Research Article

A study of radial nerve and its deep branch in the cubital fossa

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Abstract

Introduction: The radial nerve anterior to the lateral epicondyle divides into superficial and deep terminal branches. Entrapment or compression neuropathy of the deep branch of radial nerve (DBRN) or posterior interosseous nerve (PIN) leads to radial tunnel syndrome or PIN syndrome. It may also be one of the differential diagnoses of lateral epicondylitis. This study was performed on 38 upper limbs of 19 formalin-fixed cadavers. In most of the instances it was found that the radial nerve divided 1.4 cm above the interepicondylar line (IEL). The nerve to extensor carpi radialis brevis (ECRB) arose at 1.2 cm from the IEL. We also observed the nature of some of the important structures which may compress deep branch of radial nerve. This knowledge is important for exploring elbow region during surgical decompression of DBRN.
Keywords: Deep branch of radial nerve, radial nerve, radial tunnel syndrome.

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INTRODUCTION

The radial nerve is the largest branch of brachial plexus. It begins in the axilla as a continuation of the posterior cord. In front of lateral epicondyle the radial nerve divides into superficial and deep terminal branches. The radial nerve and deep branch of radial nerve (DBRN) is mostly compressed in the forearm, at the arcade of Frohse[1]. It is the most common entrapment neuropathy of the radial nerve[2]. In this study, we observed the site of division of radial nerve and nature of some of the structures that may compress DBRN. We also observed the site of origin of nerve to extensor carpi radialis brevis (ECRB), number of branches and length of nerve to ECRB. This study will help the surgeons while exploring the elbow region during the surgical decompression of the DBRN.

AIMS AND OBJECTIVES

- To measure the distance between the interepicondylar line (IEL) and the site of division of radial nerve
- To measure the distance between the IEL and the site of origin of nerve to extensor carpi radialis brevis (ECRB)
- To measure the shortest distance from radial tuberosity to the arcade of Frohse
- To note the nature of some of the structures that may compress DBRN
- To note the site of origin of nerve to ECRB and number of branches
- To measure the length of nerve to ECRB

MATERIALS AND METHODS

Thirty eight upper limbs from 19 formalin-fixed cadavers of a tertiary care hospital were dissected carefully. The radial nerve was exposed in the cubital fossa between brachioradialis laterally and brachialis medially. Its terminal branches were identified i.e. superficial branch of radial nerve (SBRN) and deep branch of radial nerve (DBRN). The interepicondylar line (IEL) was marked with the help of a thread. The site of division of radial nerve was observed, whether it was above or below the IEL. The distance was measured between the IEL and the site of division of radial nerve. The site of origin of nerve

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to ECRB and number of branches were observed. The distance between the site of origin of nerve to ECRB and IEL was measured. We also observed the nature of some of the structures that may compress DBRN. The length of the nerve to ECRB was measured (Fig 1). The shortest distance from radial tuberosity to the arcade of Frohse was measured (Fig. 2). This study was conducted over a period of one year.

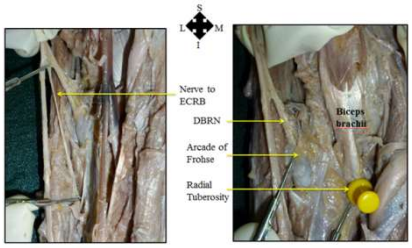

Figure 1: Measurement of the length **Figure 2:** Measurement of the distance of nerve to ECRB from radial tuberosity to arcade of Frohse

RESULTS

Table 1: Mean distance between the interepicondylar line (IEL) and radial nerve division and origin of nerve to ECRB

Parameter	Above IEL (in cm)	Below IEL (in cm)
Radial nerve division	1.4	1.2
Origin of nerve to ECRB	1.5	1.2

- In 29 limbs out of 38, radial nerve divided above the IEL and in 5 limbs it divided below IEL.
- In 4 limbs out of 38, radial nerve divided at the IEL.
- Out of those 4 limbs, in 3 limbs origin of nerve to ECRB was also arising at the level of IEL. i. e. trifurcation of radial nerve.

Table 2: Nature of some of the structures that may compress DBRN

	Tendinous	Musculotendinous	Membranous	Muscular
Superior border of superficial ayer of supinator	4 (10%)	22 (58%)	12 (32%)	0
Inferior border of superficial layer of supinator	6(16%)	8(21%)	4(10%)	20(53%)
Superomedial margin of ECRB	11(29%)	3(8%)	16(42%)	8(21%)

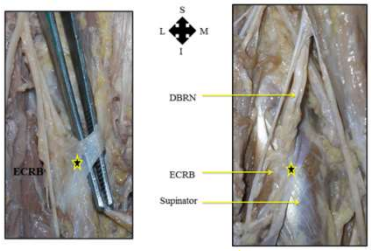

Figure 3: Tendinous arch of ECRB (★) winding around DBRN

1. The mean shortest distance from radial tuberosity to the arcade of Frohse where DBRN pierces the supinator was 1.7 cm.
2. The nerve to ECRB was a branch from radial nerve in 16 limbs, from DBRN in 16 limbs and from SBRN in 6 limbs.

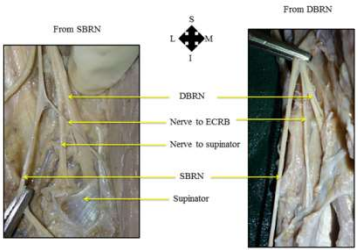

Figure 4: Origin of nerve to ECRB

1. There was a single branch to ECRB in 36 limbs and in 2 limbs there were 2 branches.
2. The mean length of nerve to ECRB from its origin to the entry point in ECRB was 5cm.

DISCUSSION

Table 3: The radial nerve division in our study was more close to interepicondylar line as compared to other studies, as given below

	Radial nerve division (in cm)		Origin of nerve to ECRB(in cm)	
	Above IEL	Below IEL	Above IEL	Below IEL
Fuss and Wurzl (1991)	2.5	3.0	_	
Konjengbam and Elangbam (2004)	2.7	3.0	_	
Present study	1.4	1.2	1.5	1.2

Table 4: Some of the structures that may compress DBRN are tabulated below

	Superior border of superficial layer of supinator	Inferior border of superficial layer of supinator	Superomedial margin of ECRB
Papadopoulos *et al* (1989)	_	_	Tendinous – 90%
Konjengbam and Elangbam (2004)	Tendinous – 87% Musculotendinous – 13%	Tendinous – 65% Muscular – 22%	Tendinous – 78% Membranous – 13%
Soubhagya *et al* (2009)	_	_	Tendinous – 29% Absent arch – 57%
Present study	Musculotendinous – 58% Membranous – 31%	Muscular – 52% Musculotendinous - 21%	Tendinous – 29% Membranous – 42%

In this study, nature of superior border of superficial layer of supinator muscle was commonly found to be musculotendinous while it was commonly found to be tendinous by Konjengbam *et al*. Inferior border of superficial layer of supinator muscle was commonly found to be muscular while it was commonly found to be tendinous by Konjengbam *et al*. The superomedial margin of ECRB was commonly found to be membranous while it was commonly found to be tendinous by Konjengbam *et al*.

Table 5: We found that the nerve to ECRB arises from the radial nerve and deep branch of radial nerve in equal instances which differed from other studies

	From radial nerve	From deep branch of radial nerve	From superficial branch of radial nerve(SBRN)
Fuss and Wurzl (1991)	_	60%	_
Prasartritha *et al* (1993)	55%	2%	43%
Riffaud *et al* (1999)	_	_	Mainly
Konjengbam and Elangbam (2004)	2%	59%	39%
Soubhagya *et al* (2009)	15%	50%	35%
Present study	42%	42%	16%

CONCLUSIONS

- The knowledge of site of radial nerve division at, above or below the IEL will help surgeons while releasing DBRN during lateral epicondylitis surgery.
- Arcade of Frohse is one of the commonest causes for compression of DBRN.
- The superomedial margin of ECRB may compress DBRN before its entry into the supinator muscle.
- Data regarding the origin of nerve to ECRB and its length will help surgeons, while exploring the elbow region during the surgical decompression of DBRN.

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