

RAMIFICATION OF THE SUPERFICIAL BRANCH OF THE RADIAL NERVUS

RAMIFICACIÓN DEL RAMO SUPERFICIAL DEL NERVIO RADIAL

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SUMMARY: Based upon 36 fresh and embalmed adult cadaver specimens, the arrangement of the superficial branch of the radial nerve (SBRN) is described in the present study. For that purpose, the radial styloid process (RSP) and the tendon of the extensor pollicis longus (EPL) have been used as fixed points of reference. It was proved in all these cases, that the SBRN became divided proximal to the SRP into a volar (R1) and a dorsal branch. The latter, in the majority of these cases became divided at the SRP level in a radial branch and an ulnar branch. The digital dorsal collaterals of the thumb, indexfinger and middle finger originate from these two branches. Four groups of digital collaterals are made up according to the variation of the origin of C1. When considering EPL, the origin of the digital collaterals occurs proximal and over EPL in almost identical proportions.

KEY WORDS: 1. Anatomy; 2. Radial nerve; 3. Peripheral nerves.

INTRODUCTION

The study of the superficial branch of the radial nerve (SBRN) –ramus superficialis of the *nervus radialis*– becomes worthy of consideration for anesthetic regional blocks and in both surgical and arthroscopic approaches. The arrangement of the branch and its vulnerability have been described by several authors (Testut & Latarjet, 1954; Abrams *et al.*, 1992; Abrams *et al.*, 1994; Steinberg *et al.*, 1995; Ndiaye *et al.*, 1996 and Bianchi, 2001).

This paper will focus on the arrangement of the nervous collaterals-*nervi digitalis dorsales*- injury-prone; therefore, digital collaterals of the middle fingers will be mentioned as required.

MATERIAL AND METHOD

A group of 36 adult cadaver specimens, either male or female were dissected and we examine the division of the SBRN related to the radial styloid process (RSP) and the division of the medial branch also related to the point of reference before mentioned. Furthermore, the analysis was performed considering the origin of the sensitive collaterals of the fingers related to the extensor pollicis longus (EPL).

RESULTS

a) Division of the SBRN: origin of the dorsal and ventral branches. In each specimen, the SBRN is divided into two branches: one dorsal and one ventral; both over and proximal to the RSP, positioned within a distance of 10 to 2 cm.

Identifiable positions are described below:

3 cases over the RSP (8.3%); 8 cases at 4 cm (22.2%); 6 cases at 4.5cm (16.6%); 5 cases at 3 cm (14%); 5 cases at 5 cm(14%); 3 cases at 2,5cm(8.3.%); 2 cases at 6 cm (5.5%). From the 4 remaining cases, there were four different results for each case: 10, 7, 6.5, and 2 cm.

The average distance varies from 4 to 4.5cm, proximal to the RSP. (Figs. 2, 3, 4, 5, 6, 7).

The ventral branch forms the radial dorsal collateral of the thumb (R1); in two cases produced an anastomotic branch with the dorsal ulnar collateral of the thumb (C1). (Fig. 6).

b) Division of the branch of dorsal division: It is divided in an ulnar branch and a radial branch; but the division point of the dorsal branch in both the ulnar and radial branches varies related to the RSP as follows, (Fig. 1).

Fig. 1. Division of the dorsal branch of the superficial branch of the radial nerve in relation with radial styloid process.

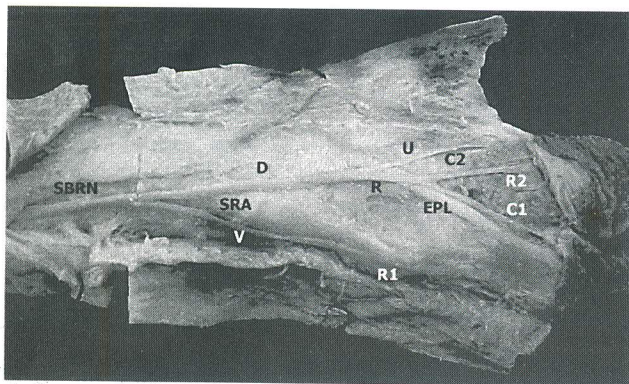
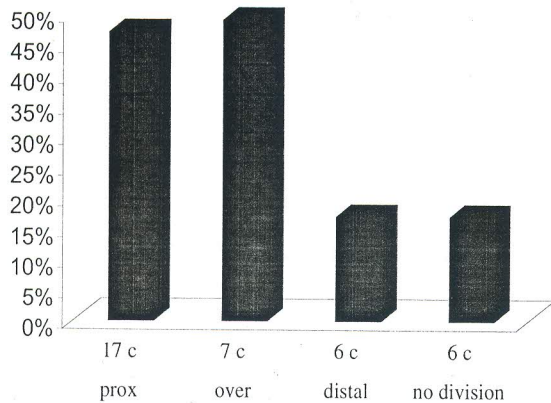


Fig. 2. Origin of C1 from division of the radial branch. SBRN. Superficial branch radial nerve; D. Dorsal branch; U. Ulnar division of the dorsal branch; R. Radial division of the dorsal branch. R1. Dorsal radial collateralis digital of thumb. C1. Dorsal ulnar collateral digital of thumb; EPL. Extensor pollicis longus muscle; R2. Dorsal radial collateral digital of the index finger; C2/ R3. Radial dorsal ulnar collateral digital of the index finger and radial of the middle finger.

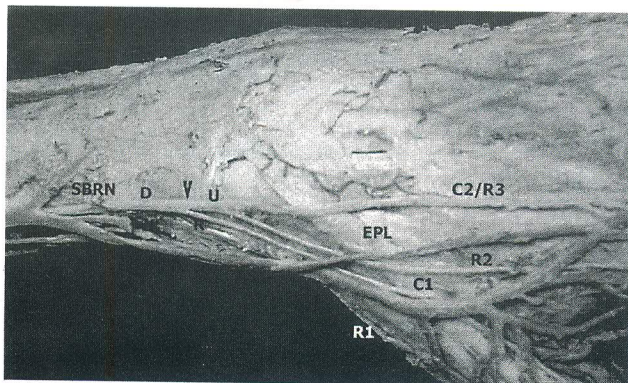


Fig. 3. C1 is the radial division of dorsal branch; bifurcation of the ulnar branch. SBRN. Superficial branch of the radial nerve; R1. Collateral dorsal digital branch of the thumb; D. Dorsal branch; R. Radial division became in C1 dorsal collateral digital finger; U. Ulnar division; R2. Dorsal radial collateral digital of the index finger; R2/C3. Common trunk of the dorsal collateral digitals of index and middle fingers; EPL. Extensor pollicis longus; SRA. Radial styloid process.

There were 17 examples defined as completely proximal (47%) (Fig. 5) 10 cases 2.5cm (59%); 5 cases, 4cm (29%); 2 cases 4.5cm (50%); 2 cases 3.5cm (33%); 1 case: 2.5cm (17%).

7 cases were founded over the RSP (19%) (Figs. 4 and 5) and 6 cases divided distal to the RSP (17%) (Figs. 2,3,7). Besides, there are 6 cases (17%) referred hereafter, when the dorsal branch does not divide (Fig. 6).

c) Origin of the digital dorsal collaterals of the fingers: (*nervis digitales dorsales*)

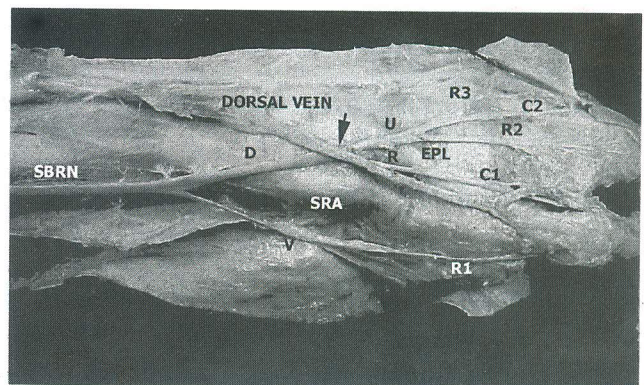


Fig. 4. C1 is the radial division of the dorsal branch with trifurcation of the ulnar branch. SBRN. Superficial dorsal branch of the radial nerve. V. Ventral branch become in. R1. Dorsal radial collateral of the thumb. D. Dorsal branch; R. Radial branch became in C1 dorsal ulnar collateral of the thumb; U. Ulnar branch; EPL. Extensor pollicis longus muscle; R2: Dorsal radial collateral digital of the index finger; C2. Dorsal ulnar collateral digital of the index finger; R3. Dorsal radial collateral digital of the middle finger; Arrow shows the division of the dorsal branch.

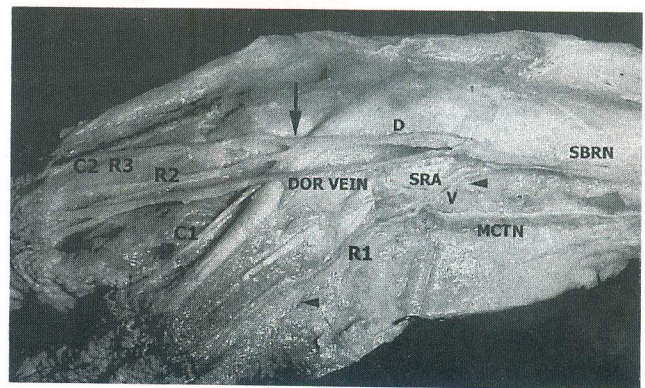


Fig. 5. C1 is part of the trifurcation of the ulnar branch. SBRN. superficial branch of the radial nerve; DOR VEIN. Dorsal vein; D. Dorsal branch; V. Ventral branch; R1. Dorsal radial collateral digital of the thumb; C1. Dorsal ulnar collateral digital of the thumb; R2. Dorsal radial collateral digital of the index finger; C2/C3. Dorsal ulnar y dorsal radial collaterals digitals of the index and middle finger; Little superior and inferior arrows shows R1; Big arrow shows the trifurcation of the ulnar branch over the EPL; MCT. Musculocutaneous nerve.

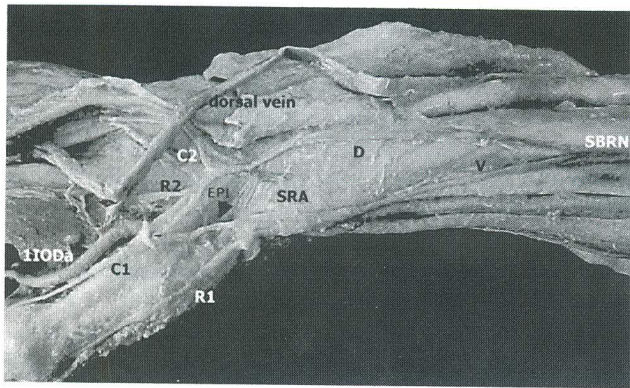


Fig. 6. No division of the dorsal branch. SBRN. Superficial branch of the radial nerve. D. Dorsal branch; V. Ventral branch; EPL. Extensor pollicis longus muscle; R1. Dorsal radial collateral digital of the thumb; C1. Dorsal ulnar collateral digital of the thumb; Arrow. Shows the anastomoses between R1 and C1; R2. Dorsal radial collateral digital of the index finger; C2. Dorsal ulnar collateral digital of the index finger; SRA. Radial styloid process; IIOBa. First interosseous dorsal artery.

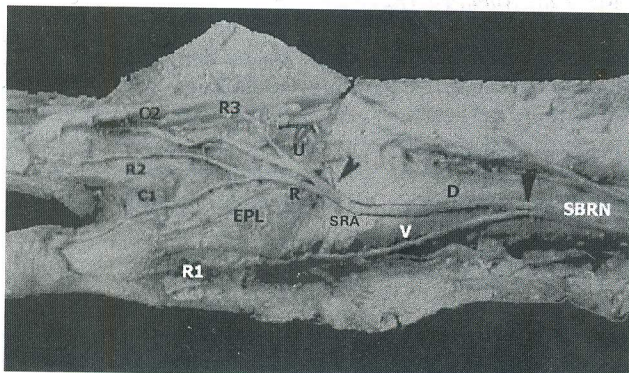


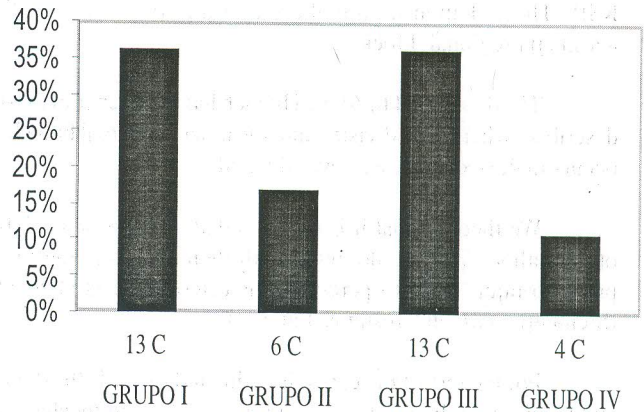
Fig. 7. Division of the radial and ulnar branches in two branches. SBRN. Superficial branch of radial nerve; Right arrow division of SBRN in dorsal and ventral branches. V. Ventral branch; D. Dorsal branch; SRA. Radial styloid process; Left arrow shows the division of the dorsal branch. EPL. Extensor pollicis longus; U. Ulnar branch; R. Radial branch; R1. Dorsal radial collateral digital of the thumb; R2. Dorsal radial collateral digital of the index finger; C2. Dorsal ulnar collateral digital of the index finger; R3. Dorsal radial collateral digital of the middle finger

The collaterals originate from the ulnar and radial branches. The pattern is based upon the origin of C1 and can be classified into four groups:

Group I: Bifurcation of the radial branch: the radial branch provides C1/R2 and the ulnar branch C2, in 13 cases (36%). (Fig. 2).

Group II: Bifurcation of the ulnar branch: thereby the radial branch provides C1 while the ulnar branch provides R2/C2, in 6 cases (17%). (Fig 3).

Fig. 8. Origin of the dorsal digital branches (*Nn digitales dorsales*) of the superficial branch of the radial nerve.



Group III: several subgroups are detectable:

IIIa: the dorsal branch provides both a radial branch, C1, and the trifurcation of the ulnar branch into R2, C2, R3 in 7 cases (19%) (Fig. 4).

IIIb: C1 is part of the trifurcation itself and is completed with R2, C2 in six cases (17%). (Fig. 5).

IIIc: C1 arises from the trifurcation of the dorsal branch which not divided in ulnar and radial branches in 6 cases (17%). (Fig. 6).

Group IV: bifurcation of radial and ulnar branch: radial C1/R1, ulnar C2/R2 in 4 cases (11%). (Fig. 7).

This findings are summarized in Fig. 8.

In connection with the EPL, the division proximal (Figs. 2 and 3) and on the tendon, (Figs. 5 and 6) they are similar, 13 (36%) and 14 cases (39%) respectively, continued by the division distal, 9 cases (25%) (Figs. 4 and 7).

DISCUSSION

To achieve the intended purpose of this study on the division patterns of the SBRN and its branch, two fixed points of reference have been considered: a) the radial styloid process and b) the *extensor pollicis longus* muscle.

According to overall results, the SBRN divides over and proximally to the RSP in most of the cases, with an average range from 4 to 4,5 cm in a dorsal branch and a volar branch

(Linsched, 1965; Depreux, 1975; Abrams *et al.*, 1992 and 1994 and Auerbach, 1994). The latter is located at 1,5 cm from the RSP. These demonstrations become quite important for the anesthetic regional block.

The division of the dorsal branch has not been previously described, whereas its division into the ulnar and radial branches occurs in 48% of the cases over the RSP.

We theorize that it is the so called "central branch" by other authors; and we do agree with them that it is the most prone to injuries due to percutaneous osteosynthesis elements (Steinberg *et al.* and Testut & Latarjet).

For the rest of the cases, it is situated towards the dorsal and medial part, being therefore protected, though mechanical means can cause irritation.

Consequently no element of osteosynthesis should be applied through the RSP without previous division or in cases

when arthroscopic dorsal techniques are used.

The point of reference for determining the point of division of the medial branch is the EPL. We prove that the most frequent division of the ulnar and radial branches occurs next to the tendon, in 44% of the cases followed by the divisions occurring over and distally.

The patterns followed by the ulnar and radial branches originating the dorsal digital collaterals of the fingers present variable performances and have been classified according to the origin of the collateral C1 in 4 groups.

The nervous branches within the RSP and EPL vary from 2 to 5 or 6 branches, as already described by Abrams *et al.*, 1994. These conclusions have promising results in surgeries performed within both points of reference.

As different kind of divisions occur in a single specimen, it become advisable to identify branches in each particular case.

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RESUMEN: Describimos la disposición del ramo superficial del nervio radial (RSNR) en 36 cadáveres formolizados. Utilizamos como puntos de referencia el proceso estiloides del radio (PER) y el tendón del músculo extensor largo del pulgar (MELP). Pudimos observar en todos los casos que el RSNR se dividía proximal al PER en un ramo volar (R1) y un ramo dorsal. Posteriormente, en la mayoría de estos casos se dividía a nivel del PER en un ramo radial y otro ulnar. Los ramos digitales dorsales colaterales del pulgar, de los dedos índice y medio se originaron de estos dos ramos. Cuatro grupo de ramos colaterales digitales encontramos como variación de origen de C1. En igual proporciones proximal y distal al músculo extensor largo del pulgar se originan los ramos digitales colaterales.

PALABRAS CLAVE: 1. Anatomía; 2. nervio radial; 3. Nervios periféricos.

REFERENCES

- Abrams, R. A.; Brown, R. A. & Botte, M. The superficial branch of the radial nerve: an anatomic study with surgical implications. *J. Hand. surg.* 17:1037-41, 1992.
- Abrams, R. A.; Petersen, M. & Botte, M. Arthroscopic Portals of the Wrist: an anatomic study. *J. Hand Surg.*, 19: 940-4, 1994.
- Auerbach, D. M.; Collins, E. D.; Kunkle, K. L. & Monsanto, E. H. The radial sensory nerve. An anatomic study. *Clin Orthop.* Nov., 308:241-9, 1994.
- Bianchi, H. Disposición del *Nervus radialis superficialis*. *Rev. Chil. Anat.*, 19(1):110, 2001.
- Depreux, R.; Mestdagh, H.; Monier, R. & Bailleul, J. P. Neuroskeletal radiography and relationships of the sensitive branch of the radial nerve. *Bull. Assoc. Anat.*, 59(166): 611-20, 1975.
- Linsched, R. L. Injuries to radial nerve at wrist. *Arch Surg* 91: 942-6, 1965.
- Ndiaye, A.; Diop, M.; Dia, A.; Seye, S. I. & Sow, M. L. The sensitive branch of the radial nerve at the inferior third of the forearm and at the wrist. Clinical applications. *Bull. Assoc. Anat.*, 80:27-30, 1996.
- Steinberg, B. et al. Percutaneous Kirschner wire fixation through the snuff box: an anatomic study. *J. Hand Surg.*, 20: 57-62 1995.
- Testut, L. & Latarjet, A. *Tratado de anatomía humana*. Salvat Buenos Aires, 1954.

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