Int J Biol Med Res. 2012; 3(3): 2214-2217

BioMedSciDirect Publications

Contents lists available at BioMedSciDirect Publications

International Journal of Biological & Medical Research

Journal homepage: www.biomedscidirect.com

Original article

A cadaveric study of variation of posterior cord of brachial plexus

Samta Gaur , SK Katariya, H. Vaishnani , IN Wani, K V Bondre , G V Shah ,

**Ph.d. Candidet, Dr. SN Medical College, Jodhpur, Rajasthan.*
***Head and Professor, Anatomy Department, Dr.SN Mdical College,Jodhpur,Rajasthan.*
****Assistent Professor, Department of Anatomy, SBKS MI & RC, Sumandeep Vidyapeeth, Piparia, Vadodara, Gujarat.*

ARTICLE INFO

Keywords:
Extra branches posterior cord
Nerve supply of latisimus dorsai
Sub-scapular nerves

ABSTRACT

Aims: The aims of the present study were to describe variation in the branching pattern of posterior cord of brachial plexus for its clinical and surgical importance. Material and Methods: The present study undertaken on 50 upper limb in department of Anatomy, SBKS MI & RC, Sumandeep Vidyapeeth, Piparia, Vadodara, Gujarat. The cadavers were donated by relatives with consent letter and certificate of cause of death by practicener. None of them had any pathological lesions, traumatic lesions or surgical procedures in the neck and the axillary region. Result: Present study shows that out of 50 limbs, 38(76%) limbs having classic branching pattern and 12(24%) limb having the variation in which 6(12%) limbs were having variation in order of branching and 6(12%) limbs were having variation in number of branches arising from posterior cord of brachial plexus. Also the study shows that the latisimus dorsai muscles having dual nerve supply. Conclusion: Descriptions of nerve variations are useful in clinical and surgical practice, since an anatomical variation can be the cause of nerve palsy syndromes and vascular problems. In particular, anatomical variations of the human brachial plexus are very important to note during neck dissections, while managing axillary tumours, where these unusual distributions are prone to damage.

1.Introduction:

The brachial plexus is a network of nerves which supply the upper limb with the root value C5-T1. These roots join with each other to form three trunks, each of which bifurcates into anterior and posterior divisions. These divisions reorient themselves to form lateral, medial and posterior cords, which give rise to different nerves for the upper limb [1].

Anatomical variations in different parts of the brachial plexus have been described in humans by many authors, although these have not been extensively catalogued. These may be due to an unusual formation during the development of the trunks, divisions, or cords and they usually occur at the junction or separation of the individual parts. The clinical implications of these variations lie in the anaesthetic blocks and the surgical approaches to the region and the interpretation of a nervous compression which have unexplained clinical symptoms (sensory loss, pain, wakefulness and paresis [2].

* Corresponding Author : Ms Samta Gaur
K- 29, Pratap Nagar,
Jodhpur, 342001
Rajasthan, India
Mob: 09782272111
E.mail: gaursamta@gmail.com

or a surgeon, to have the various patterns of the brachial plexus at his finger's ends is essential in the light of not only the frequency with which the surgery is performed in the axilla and the surgical neck of the humerus and the rapid development of microsurgical techniques but also to give explanations when encountering an incomprehensible clinical sign [3].

The upper subscapular, lower subscapular, thoracodorsal and the axillary nerves usually arise from the posterior cord of the brachial plexus. But during a study which was performed on 50 upper limbs, different patterns of the origins of these nerves were observed which were being reported here. Further, an attempt was made to discuss their clinical significance.

2. Material and Methods

The material for the present study comprised of 50 upper limbs which belonged to 25 adult human cadavers, which were obtained from the Department of Anatomy, SBKS MI & RC, Sumandeep Vidyapeeth University, Piparia, Vadodara, Gujarat. The cadavers were donated by relatives with consent letter and certificate of cause of death by practicener.

The brachial plexus was dissected and exposed according to the methods described by Romanes [4] in Cunningham's Manual of Practical Anatomy. All its roots, trunks, divisions, cords and branches were cleaned and the pattern of its formation and branching was seen. Out of all these, the formation and the branching pattern of the posterior cord have been reported here.

3. Observations and Results

The posterior cord of brachial plexus was formed from posterior divisions of brachial plexus in all specimens studied. Radial nerves in all cases studied originated from the posterior cord as its terminal branch. Observations were under three heading:

(1) Classic branching pattern: Present study shows that 38 (76%) limbs having the classic branching pattern in the posterior cord of brachial plexus.

2) Variation in order of branching: In this category present study shows that in 2 (4%) limbs all the branches of posterior cord arises at the same point. Other then this in 4 (8%) limbs the posterior cord divide two division one continues as radial nerve and do not give any branch. Other division gives all the branches of posterior cord and continuous as axillary nerve. Here we can say the posterior cord divide into two terminal branches that are axillary and radial nerves. The axillary nerve gives upper subscapular, thoraco dorsal and lower subscapular.

(3) Variation in number of branches: In 6 (12%) limbs shows variation in number of branches which arises from posterior cord. In which 4 (8%) limbs show variation in number of subscapular nerve in one case one extra and in one case three extra subscapular nerves present.

In 2 (4%) case the posterior cord divides into two divisions but before it divides it give two subscapular nerves and after it divides again it give two subscapular branches. In 2 (4%) cases four subscapular nerve present, all are arise before the dorsal scapular nerve in the classic pattern of posterior cord.

In 2 (4%) cases having unreported variation that is the extra branch arises after the origin of dorsal scapular nerve (order is upper and lower subscpular, dorsal scapular, extra branch then axillary and radial nerve) and runs parallel to thoraco-dorsal nerve and supplies the teres major and lattissimus dorssai. This case shows the dual nerve supply of lattissimus dorsai.

4. Discussion

Anatomical variations in different parts of the brachial plexus have been described in humans by many authors, although these have not been extensively catalogued. Variations in plexus patterns may be due to unusual formation during the development of trunks, divisions, or cords [5]. The more common variations occur at the junction or separation of the individual parts [6-7].

As the embryonic somites migrate to form the extremities, they bring their own nerve supply, so that each dermatome and myotome retains its original segmental innervations. Throughout somite migration, some of the nerves come into close proximity and fuse in a particular pattern, forming a plexus early in fetal life. Variations of the brachial plexus are often accompanied by abnormalities of vessels. The axillary artery has an association to the division of the cords [8-10].

Thus, it appears that, during development, if the axillary artery had abnormal relations to the brachial plexus, the division of the cords would be modified by the presence of the abnormally placed artery.

Present study shows that classic order of branching was found in 76%; 12% cases were observed in number of branches arising from posterior cord whereas 12% cases were observed in variation of order of branching. The incidence of variation in plexus patterns may be due to unusual formation during the development of trunks, division or cords [11].

Descriptions of peripheral nerve variations are useful in clinical and surgical practice, since an anatomical variation can be the cause of nerve palsy syndromes and vascular problems. They are of particular importance during diagnosis of injuries of the plexus, neck dissections, infraclavicular block procedures and surgical approaches to axillary region tumors where these unusual distributions are prone to damage. Further, identification of specific nerves originating from posterior cord of brachial plexus is necessary during neurotization processes [12-14].

In the present study, similar to conventional descriptions, radial nerves consistently originated from the posterior cord as its terminal branch [1]. This implies that it is a reliable landmark after which the other nerves can be identified.

Johnstone et al reported in Kenyan population [15] that is only 8 out of 75 (10.7%) posterior cords showed the classical branching pattern. 43(57.3%) lower subscapular, 8(10.3%) thoracodorsal and 8(10.3%) upper subscapular nerves came from the axillary nerve instead of directly from posterior cord. A new finding was that in 4(5.3%) and in 3(4%) the medial cutaneous nerves of the arm and forearm respectively originated from the posterior cord in contrast to their usual origin from the medial cord. As compared to present study classic pattern findings are very less [Table 1].

Priti choudhary et al. [16] reported that normal branching pattern of the posterior cord was encountered in 52 (86.67%) limbs, the remaining 8 (13.33%) being variants in one form or the other as compared to our study classic pattern finding are more and variation finding are less in number [Table 1].

The thoracodorsal nerve was given from the posterior cord in 90% of cases. This is within the range of 78.6% and 98.5% described in literature [12]. The rest originated from the axillary nerve (10%) which was similar to 8.9% found by Ballesteros & Ramirez [17] but slightly lower than 13% reported by Fazan et al [18]. A hitherto unreported finding is that one thoracodorsal nerve originated from a common trunk with upper and lower subscapular nerves. Unreported finding of present study is the extra nerve arises from posterior cord and supplies the teres major and lattissimus dorsai. It shows the dual nerve supply of lattissimus dorsai.

Clinically, trauma of the posterior wall of the axillary region could present with a wide range of degrees of muscle impairment. Variations described here may explain these presentations which depend on lesion level and the degree of involvement of the thoracodorsal nerve's several origins. For instance, lesions involving axillary nerves that give rise to thoracodorsal nerve may produce more extensive functional lesions including latisimus dorsi, deltoid and teres minor muscles.

Subscapular nerves exhibited wide variations in origin and order of branching similar to literature reports [12]. Upper subscapular nerve originated from axillary nerve in 8%, higher than values reported by other studies. The nerve originated as a single nerve in 46 (92%) cases, 2 separate branches in 4% and as three trunks in one 2% case. 20% lower subscapular nerves were given off by axillary nerve which is very less range of 54-57.3% reported [12, 18-20].

Knowledge of these variations is important to vascular surgeons working on this region. The posterior cord unusually gave origin to the extra branches in 12% cases. These previously unreported findings are important in explaining outcome of anesthetic blocks and in interpreting nerve injuries.

For a surgeon, to have the various patterns of the brachial plexus at his finger's ends is essential in the light of not only the frequency with which the surgery is performed in the axilla and the surgical neck of the humerus and the rapid development of microsurgical techniques but also to give explanations when encountering an incomprehensible clinical sign [19].

Table 1: Observation of present study:

Type of Observation	No. of cases	%
Classic pattern (UTLAR)*	38	76
Variation in order of branching	6	12
Variation in number of branches	638	12
Total	50	100

Note: * U- Upper subscpular nerve, T- Thoraco dorsal nerve , L- Lower subscapular nerve, A- Axillary nerve, R- Radial nerve.

Table 2: Variation in order of branching pattern of posterior cord:

Type of variation	No. of cases	%
All the branches arises same level	2	4
Posterior cord divide into two part	4	8
Total	6	12

Note: * U- Upper subscpular nerve, T- Thoraco dorsal nerve , L- Lower subscapular nerve, A- Axillary nerve, R- Radial nerve.

Table 3: Variation in the number of branches arising from posterior cord

Type of variation	No. of cases	%
Variation in number of subscapular nerves	4	8
Other extra branch	2	4
Total	6	12

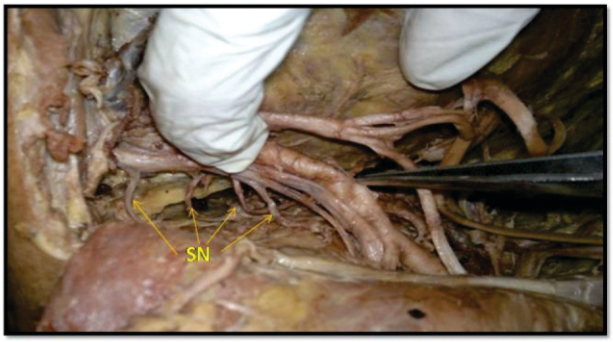

Figure 1: showing the variation in the number of sub scapular nerves

SN : Subscapular Nerves

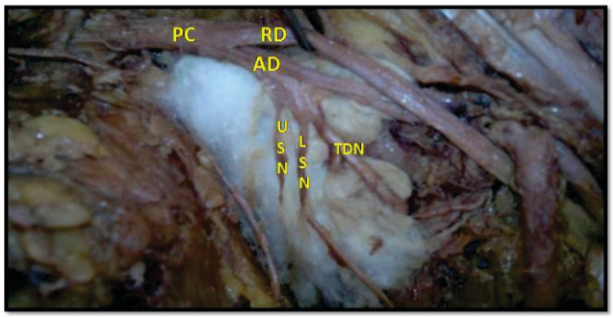

Figure 2: showing the posterior cord divide into two divisions, radial and axillary. Axillary division gives all other branches of posterior cord.

PC : Posterior cord, RD: Radial division, AD : Axillary division, USN: upper subscpular nerve, LSN : Lower subscapular nerve, TDN :- Thoracodorsal nerve

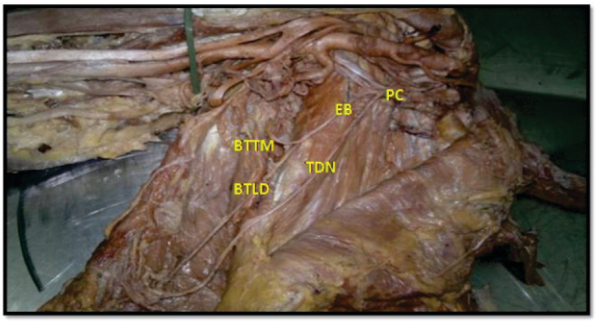

Figure 3: showing the extra branch from the posterior cord which supply the teres major and latissimus dorsi

PC: Posterior cord, EB: Extra branch, BTTM: Branch to teres major, BTLD: Branch to latissimus dorsi, TDN : Thoraco dorsal nerve

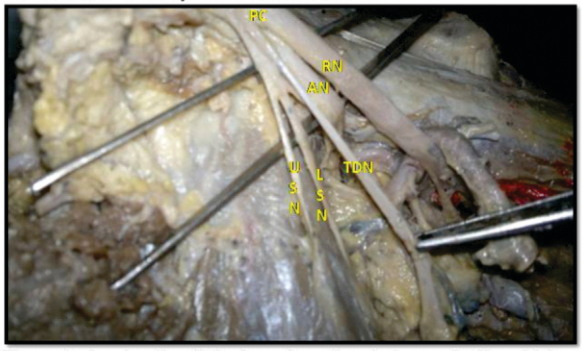

Figure 4: showing the all the branches of posterior cord of brachial plexus arises from same level

PC: Posterior cord, RN: Radial nerve, AN: Axillary nerve, USN: Upper subscapular nerve, LSN: Lower subscpular nerve, TDN :- thoracodorsal nerve,

4. Conclusion:

The brachial plexus is a group of nerves originating from the spinal cord. These nerves are mainly responsible for movement and sensation of the arm and hand. Brachial plexus injuries are very serious and can cause partial or complete loss of function or sensation of the involved upper extremity.

Majority of posterior cords in studied population display a wide range of variations. Anesthesiologists administering local anesthetic blocks, clinicians interpreting effects of nerve injuries to the upper limb and surgeons operating in the axilla should be aware of these patterns to ensure correct management and avoid inadvertent injury. A wider study of the branching pattern of infraclavicular brachial plexus is recommended.

Knowledge of variations in anatomy is important to anatomists, radiologists, anaesthesiologists and surgeons, and has gained more importance due to the wide use and reliance on computer imaging in diagnostic medicine [20]. Also, the presence of anatomic variations of the peripheral nervous system is often used to explain unexpected clinical signs and symptoms. Descriptions of nerve variations are useful in clinical and surgical practice, since an anatomical variation can be the cause of nerve palsy syndromes and vascular problems. In particular, anatomical variations of the human brachial plexus are very important to note during neck dissections, while managing axillary tumors, where these unusual distributions are prone to damage. They may also have clinical importance in diagnosis of injuries of the plexus. In image-processed three-dimensional volume-rendered magnetic nuclear resonance scans, which allow visualization of the entire brachial plexus within a single composite image [21], knowledge of this variation may be useful for surgeons for improved guidance during infra clavicular block procedures and for surgical approaches for brachial plexus region tumours.

Acknowledgment

I have great pleasure in aknowledging to: Dr DS Chowthary, Professor and Head of Department of Anatomy, MG Medical college, Jaipur, Rajasthan; Dr GV Shah, Professor and Dean, Dr. KV Bondre, Professor and Head of Department of Anatomy; all teaching and non teaching staff of Anatomy Department, SBKS MI & RC, Pipariya, Vadodara, Gujarat.

5.References

[1] Gray H, Susan S: In Grays anatomy. Volume 39.. 4 edition. London, UK: El savier; 2004.

[2] Johnston M M et al: Variation in Branching of posterior cord of Brachial Plexus in a Kenyan Population. J. Brachial plexus and Peripheral nerve Injury 2011.

[3] Hecht JS: Subscapular nerve block in the painful hemiplegic shoulder. Arch Phys Medical Rehabilitation 1992, 73:1036-1039.

[4] Romanes G J: Cunningham's Manual of Practical Anatomy. Vol 1Upper Limb and Lower Limb 15th edi 2003: 27-35.

[5] Gupta M, Goyal N, Harjeet. Anomalous communications in the branches of brachial plexus. J.Anat. Soc.India. 2005; 54: 22–25.

[6] Goyal N, Harjeet, Gupta M. Bilateral variant contributions in the formation of median nerve. Surg. Radiol.Anat. 2005; 27: 562–565.

[7] Nayak S, Somayaji N, Vollala VR, Raghunathan D, Rodrigues V, Samuel VP, Alathady Malloor P. A rarevariation in the formation of the upper trunk of the brachial plexus – a case report. Neuroanatomy.2005; 4: 37–38.

[8] Hollinshead WH. Anatomy for surgeons. 3rd Ed., Vol 3., The back and limbs. Philadelphia, Haper & Low.1982; 220–223.

[9 Miller RA. Observations upon the arrangement of the axillary artery and brachial plexus. Am. J. Anat.1939; 64: 143–163.

[10] Nakatani T, Tanaka S, Mizukami S. Superficial brachial arteries observed in bilateral arms. KaibogakuZasshi. 1996; 71: 308–312.

[11] Gupta M, Goyal N, Harjeet : Anomalous communications in the branches of brachial plexus. J Anat Soc India 2005, 54:22-25

[12] Ballesteros E, Ramirez ML: Variations of the origin of collateral branches emerging from the posterior aspect of the brachial plexus. J Brachial Plexus and Peripheral Nerve Injury 2007, 2(1):14.

[13] Chuang D: Neurotization and Free Muscle Transfer for Brachial Plexus Avulsion Injury. Hand Clinics 2007, 23:91-104.

[14] Richardson PM: Recovery of Biceps Function after Delayed Repair for Brachial Plexus Injury. J trauma 1997, 42(5):791-792.

[15] Johnston M M et al: Variation in Branching of posterior cord of Brachial Plexus in a Kenyan Population. J. Brachial plexus and Peripheral nerve Injury 2011.

[16] Priti Choudhary et al: Branching pattern of posterior cord of Brachial plexus: A cadaveric study. J. Clin. and diagnostic research 2011. Vol 5(4); 787-790.

[17] Harry WG, Bennett JD, Guha SC. Scalene muscles and the brachial plexus: anatomical variations andtheir clinical significance. Clin. Anat. 1997; 10: 250–252.

[18] Raphael DT, McIntee D, Tsuruda JS, Colletti P, Tatevossian R. Frontal slab composite magneticresonance neurography of the brachial plexus: implications for infraclavicular block approaches.Anesthesiology. 2005; 103: 1218–1224.

[19] Tubbs RS, Tyler-Kabara EC, Aikens AC, Martin JP, Weed LL, Salter EG, Oakes WJ: Surgical anatomy of the dorsal scapular nerve. J Neurosurg 2005, 102:910-911.

[20] Kerr AT: The Brachial Plexus of Nerves in Man, the Variations in its Formation and Branches. Am J Anat 1918, 23:285-295.

[21] Fazan VPS, André SA, Adilson LC, Omar ARF: Brachial plexus variations in its formation and main branches. Acta Cirurgica Brasileira 2003, 18(5).