

The course of the posterior interosseous nerve in relation to the proximal radius: Is there a reliable landmark?



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ABSTRACT

Purpose: The posterior interosseous nerve (PIN) is closely related to the proximal radius, and it is at risk when approaching the proximal forearm from the ventral and lateral side. This anatomic study analyzes the location of the PIN in relation to the proximal radius depending on forearm rotation by means of a novel investigation design. The purpose of this study is to define landmarks to locate the PIN intraoperatively in order to avoid neurological complications.

Methods: We dissected six upper extremities of fresh-frozen cadaveric specimens. The mean donor age at the time of death was 81.2 years. The PIN was dissected and marked on its course along the proximal forearm with a 0.3-mm flexible radiopaque thread. Three-dimensional (3D) X-ray scans were performed, and the location of the nerve was analyzed in neutral rotation, supination, and pronation.

Results: In the coronal view, the PIN crosses the radial neck/shaft at a mean of 33.4 (± 5.9) mm below the radial head surface (RHS) in pronation and 16.9 (± 5.0) mm in supination. It crosses 4.9 (± 2.2) mm distal of the most prominent point of the radial tuberosity (RT) in pronation and 9.6 (± 5.2) mm proximal in supination.

In the sagittal view, the PIN crosses the proximal radius 61.8 (± 2.9) mm below the RHS in pronation and 41.1 (± 3.6) mm in supination. The nerve crosses 29.2 (± 6.2) mm distal of the RT in pronation and 11.0 (± 2.8) mm in supination.

Conclusion: With this novel design, the RT could be defined as a useful landmark for intraoperative orientation. On a ventral approach, the PIN courses 10 mm proximal of it in supination and 5 mm distal of it in pronation. Laterally, pronation increases the distance of the PIN to the RT to approximately 3 cm.

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Introduction

The posterior interosseous nerve (PIN) plays a critical role in maintaining the integrity of upper-limb functionality as it innervates the extensor muscles of the forearm. The radial nerve crosses the elbow joint on its anterior aspect, and while the superficial branch runs along and underneath the brachioradial muscle, the PIN passes through the supinator canal and winds around the proximal radius to reach the forearm extensors where it spreads into its motor branches [1].

Although fractures of the radial head and neck have been described to lead to PIN palsy [2], the nerve can also be injured

intraoperatively – especially in an anterior, lateral, or posterolateral approach to the proximal radius or even during arthroscopy [3–7]. Surgical treatment of radial head or neck fractures as well as of distal biceps tendon ruptures can therefore put the PIN at a risk of iatrogenic injury [8,9].

Intraoperative transection of the PIN is a major complication and can be avoided or at least minimized by detailed knowledge of the anatomic course of the nerve. Diliberti et al. [10] have already shown that pronation increases the proximal “safe zone” to the proximal radius. However, currently, anatomic landmarks are missing to reliably predict the location of the nerve.

Hence, this anatomic study analyzes the location of the PIN in relation to the proximal radius depending on forearm rotation by means of a novel investigation design. The purpose of this study is to define intraoperative landmarks to locate the PIN in order to avoid neurological complications.

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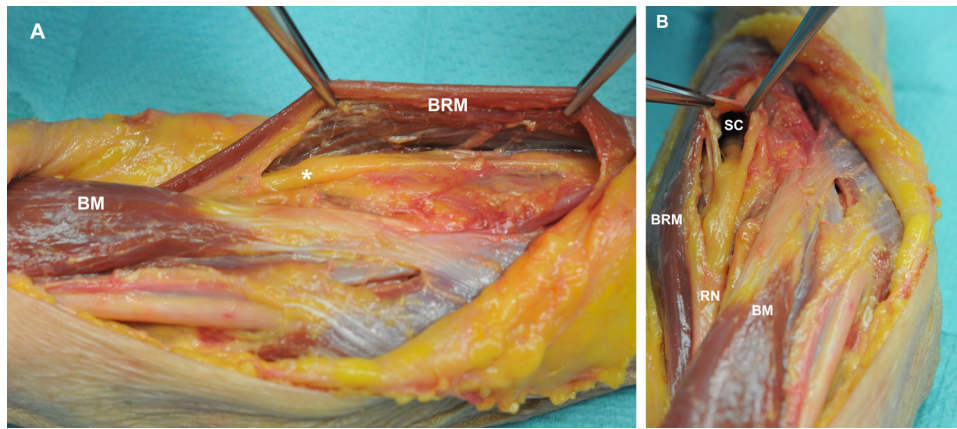


Fig. 1. Dissection of elbow specimens. A: View from the anteromedial side. The radial nerve has been dissected lateral to the biceps muscle (BM). The superficial branch (*) runs along and underneath the brachioradialis muscle (BRM), which is manually retracted with a forceps. B: View from the anterior and proximal sides. The main branch of the radial nerve is visible between the BM and BRM. The supinator muscle is elevated with a forceps to illustrate the posterior interosseous nerve in the supinator canal (SC).

Methods

We dissected six upper extremities of fresh-frozen cadaveric specimens. The mean age of donors at the time of death was 81.2 years (74–95). Four left-sided (67%) and two right-sided extremities (33%) were utilized in this study. Three of the body donors were male (50%) and three were female (50%). The specimens were thawed at room temperature before dissection. There was no radiological or visual evidence of prior elbow trauma or surgery as well as no signs of bony deformation. All specimens reached full flexion and full extension of the elbow joint as well as at least 80° of pronation and supination.

First, an extended ventral Henry approach [5] was used and the radial nerve was located anterior to the lateral epicondyle and lateral to the biceps muscle. Its course was followed with the

superficial branch running beneath the brachioradial muscle and the deep branch piercing the supinator muscle to reach the dorsal aspect of the forearm. The supinator muscle and the supinator canal were left intact while cautiously following the PIN.

Secondly, an additional, longitudinal skin incision over the dorsolateral aspect of the proximal radius was performed. The extensor fascia was incised and the extensor ulnaris muscle was separated bluntly from the anconeus muscle to visualize the PIN along its course around the proximal radius. Then a fine, radiopaque thread was sutured onto the PIN, and suture of the dissected soft tissue was performed. Great care was taken not to mobilize the nerve from its original course (Figs. 1 and 2).

A 3D X-ray scan was then performed using the Siemens ARCADIS® Orbic 3D C-Arm image intensifier. The specimens were placed in full extension as in a ventral approach [5] and in

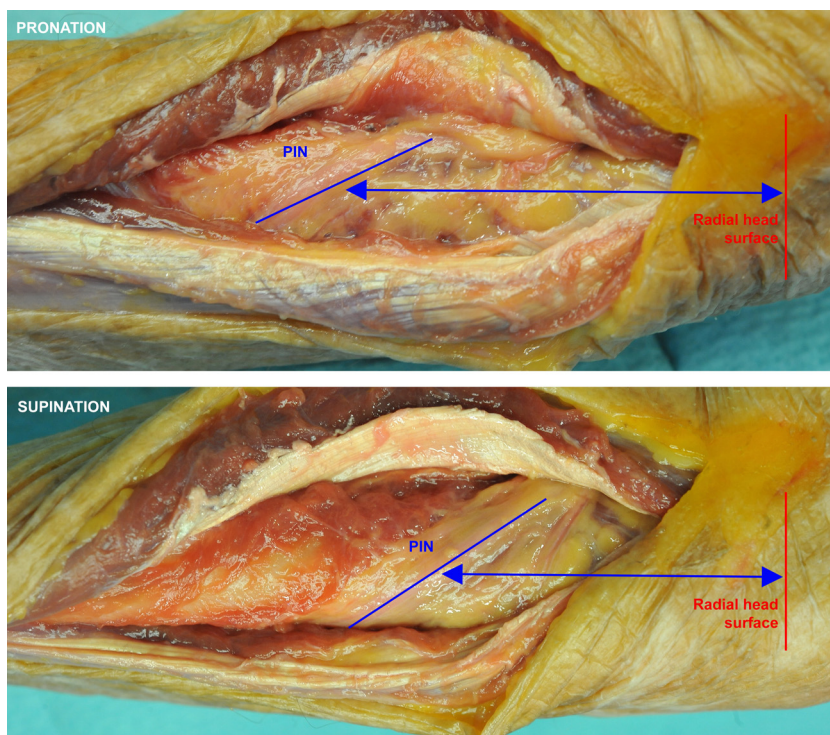


Fig. 2. View from the lateral side. The extensor fascia has been incised longitudinally and the extensor muscle has been bluntly dissected to show the posterior interosseous nerve (PIN, blue line) on its course around the lateral side of the radial neck. The red line shows the surface of the radial head. The distance between the PIN to the radial head increases when the forearm is pronated (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article).

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