A SURGICAL APPROACH TO THE POSTERIOR INTEROSSEOUS BRANCH OF THE RADIAL NERVE THROUGH THE BRACHIORADIALIS – A CADAVERIC STUDY

C K Low, J T H Chew, A K Mitra

ABSTRACT

Twelve cadaveric upper limbs were selected to evaluate the surgical approach to the posterior interosseous nerve through the mid-line of brachioradialis. There were 6 right and 6 left upper limbs. The limbs were placed with forearm in mid-prone position and elbow at 90° of flexion. The incisions were made 2 cm distal to the lateral condyle and along the midline of the brachioradialis towards the radial styloid process for an average of 4.7 cm. The lateral cutaneous nerve of forearm was found lying on the anterior third of the brachioradialis. The brachioradialis was split along the midline. The following structures were identified. The radial nerve branched into superficial radial nerve and posterior interosseous nerve at an average of 1.8 cm below the lateral condyle. The superficial branch descended along the anterior third of the brachioradialis. The posterior interosseous nerve passed beneath the arcade of Frohse at an average of 3.8 cm below the lateral condyle. The radial recurrent artery was found crossing the posterior interosseous nerve at an average of 2.7 cm below the lateral condyle. The nerve to the extensor carpi radialis brevis originated from the radial nerve bifurcation or its branches at an average of 2.3 cm below the lateral condyle and entered the muscle at an average of 3.9 cm below the lateral condyle. The arcade of Frohse and the superficial head of supinator were divided to expose the entire posterior interosseous nerve. The approach gave direct access to posterior interosseous nerve without direct danger to the lateral cutaneous nerve of forearm and the superficial radial nerve as they were anterior to the mid-line of brachioradialis.

Keywords: approach through brachioradialis, posterior interosseous nerve

SINGAPORE MED J 1994; Vol 35: 394-396

INTRODUCTION

Of the causes of posterior interosseous nerve syndrome reported on the literature, the important ones are compression by the fibrous arch of supinator (arcade of Frohse)[1-4] tendinous origin of the extensor carpi radialis brevis[2,4] and radial recurrent vessels[5,6]. During extension of the elbow with the forearm in pronation and the wrist in flexion, the position adopted at the end of a tennis service, the tendinous edge of the supinator and the superior border of extensor carpi radialis brevis (ECRB) encroach on the posterior interosseous nerve. Such entrapment can cause pain restricted to this area and present as a resistant tennis elbow[4].

Surgical decompression of the posterior interosseous nerve allows recovery of the nerve function and relief of pain. Many surgical approaches have been described. The Henry approach[7] exposes the posterior interosseous nerve by retracting the brachioradialis laterally after making the incision along the anterior border of the brachioradialis. The Hall approach[8] exposes the nerve through the intermuscular plane between the brachioradialis and extensor carpi radialis longus and by retracting the brachioradialis anteriorly. The Roles and Maudsley approach[4] exposes the nerve through an anterior muscle splitting incision.

The radial nerve in the arm pierces the lateral intermuscular septum entering the anterior arm compartment and lying between the brachioradialis and brachialis as it crosses the elbow. The radial nerve divides in the cubital fossa at the radiohumeral joint into the posterior interosseous nerve which enters the supinator between the superficial and deep head of the muscle and the superficial radial nerve which descends on the lateral side of the forearm under the brachioradialis.

Based on the above anatomical knowledge and the fact that the nerve can be exposed in Henry and Hall approaches by retracting brachioradialis towards one side, an approach through the mid-line of brachioradialis will give direct access to the posterior interosseous nerve at the arcade of Frohse, tendinous origin of extensor carpi radialis brevis and radial recurrent vessels. Decompression of the nerve at these levels can be performed.

The aims of our cadaveric study are firstly to study the applied surgical anatomy and advantages of the approach.

MATERIALS AND METHODS

Twelve cadaveric upper limbs were selected for our study. There were 6 right and 6 left upper limbs. The limbs were placed with forearm in the mid-prone position and the elbow at 90° of flexion. For each limb, a 4 cm long incision was made 2 cm distal to the lateral condyle and along the midline of the brachioradialis towards the radial styloid process. If extension of the incision was required during subsequent dissection, the total length of the incision was documented. Care was taken to identify the lateral cutaneous nerve of the forearm (Fig 1). Its relationship to the brachioradialis was documented. The brachioradialis was split in the midline along the direction of the muscle fibres. The bifurcation of radial nerve, superficial radial nerve, posterior interosseous nerve, nerve to ECRB and radial recurrent vessels were identified in each limb (Fig 2). The relationships between each other and the brachioradialis were determined.

Department of Orthopaedic Surgery 'O'
Singapore General Hospital
Outram Road
Singapore 0316

C K Low, MBBS, M Med (Surg), FRCS (Edin), FRCS (Glas)
Registrar

J T H Chew, MBBS
Medical Officer

A K Mitra, MBBS, FRCS (Glas)
Consultant Orthopaedic Surgeon

Correspondence to : Dr C K Low

Fig 1 - The lateral cutaneous nerve of forearm (N) was lying on anterior third of brachioradialis (B). The brachioradialis (B) was split in the midline along the direction of muscle fibres.

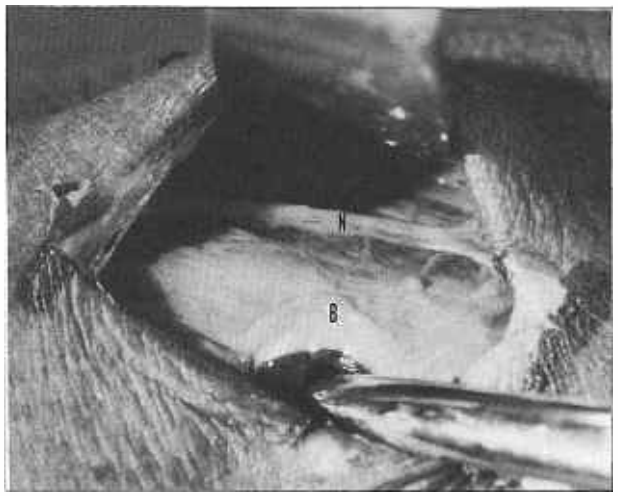
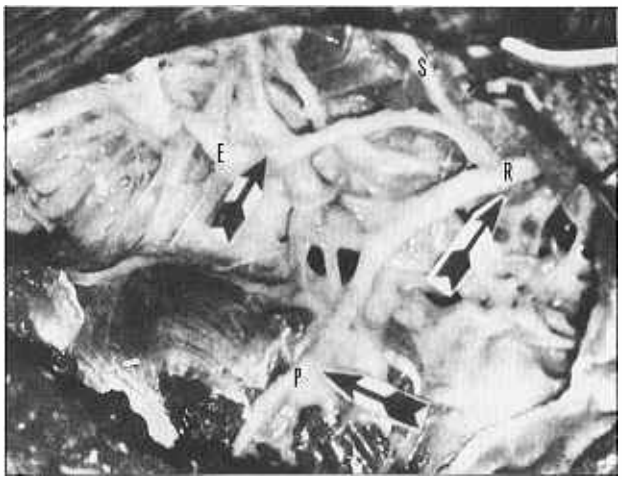


Fig 2 - The radial nerve (R) divided into posterior interosseous nerve (P) which passed beneath the arcade of Frohse and superficial radial nerve (S) which descended along the anterior third of brachioradialis. The nerve to ECRB (E) arose from the bifurcation. The superficial head of supinator was divided to expose the intramuscular course of the posterior interosseous nerve (P).



The following measurements were taken:

1. The distance between the radial nerve bifurcation and the lateral condyle.
2. The distance between the arcade of Frohse and the lateral condyle.
3. The distance between origin of nerve to ECRB and the lateral condyle.
4. The distance between the nerve entry into ECRB and the lateral condyle.
5. The distance between the level where the radial recurrent artery crossed the posterior interosseous nerve and the lateral condyle.

The posterior interosseous nerve was decompressed by following it distally into the supinator. The radial recurrent artery, the arcade of Frohse and the superficial head of supinator were divided to expose the entire intramuscular course of the nerve. The advantages of the approach were evaluated.

RESULTS

Length of incision

Five out of 12 dissections required extension of incision distally for another 1 to 2 cm. The average length of the incision was 4.7 cm and the range was 4 to 6 cm.

Lateral cutaneous nerve of forearm

The lateral cutaneous nerve of forearm (the sensory branch of the musculocutaneous nerve) was found lying on anterior third of the brachioradialis (Fig 1). The nerve was anterior to the mid-line of brachioradialis.

The bifurcation of the radial nerve

The radial nerve was found under the middle third of the brachioradialis. It divided into superficial radial nerve and posterior interosseous nerve at an average of 1.8 cm below the lateral condyle and the range was 1 to 3 cm.

The superficial radial nerve

The nerve descended along the anterior third of the brachioradialis. The nerve was anterior to the mid-line of brachioradialis.

The posterior interosseous nerve

The nerve was found under the posterior half of the brachioradialis. It passed beneath the arcade of Frohse at an average of 3.8 cm below the lateral condyle with a range of 3 to 5 cm. The superior border of ECRB lay 0.5 to 1 cm proximal to the arcade of Frohse.

The nerve to ECRB

The nerve was found under the middle third of the brachioradialis. It arose from the radial nerve bifurcation in 3, superficial branch in 2 and deep branch in 7 instances. The average distance between the origin and lateral condyle was 2.3 cm and the range was 1 to 3.5 cm. The nerve entered the ERCB at an average of 3.9 cm below the lateral condyle and a range of 3 to 5 cm.

The radial recurrent artery

The artery was found under the posterior half of the brachioradialis. It arose from the radial artery and crossed the posterior interosseous nerve at an average of 2.7 cm below the lateral condyle and a range of 2 to 4 cm.

DISCUSSION

The approach has many advantages. It is a simple procedure. It gives direct access to the posterior interosseous nerve at the level of arcade of Frohse, the tendinous origin of ECRB and the radial recurrent artery (common sites of compression) by going through skin, subcutaneous tissue and brachioradialis. The posterior interosseous nerve can be decompressed by following it distally into the supinator. The radial recurrent vessles, tendinous origin of ECRB, arcade of Frohse and superficial head of supinator can be divided to expose the entire intramuscular course of the nerve. The approach can also allow the course of the ECRB nerve to be traced and any compressing structure can be released. The approach is adequate for exposure and performing the nerve decompression. A 4 cm long incision is adequate in 7 out of 12 dissections. The exposure can be enlarged by extending the incision distally for 1 to 2 cm.

There is no direct danger to the lateral cutaneous nerve of the forearm and superficial radial nerve if the incision and splitting of muscle take place along the midline of the brachioradialis because both nerves are anterior to the midline of the muscle. In Roles and Maudsley's approach[4], the superficial branch of the radial nerve is immediately seen through the anterior brachioradialis splitting incision and can be damaged directly if care is not taken.

CONCLUSION

The approach is simple and gives direct and adequate access to the posterior interosseous nerve without direct danger to the lateral cutaneous nerve of forearm and superficial radial nerve.

REFERENCES

1. Capener N. The vulnerability of the posterior interosseous nerve of the forearm. J Bone Joint Surg 1966; 48B : 770-3.
2. Goldman S, Honet JC, Subel R, Goldstein AS. Posterior interosseous nerve palsy in the absence of trauma. Arch Neurol 1969; 21 : 435-41.
3. Spinner M. The arcade of Frohse and its relationship to posterior interosseous nerve paralysis. J Bone Joint Surg 1968; 50B : 809-12.
4. Roles NC, Maudsley RH. Radial tunnel syndrome. Resistant tennis elbow as a nerve entrapment. J Bone Joint Surg 1972; 54B : 499-508.
5. Chen DS. Clinical analysis of 25 cases of entrapment of the posterior interosseous nerve syndrome. Chung Hua Wai Ko Tsa Chih 1990; 28 : 457-9, 509.
6. Helbig B, Ulrich HW. Nervenkompressions syndrome an der oberen Extremitat mit Beispielen seltener Lasionen. Z Orthop 1984; 122 : 221-4.
7. Henry AK. Extensile exposure. 2nd ed. Edinburgh. Churchill Livingstone. 1973.
8. Hall HC, Mackinnon SE, Gilbert RW. An approach to the posterior interosseous nerve. Plast Reconstr Surg 1984; 74 : 435-7.