits the vertebrae and form the roots that mark the beginning of the brachial plexus. The brachial plexus innervates the muscles of the chest, muscles neighbouring the scapula, and the entire upper limb [1]. They also provide sensory and cutaneous innervation to their respective parts of the body depending on where the nerve separates and its route throughout the upper limb [1]. Medically, it is of utmost importance to know the location of nerves, junctions, separations, and affiliations. Many nerves are accidentally lesioned due to their proximity to major arteries, abnormalities, and surgeries. A

significant landmark of the brachial plexus is the axillary artery; this artery is what gave the cords of the brachial plexus their name due to their respective relations to the artery [1]. The relationship of the cords to the axillary is shown in Figure 1.

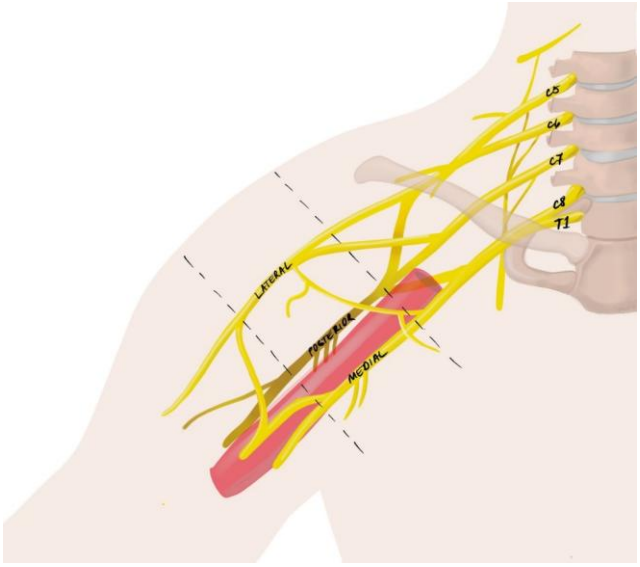

Figure 1: The cords are labelled in the figure as they relate to the axillary artery

The axillary artery is a continuation of the subclavian artery that routes inside the intricate plexus of nerves. The axillary artery runs anterior to the posterior cord, laterally to the medial cord, and medial to the lateral cord, as demonstrated in Figure 1. Malformations and variations can obscure the clinical presentations of lesions associated with the brachial plexus, while also making surgeries difficult if nerves and arteries are not in anatomical position.

This case report shows a unique variation of the medial cord about the axillary artery observed during a routine student cadaveric dissection.

Understanding the brachial plexus is of crucial importance when dealing with nerve lesions and surgical procedures of the upper limb. Variations in the brachial plexus [Af1] are multifactorial in presentation and can either hinder or help patients continue to have valued nerve supply for supporting multiple functions. Some variations are more common than others and have been studied significantly; these malformations usually include the addition of C4 or T2 spinal roots to the standard origin of C5-T1 spinal root of the brachial plexus [2]. A contributing branch of C4 to C5 variation in the brachial plexus occurs in about thirty per cent of the population. The median nerve has also been found to be more prone to abnormalities than other branches of the brachial plexus. In about ten per cent of the population, an abnormality has been identified as having an additional branch forming the median nerve [2]. This additional branch comes from the medial cord. Normally the median nerve is formed from the combination of the lateral and medial cord branches joining together [2].

Case Report

A routine cadaveric dissection of the axilla and upper limbs of a 90-year-old Caucasian female cadaver by medical students at the Anatomy laboratory, University of Medicine and Health Sciences, St. Kitts & Nevis revealed a variant split of the medial cord located distal to its formation from the inferior trunk of the brachial plexus, creating a medial cord with two nerve branches in the right axilla. The branch that was most medial to the axillary artery travelled the normal course of the medial cord running medially to the axillary artery and deep to the pectoralis minor muscle before giving off additional nerves that innervate the forearms and the hand. The other branch travelled in a posterolateral to anteromedial direction over the axillary artery before joining with the normal branch to further create the medial root of the median nerve and the ulnar nerve of the right brachial plexus as shown in figure 2. Both branches that formed the medial cord were joined distally by neural connective tissue splitting around the axillary artery.

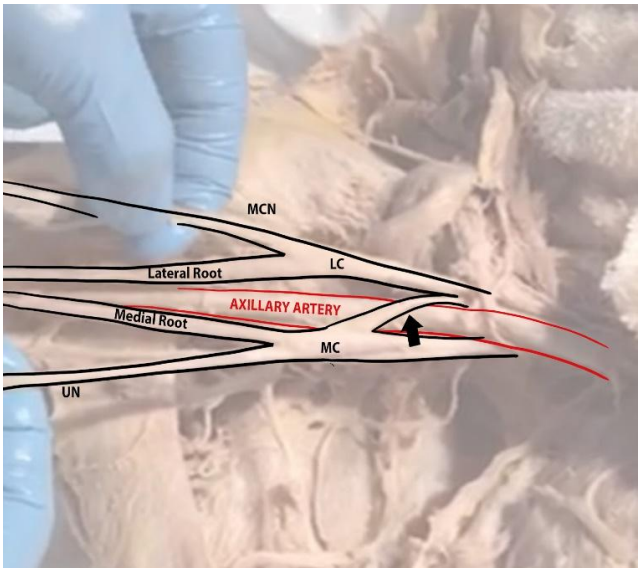

Figure 2: The medial cord of the brachial plexus split distal to its formation in the right axilla (indicated by the black arrow). LC: Lateral Cord; MC: Medial cord; MCN: Musculocutaneous nerve MN: Median nerve; UN: Ulnar nerve

As described, the axillary artery coursed through a split in the medial cord, while a communicating branch connected the posterior cord to the medial cord immediately adjacent to the subscapular artery, almost pinching it in between as demonstrated in Figure 3. The nerves ran their normal course to their respective regions in the indicated

limb. The course and origin of the medial cord of the brachial plexus were located normally in the left axilla and upper limb.

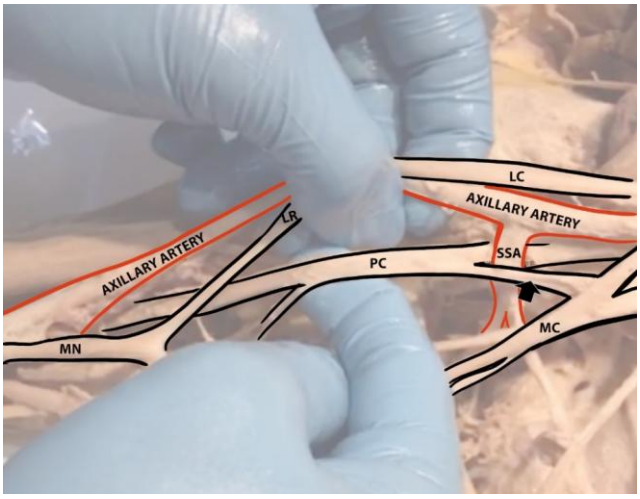

Figure 3: Brachial plexus cords about the axillary artery. Arrow points to the abnormal presentation of a communicating branch from posterior cord to the medial cord of the brachial plexus. LC: Lateral cord; LR: Lateral root; SSA: Subscapular Artery; PC: Posterior cord; MN: Median Nerve; MC: Medial cord

Discussion

The brachial plexus and the upper limb vessels are closely associated with one another. Therefore, the anatomical configuration and form of either structure can affect both nerve conduction and blood supply function. Interestingly, previous studies have shown that variation in the brachial plexus is more often found on the right side of the body, as the case with our female cadaver [2], [3]. The cords of the brachial plexus are of special significance in the axillary region of the body due to their proximity to the third part of the axillary artery. In one case previously reported, the medial cord was observed to be sandwiched in the middle of the axillary and superficial brachial arteries [4]. In another case, it was reported that 4 out of 480 (0.0083%) cadavers had the medial cord divided by the common stem of the lateral thoracic arteries [5]. This paper reveals a pair of medial cord formations, never described in the literature. These anomalies regarding the brachial plexus are thought to be out of an embryologic origin.

Although no significant lesion of both the cords and vessels can be readily appreciated during the dissection, it is difficult to disprove whether the anatomical variation was pathological and rendered the axillary artery susceptible to pinching and thus to symptoms mild of ischemia. This may suggest that in rare cases, upper limb vasoocclusions can result from congenital brachial plexus morphology. Patients that suffer from loss of muscle function due to peripheral nerves anomalies can be treated by gliding therapies as part of a rehabilitation program or perioperative treatment. Gliding therapy consists of a series of active range of movements of the muscles surrounding the targeted nerve, with the purpose of release compression on the nerve [1]. Due to the anomaly found on this cadaveric patient regarding the axillary artery, we believe that if the cadaver had any kind of motor dysfunction originating from the brachial plexus, gliding therapy would not be efficient. Anatomical anomalies are very important to be aware of during surgical procedures. This is especially true when it comes to regions of the brachial plexus and its surrounding areas. An injury to the brachial plexus represents “a severe and difficult-to-handle” traumatic event for the patient. Physicians and surgeons must be aware of the anatomical variations and locations before performing procedures that can drastically affect the lives of their patients. Medical technology can help to play a role in guiding surgeons and anesthesiologists during operative procedures. Diagnostic Sonography is an important tool that can be used to avoid brachial plexus injuries. Also, viewing of such anomalies may aid in orienting patients about possible physiological changes which might occur as a result of such abnormal findings. Sonography is a cost-effective and safe technique which can be used to ensure that nerves and vasculature are normally distributed in the patient, especially if there is an anomaly that is not yet known [2]. To better understand the brachial plexus and possible variations, technology such as sonography and other diagnostic tools must be used. This can lead to the evolution of surgical quality and anaesthesia by leading to facilitated nerve blockage [6]. The location of the axillary artery and its surrounding structures is also important for peripherovascular surgeons and invasive cardiologists due to the use of the axillary artery for coronary bypass. Also, brachial plexus blocks are common in orthopaedic surgeries, but there are novel uses in radical mastectomies for blocking the pectoral nerves [7]. For once we are better able to understand the cause of these variations, we can use them to our advantage in medicine for the benefit of the patient.

In conclusion, knowledge of variations of the brachial plexus and its relation to the axillary artery is important clinically in the planning of surgical and diagnostic procedures. The unusual splitting of the right brachial plexus on the medial cord into two branches which wrap around the axillary artery on the lateral side is an anatomical anomaly that has never been recorded in literature. The embryological origin of this anomaly suggests that congenital brachial plexus morphology can result in changes in the position and shape of the axillary artery. The use of medical technologies, such as sonography, can be used by surgeons to guide and be able to identify any possible variations, to ensure the safety and wellbeing of the patient. Anomalies such as this, are rare and often discovered with little prior information to help

surgeons and other medical professionals in identifying and aiding in treating their patients. Due to this, further research is needed to look deeper into the embryological origin of the cause of this type of anomalies and to look at different surgical and diagnostic procedures that can be used to aid in this outcome.

References

1. Loh P, Yeoh W, Nakashima H, Muraki S. Deformation of the median nerve at different finger postures and wrist angles. PeerJ. 2018; 6:e5406. https://doi.org/10.7717/peerj.5406 PMid:30123715 PMCid:PMC6087621

2. Yang W, Chui P, Metreweli C. Anatomy of the normal brachial plexus revealed by sonography and the role of sonographic guidance in anaesthesia of the brachial plexus. American Journal of Roentgenology. 1998; 171(6):1631-1636. https://doi.org/10.2214/ajr.171.6.9843302 PMid:9843302

3. Uysal İ, Şeker M, Karabulut A, Büyükmumcu M, Ziylan T. Brachial Plexus Variations in Human Fetuses. Neurosurgery. 2003; 53(3):676-684. https://doi.org/10.1227/01.NEU.0000079485.24016.70 PMid:12943583

4. Nakatani T, Mizukami S, Tanaka S. A rare case: The medial cord of the brachial plexus sandwiched between the axillary and superficial brachial arteries. Kaibogaku Zasshi. 1997; 72:151-154.

5. Miller R. Observations upon the arrangement of the axillary artery and brachial plexus. American Journal of Anatomy. 1939; 64(1):143-163. https://doi.org/10.1002/aja.1000640107

6. Emamhadi M, Chabok S, Samini F, Alijani B, Behzadnia H, Firozabadi F et al. Anatomical Variations of Brachial Plexus in Adult Cadavers; A Descriptive Study. The archives of bone and joint surgery. 2016; 4(3):253-258.

7. Cassai A, Bonvicini D, Ruol M, Correale C, Furnari M. Erector spinae plane block combined with a novel technique for selective brachial plexus block in breast cancer surgery. Korean Journal of Anesthesiology. 2018. https://doi.org/10.4097/kja.d.18.00266 PMid:30481947 PMCid:PMC6547240