ID: JCDR/2012/2942.3629:1879

Original Article

Anatomy Section

Variations in the Nerve Supply to the Extensor Carpi Radialis Brevis

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ABSTRACT

Introduction: An area of variability has been noted in the origin of the nerve to extensor carpi radialis brevis, with previous studies attesting variably that it arises more commonly from the radial, deep radial or the superficial radial nerve. This study was undertaken to confirm or refute our impression that the superficial radial nerve is purely a sensory nerve as has been often reported in literature.

Methods: The nerve supply to Extensor carpi radialis brevis was studied in 60 adult cadaveric upper extremities.

Results: In only 50% of the limbs, this branch had the usual origin from deep branch of radial nerve. In the remaining 50% limbs, it arose from the angle of bifurcation of radial nerve in 20% and from the superficial branch of radial nerve in 30%. However, there was no corelation between the site of division of radial nerve and the source of nerve to this muscle.

Conclusions: The present data emphasizes that the nerve supply to extensor carpi radialis brevis from superficial branch of radial nerve is not a rare occurrence, but that it holds a significant variability which is worth considering while planning for surgeries.

Key Words: Extensor carpi radialis brevis, Superficial radial nerve, Nerve variation

INTRODUCTION

The extensor carpi radialis brevis (ECRB) is one of the superficial muscles of the extensor compartment of the forearm. It arises from the lateral epicondyle of the humerus, by the common extensor tendon; from the radial collateral ligament of the elbow joint; from a strong aponeurosis which covers its surface; and from the inter-muscular septa between it and the adjacent muscles. Like the other muscles of the extensor compartment of the forearm, this is also usually supplied by a branch from the deep branch of the radial nerve.

It is a universally accepted axiom that the variation in the nerve supply to any muscle, particularly in an extremity, is of definite surgical importance and that it calls for the surgeon's attention, to avoid any error in its judgement. A recent report by Al-Qattan, which showed that the nerve supply to the ECRB arises most frequently from the superficial branch of radial nerve and not from its deep branch as was usually described, prompted us to carry out the present study [1].

MATERIALS AND METHODS

The present study was conducted on 60 adult cadaveric upper extremities in the Department of Anatomy, Government Medical College, Amritsar. The superficial muscles of the extensor compartment of the forearm were separated from each other, starting with the tendons at the wrist. The three anterolateral muscles (the brachioradialis and the radial extensors of the carpus) were completely separated from the extensor digitorum and the supinator muscle which lay deep in these muscles, was exposed. The deep branch of the radial nerve (the posterior interosseous nerve) was revealed to be emerging from the supinator near its distal border and subsequently giving branches to the various muscles in its vicinity.

The nerve which supplied ECRB was then identified in all the specimens. Observations were made and the following data was recorded:

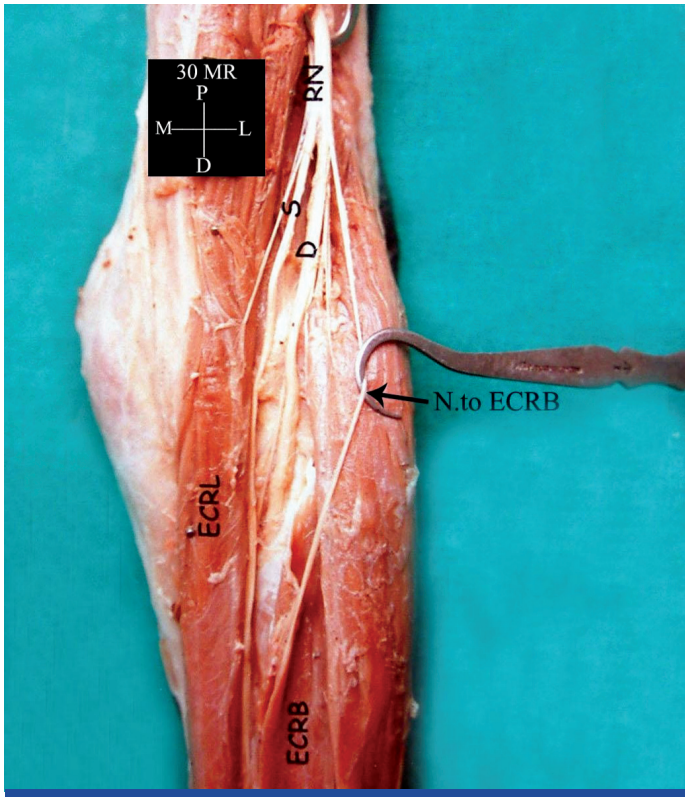
1. Site of division of the radial nerve in relation to the lateral epicondyle of the humerus.
2. Number of terminal branches of the radial nerve.
3. Source of the nerve to the ECRB i.e. radial nerve trunk above its division, angle of its bifurcation, deep branch or superficial branch of the radial nerve.

RESULTS

We found that in a majority of the limbs, the radial nerve divided into two branches i.e. superficial and deep branches (48 limbs) and in the remaining 12 limbs, it showed three divisions, the third being the nerve to the extensor carpi radialis brevis. The nerve to the ECRB arose from the deep branch of the radial nerve before it entered the supinator muscle in 50% of the limbs [Table/Fig-1], from its superficial branch in 30% limbs [Table/Fig-2] and as one of its terminal branches in 20% limbs [Table/Fig-3]; as depicted in [Table/Fig-4]. Contrary to the common belief, no specimen was seen to arise from the radial nerve trunk above the level of its division. The application of the Chi-square test did not reveal any correlation between the site of division of the radial nerve and the source of the nerve to the ECRB. The radial nerve was divided most commonly above the level of the lateral epicondyle (41.67%), followed by its division at the level of the lateral epicondyle (30%) and in the remaining limbs, it was divided below this level (28.33%); as depicted in [Table/Fig-5].

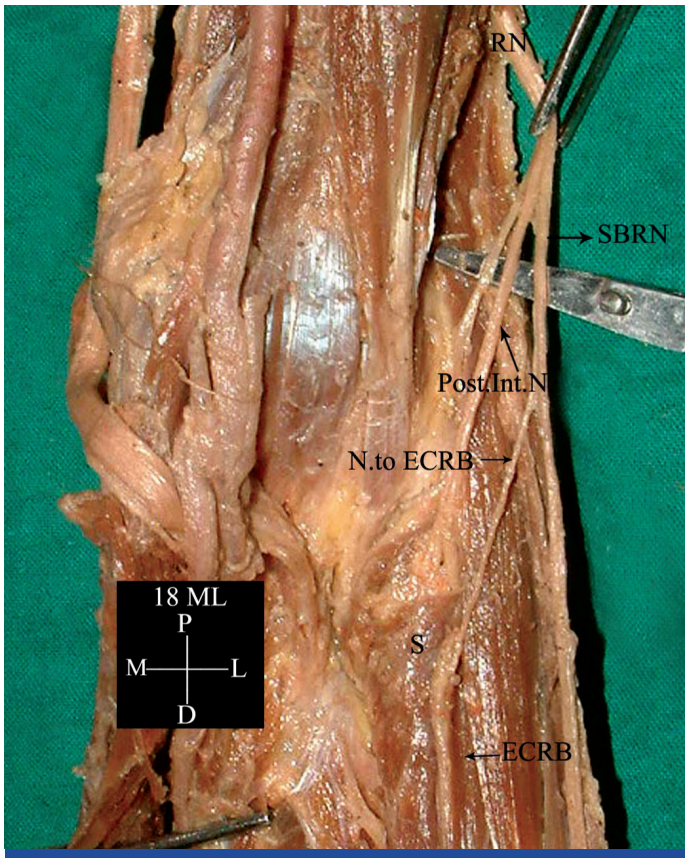
DISCUSSION

Most of the standard texts in various specialities and surgeons believe that the nerve supply to the ECRB is either from the radial nerve trunk before its division into the deep and superficial branches or from its deep branch (posterior interosseous nerve) [2,3,4,5,6,7,8]. They have described the superficial branch of the radial nerve (SBRN) as a purely sensory nerve. As suggested by Williams et al in the myology section of Gray's Anatomy, the nerve supply to the ECRB is from the posterior interosseous nerve.



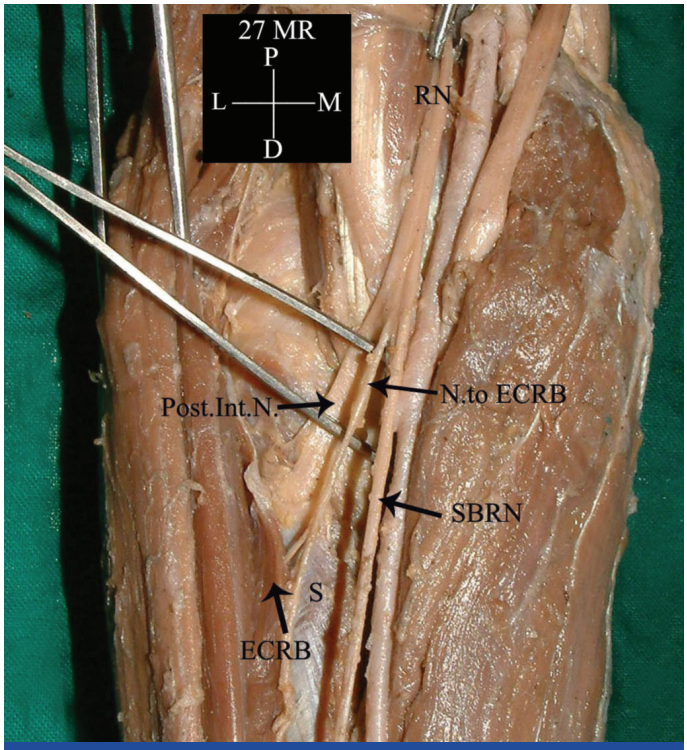
[Table/Fig-1]: Photograph showing the Extensor carpi radialis brevis muscle being supplied by the deep branch of Radial nerve

RN: Radial nerve; S – Superficial branch of radial nerve; D – Deep branch of radial nerve; ECRL – Extensor carpi radialis longus; ECRB – Extensor carpi radialis brevis; N. to ECRB – Nerve to extensor carpi radialis brevis (from the deep branch of radial nerve).



[Table/Fig-2]: Photograph showing the Extensor carpi radialis brevis muscle being supplied by the superficial branch of radial nerve

RN – Radial nerve; SBRN – Superficial branch of radial nerve; Post. Int. N. – Posterior interosseous nerve (deep branch of radial nerve); S – Supinator; ECRB – Extensor carpi radialis brevis; N. to ECRB – Nerve to extensor carpi radialis brevis (from the superficial branch of radial nerve).



[Table/Fig-3]: Photograph showing the Extensor carpi radialis brevis muscle being supplied by a branch from the angle of bifurcation of radial nerve

RN – Radial nerve; Post. Int. N. – Posterior interosseous nerve (deep branch of radial nerve); SBRN – Superficial branch of radial nerve; S – Supinator; ECRB – Extensor carpi radialis brevis; N. to ECRB – Nerve of Extensor carpi radialis brevis (from the angle of bifurcation of radial nerve).

Limb	Site of origin of nerve to ECRB			
	Radial nerve Trunk	Angle of Bifurcation	Deep Branch	Superficial Branch
Right	–	5	17	8
Left	–	7	13	10
Total	–	12 (20%)	30 (50%)	18 (30%)

[Table/Fig-4]: Showing the relative incidence of the different sites of origin of the nerve to ECRB.

Sl. No.	Site of division of radial nerve	Number of limbs with a particular source of nerve to ECRB		
		Angle of Bifurcation	Deep branch	Superficial branch
1.	Above lateral Epicondyle	6	12	7
2.	At lateral epicondyle	4	9	5
3.	Below lateral Epicondyle	2	9	6

[Table/Fig-5]: Showing relationship between the site of division of radial nerve and the source of nerve to ECRB.

No mention has been made about the nerve arising from the SBRN [9].

On the contrary, the incidence of the nerve supply to the ECRB from the SBRN had been reported by Salisbury, Brash and Al-Qattan as 56%, 21% and 48% limbs respectively [10, 11, 1]. The present study also showed that this was the case in 30% limbs. This high percentage cannot be ignored as a rare variation. The variation in the incidence of the superficial branch of the radial nerve which supplies the ECRB in different studies may be due to racial factors. [Table/Fig-6] shows the comparison between the

Worker	Year	No. of limbs studied (n)	No. of limbs with a particular source of nerve to ECRB (n%)		
			Deep Branch	Superficial Branch	Angle of Bifurcation
Salisbury [10]	1938	50	18 (36.00 %)	28 (56.00 %)	4 (8.00 %)
Prasartritha et al [15]	1993	60	1 (1.67 %)	26 (43.33 %)	33 (55.00 %)
Crecenti et al [16]	1994	30	28 (93.33%)	2 (6.67 %)	–
Al-Qattan [1]	1996	25	8 (32.00 %)	12 (48.00 %)	5 (20.00 %)
Abrahams et al [17]	1997	20	9 (45.00 %)	5 (25.00 %)	6 (30.00 %)
Branovacki et al [18]	1998	60	27 (45.00 %)	15 (25.00 %)	18 (30.00 %)
Thomas et al [19]	2000	31	8 (25.81 %)	9 (29.03 %)	14 (45.16 %)
Latev and Dalley [20]	2005	60	30 (50.00 %)	21 (35.00 %)	9 (15.00 %)
Present study	2010	60	30 (50.00 %)	18 (30.00 %)	12 (20.00 %)

[Table/Fig-6]: Comparison between the relative incidences of the different sites of origin of the nerve to ECRB in different studies.

relative incidences of the different sites of origin of the nerve to the ECRB in different studies.

Sunderland reported that the origin of the nerve to the ECRB from the radial nerve trunk or the posterior interosseous nerve appeared to be related to a low or high division of the radial nerve trunk and no relationship was there between the supply from the SBRN and the site of division of the radial nerve was observed.[12] On the contrary, in our study, we observed that there was no relationship between the site of division of the radial nerve and the source of the nerve to the ECRB.

CLINICAL SIGNIFICANCE

Variations in the origin of the nerve to the ECRB are important in the clinical context. The ECRB may be spared in injuries to the posterior interosseous nerve, thereby explaining the preservation of some wrist function clinically after penetrating injuries which may otherwise result in a complete wrist drop. Likewise, injuries to the superficial radial nerve, which is supposedly a sensory nerve, may lead to pain during the extension of the wrist and slight weakness on the extension on the wrist joint due to involvement of the nerve supply of the ECRB.

Any traumatic transection of the superficial radial nerve in the distal forearm may result in a painful neuroma. This condition is very difficult to treat and more than a hundred of treatment methods have been proposed [13]. One of the options is to transect the superficial radial nerve in the proximal forearm and to bury the proximal nerve stump in the muscle. If this option is chosen, the transection of the superficial radial nerve should be performed distal to its motor branch to the ECRB.

Recently, ECRB has also gained importance for use in 'free functional muscle transfer' i.e. transfer of a muscle with its motor nerve and vascular pedicle from one site of the body to another distant site, in order to restore the motor function [14]. Knowledge of the variations in the origin of its nerve supply is thus important while this muscle is being harvested.

It is well known that the normal origin and the course of the nerve to the ECRB lie very close to the posterolateral aspect of the radius, a frequent site of pathology (e.g. infections and tumours), trauma and surgical procedures. The anterior approach to the elbow and the variations in this approach are used frequently in the surgical management of proximal radial fractures, as well as a variety of other pathologies. Such manouvers involve the separation of the ECRB distally, with resultant exposure of the radial nerve and its branches. Hence, a thorough knowledge of the anatomic variants of the nerve supply to the ECRB will assist the surgeon in avoiding an inadvertent placement of the retractors, that can result in direct injury to this nerve branch or indirectly through traction.

CONCLUSION

Our study emphasizes that the nerve supply to the extensor carpi radialis brevis from the superficial branch of the radial nerve is not a rare occurrence. This fact should not to be considered as a mere co-incidence, but it can be significant to the level of affecting the outcome of different surgeries. Hence, this needs to be mentioned not only in the text-books of anatomy, but also in plastic surgery, in view of its recent use in 'free functional muscle transfer'.

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FINANCIAL OR OTHER COMPETING INTERESTS:
None.

Date of Submission: **Jul 23, 2011**
Date of Peer Review: **Sep 30, 2011**
Date of Acceptance: **Nov 17, 2011**
Date of Publishing: **Feb 15, 2012**