

Dorsal Digital Branch of the Thumb: An Anatomical Study

Nervio Digital Dorsal del Pulgar. Estudio Anatómico

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SUMMARY: The level of origin of digital branch to thumb (DBT) of superficial branch of radial nerve (SBRN) and its relationship to brachioradialis muscle tendon (BRT) and its fascial sheath (FS) were studied on both sides of upper extremities of 50 cadavers (n=100). The DBT of SBRN originated in the middle third of forearm in 3 cases (3%), distal third of forearm in 10 cases (10%) and in wrist and dorsum of hand in 87 cases (87%). All cases having origin in the middle third of forearm and half of the cases having origin in the distal third of forearm were closely related to BRT or its FS. The clinical importance of the study lies in the fact that the DBT supplies dorsum of the thumb and first web space which has least cutaneous overlapping. Any injury or entrapment of this nerve may lead to painful neuritis. Anatomical knowledge of such variations are important for neurologists and surgeons performing operative procedures in Quervain's release, arthroscopy and Wartenberg's disease.

KEY WORDS: Radial nerve; Superficial branch; Digital branch; Thumb; Brachioradialis tendon.

INTRODUCTION

Since 19th century, distribution of superficial branch radial nerve (SBRN) has been well documented in classical anatomy textbooks and surgical atlases. Some articles have reported great variability in the branching pattern and its distribution but it is often taken for granted that only few branches cross the wrist joint and innervate the skin of the radial side of the dorsum of hand and three and half digits.

Utmost care must be taken not to damage the sensory branches of radial nerve which run across the area towards the dorsum of the hand. Despite a careful approach by majority of the surgeons, damage to these branches may occur inadvertently. Paraesthesia, hypesthesia, and painful neuromas may result due to excessive retraction, partial or complete transection of nerve (Fritz De Quervain, 1895). There are number of reports on the branches of SBRN passing through dorsum of hand (Leao, 1958). The overlapping pattern of SBRN with lateral antebrachial cutaneous nerve have also been observed in past research studies (Mackinnon & Dellon, 1985). The SBRN becomes subcutaneous as it emerges from posterior border of

brachioradialis. It is here that the nerve is likely to get injured (Braidwood, 1975). The anomalous pattern where brachioradialis tendon (BRT) is split into two slips, there are chances of SBRN getting compressed between the two slips of BRT during ulnar deviation of wrist when the BRT is stretched maximum (Turkof, 1995). However isolated neuropathy of SBRN have been found to be exceptionally rare (Wilson, 1940). It was confirmed by further studies that sensory neuropathies were poorly described in current textbooks and were often misdiagnosed.

Similar to isolated involvement of lateral cutaneous nerve of thigh, which is also known as meralgia paraesthetica, the compression of SBRN is known by the term cheiralgia paraesthetica. This condition is sometimes referred to as Wartenberg's disease (Wartenberg, 1954). This condition was reported to be less rare than was originally thought of. It is second in frequency to meralgia paraesthetica among mononeuropathies (Sproffkin, 1954). SBRN in relation to surgical injuries and entrapment neuropathies have been described but there is paucity of

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literature regarding the level of division of digital branch to thumb DBT of SBRN. As this is the branch which supplies dorsum of the thumb and first web space, the areas which have least cutaneous overlapping. Any injury to this branch during various surgical incisions or entrapment may lead to hypaesthesia, paraesthesia and debilitating neuritis. The aim of the present study was to note the level of division of DBT of SBRN and define its relationship to BRT and its fascial sheath (FS).

MATERIAL AND METHOD

Fifty non randomized cadavers (one hundred upper extremities) were selected for study without any known history of trauma or disease from the Department of Anatomy, Maulana Azad Medical College New Delhi, India. Amongst these, thirty five were male and fifteen were female. Forearm, wrist, dorsum of hand and digits were dissected. The SBRN was traced in forearm and DBT was exposed in the forearm, hand and digits to see the level of branching and distribution. To observe the level of branching, the forearm was divided into three parts by considering two bony landmarks -lateral epicondyle of the humerus and the radial styloid process. The BRT and FS was also dissected to observe its distal attachment and relationship to DBT. Observations were carefully noted and photograph was taken (Fig.1).

RESULTS

Table I shows that the DBT of SBRN was originating in the middle third of forearm in three cases (3%), out of which two belonged to the right forearm of male cadaver and one belonged to the left forearm of female cadaver (Fig. 1). The DBT of SBRN originated from the lower third of forearm in ten cases (10%), of which in two male and two female cadavers, it was a bilateral variation, while in two male cadavers this anomalous branching pattern was found unilaterally in the right forearm. Rest of the cases (87%) showed digital branches originating at or distal to the level of wrist joint. It was bilateral in twenty nine male cadavers and twelve female cadavers. This variation was unilateral in four male cadavers in the left arm and one female cadaver in the right arm. This finding had no significant relationship with sex or right or left arm.

In the three cases in which DBT of SBRN was originating from the middle third of forearm, one was passing through the BRT and the other two cases the DBT of SBRN was related to FS of BRT whereas in the lower third forearm, out of ten cases, five were related to FS and none of them were passing through the BRT.

In all cases (100%) where DBT was coming out from the middle third of forearm, the nerve was closely related to the BRT or its FS whereas only 50% cases showed the same relationship where the nerve was coming from distal third of forearm.

Table I. Level of division of DBT of SBRN in forearm and hand.

Level of division	Male (70)		Female (30)		Total(100) n (%)
	Rt. arm	Lt. arm	Rt. Arm	Lt. arm	
Upper 1/3rd of forearm	-	-	-	-	-
Middle 1/3rd of forearm	2	-	-	1	3(3%)
Lower 1/3rd of forearm	4	2	2	2	10(10%)
Wrist and below the wrist joint	29	33	13	12	87(87%)

DBT = Digital branch to thumb; SBRN = Superficial branch of radial nerve)

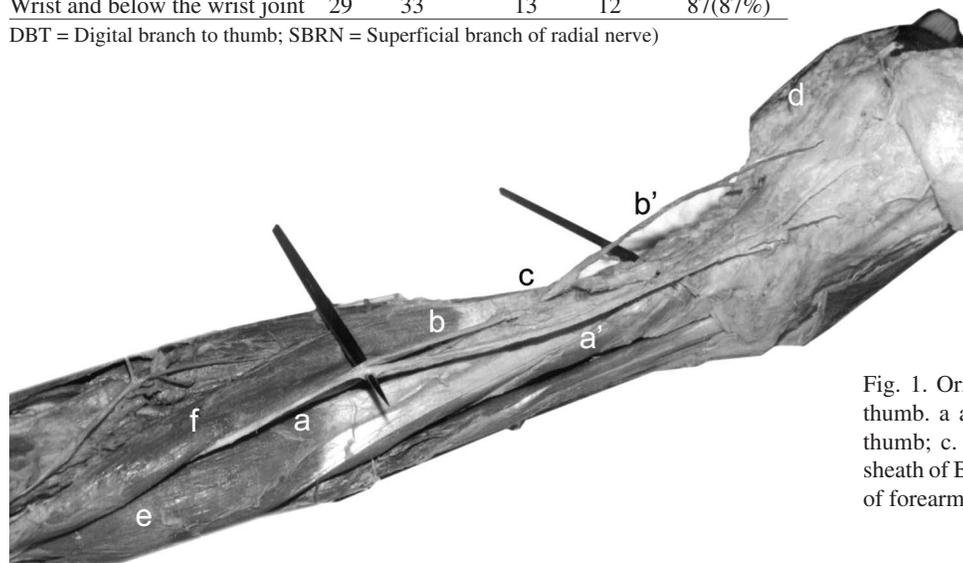


Fig. 1. Origin of digital branch of SBRN to thumb. a a'. SBRN; bb'. Digital Branch to thumb; c. Digital branch piercing the fascial sheath of BRT; d. Thumb; e. Extensor muscles of forearm; f. Brachioradialis muscle.

DISCUSSION

Surgical procedures are commonly performed over dorsum of hand and wrist in De Quervain's and Wartenberg's diseases. Recently, wrist arthroscopy has gained wide popularity and being used by surgeons as diagnostic and therapeutic modalities in treatment of many pericarpal and intercarpal disorders (Auerbach, 1994). The commonest procedure, De Quervain's release in which transverse skin incision approximately 1-2 cm proximal to radial styloid process is given (Luchetti, 2004) and in wrist arthroscopy in which 1-2 portal (between short thumb extensors and radial wrist extensors) are used, of the SBRN or its digital branch is likely get injured as it is just underneath the skin in adipose tissue (Trail, 2004). The lesion of this nerve cause painful neuromas thus transforming the clinical picture into a grave and functionally debilitating situation (Luchetti).

As per classical textbook description, it has been described that SBRN runs lateral to radial artery behind brachioradialis, leaves the artery 7 cm proximal to wrist and passes deep to BRT. It then curves around lateral side of radius and becomes subcutaneous by piercing deep fascia. It then divides into five branches of which first two supplies dorsal side of thumb and first web space (Standring, 2005). In the present study, SBRN followed its usual course and became subcutaneous by piercing the deep fascia. DBT of SBRN was originating in the middle third of forearm in 3 cases (3%) and in the distal third of forearm in 10 cases (10%) which further subdivided into two branches to supply

thumb and first web space whereas in rest of the cases (87%) all the digital branches were originating at or distal to the wrist joint.

In an earlier study, out of twenty cases, two cases (10%) SBRN became subcutaneous by piercing the tendon of brachioradialis (Abrams *et al.*, 1992) whereas another study reported that only in 2% cases SBRN passed through split tendon of brachioradialis (Turkof *et al.*, 1994). To the best of our knowledge not much work has been done on the DBT of SBRN and its relationship to BRT or its FS. An interesting finding which was observed in the present study was that all the cases where the digital branch of SBRN was originating from the middle third, pierced either through the BRT or were related to its FS, whereas only 50% cases showed the relationship of the digital branch to the BRT or its FS when it was arising from the distal third of the forearm.

SBRN becomes subcutaneous as it emerges from posterior border of brachioradialis. It is here that the nerve is likely to get injured (Braidwood). The forearm pronation which is associated with the ulnar deviation of the wrist, the slips of brachioradialis tendon get stretched maximum and there are chances of compression of SBRN as it is being impinged between the two slips of brachioradialis tendon (Turkof, 1995). In the present study, 100% cases in which DBT of SBRN was originating in the middle third of forearm and 50% cases originating in the distal third of forearm were related either to BRT or its FS.

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RESUMEN: Fue estudiado en los miembros superiores de 50 cadáveres, el origen del nervio digital dorsal para el pulgar (NDDP) desde el ramo superficial del nervio radial (RSNR) y sus relaciones con el tendón del músculo braquiorradial (TMB) y su vaina fascial (VF). El NDDP del RSNR se originó en el tercio medio del antebrazo en 3 casos (3%), en el tercio distal del antebrazo en 10 casos (10%) y en la muñeca y dorso de la mano en 87 casos (87%). En todos los casos en que el NDDP se originaba en el tercio medio del antebrazo y en la mitad de los casos en que se originaba en el tercio distal del antebrazo, tenía relaciones estrechas con el TMB o su VF. La importancia clínica de este estudio se basa en que el NDDP suple el dorso del pulgar y primer espacio interdigital, el cual tiene pequeñísima superposición cutánea. Alguna herida o compresión de este nervio puede llevar a neuritis dolorosa. El conocimiento anatómico de estas variaciones son importantes para neurólogos y cirujanos durante los procedimientos de liberación de Quervain, artroscopía y enfermedad de Wartenberg.

PALABRAS CLAVE: Nervio radial; Ramo superficial; Ramo digital; Pulgar; Tendón del músculo braquiorradial.

REFERENCES

- Abrams, R. A.; Brown, R. A. & Botte, M. J. The superficial branch of the radial nerve: an anatomical study with surgical implications. *J. Hand Surg.*, 17(A):1037-41, 1992.
- Auerbach, D. M.; Collins, E. D.; Kunkle, K. L. & Monsanto, E.H. The radial sensory nerve: An anatomic study. *Clinical Orthopaedics and Related Research*, 308:241-9, 1994.

- Braidwood, A. S. Superficial radial neuropathy. *J. Bone Joint Surg.*, 57(B):380-3, 1975.
- De Quervain, F. Ueber eine Form von chronischer tendovaginitis. *Correspondenz-Blatt für Schweizer Aerzte*, 25:389, 1895.
- Leao, L. De Quervain's disease. A clinical and anatomical study. *J. Bone Joint Surg.*, 40(A):1063-70, 1958.
- Luchetti, R.; Atzel, A. & Fairplay, T.C. *Tendon Disorder: De Quervain's Disease, Trigger finger, and Generalized tenosynovitis: in Hand Surgery*. Berger, R.A. & Weiss, A. P. C. eds. Lippincott, Williams & Wilkins, Philadelphia, 2004. V. 1. p 789.
- Mackinnon, S. E. & Dellon, A.L. The overlap pattern of the lateral antebrachial cutaneous nerve and the superficial branch of the radial nerve. *J. Hand Surg.*, 10(A):522-6, 1985.
- Sproffkin, B. E. Cheiralgia paraesthetica: Wartenberg's disease. *Neurology*, 4:857-62, 1954.
- Standring, S. *Gray's Anatomy* 39th. ed. Churchill Livingstone Elsevier, New York, 2005. pp. 886-7.
- Trail, I. A. *Principles of portal placement and anatomy*. In *Hand Surgery*. Berger, R. A. & Weiss, A. P. C. eds., Lippincott, Williams & Wilkins, Philadelphia, 2004. V. 1. p 607.
- Turkof, E.; Puig, S.; Choi, S.S.; Zoch, G. & Dellon, A.L. The Radial sensory nerve entrapped between the two slips of a split branchioradialis tendon: A rare aspect of Wartenberg's syndrome. *J. Hand Surg. (Am.)*, 20(4):676-8, 1995.
- Turkof, E.; Puig, S.; Choi, M.S.S.; Schilhan, R.; Millesi, H. & Firbas, W. The superficial branch of the radial nerve emerging between two slips of a split branchioradialis muscle tendon: a variation of possible clinical relevance. *Acta Anat.*, 150:232-6, 1994.
- Wartenberg, R. Digitalia paraesthetica and gonyalgia paraesthetica. *Neurology*, 4:106-15, 1954.
- Wilson, S. A. K. *Neurology*. Edited by A. N. Bruce. Edward Arnold & Co. London, 1940. V. 1. p 327.

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