

Localizing the Course of the Radial Nerve Based on Anatomical Landmarks: A Cadaveric Study

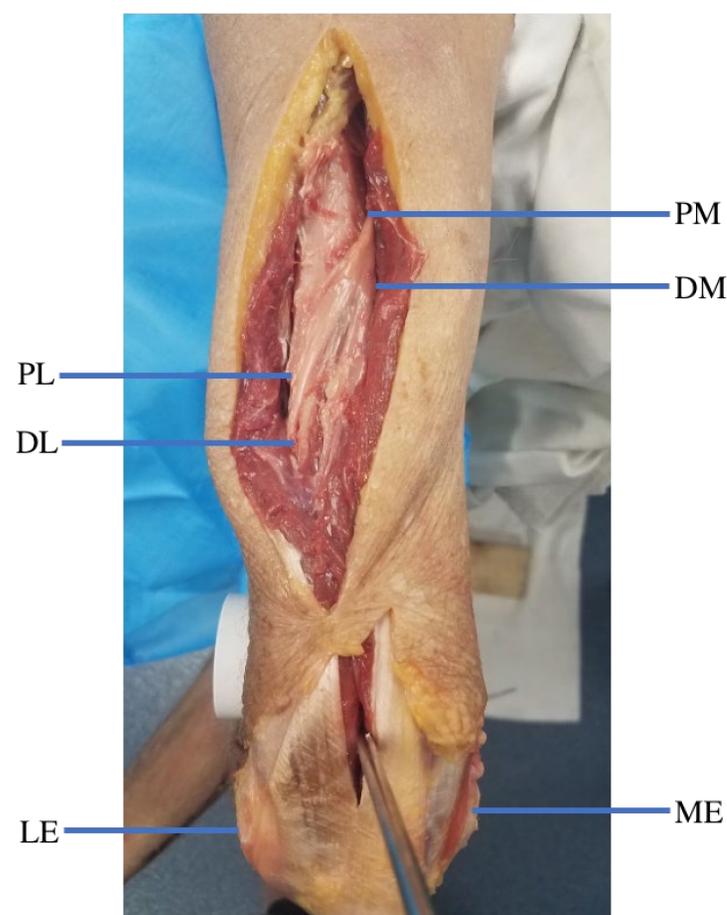
Jake Powell, OMSIII, Kalan Barnes, M.S., OMSII, Cameron Beck, OMSIV, Matthew Skinner, MD, William F Pientka II, MD, Cara L. Fisher, Ph.D.

Background

The location of the radial nerve in the spiral groove is important for surgeons to understand preoperatively due to the risk of iatrogenic injury during surgical approaches to the humerus. For many years, the standard of localizing the radial nerve is based on the distance from the medial and lateral epicondyles to the points where the radial nerve crosses the humerus posteriorly. The measurements of 20-21 cm proximal to the medial epicondyle and 14-15 cm proximal to the lateral epicondyle have been cited for decades as dogma in the field of orthopedic surgery.¹ More recent studies have demonstrated high variability in the location of the radial nerve.² The purpose of this study is to define the course and variability of the radial nerve along the posterior humerus in relationship to the medial and lateral epicondyles utilizing a greater sample size than previous works.

Method

40 fresh-frozen cadaveric arms were studied while in a lateral recumbent position with the shoulder and the elbow flexed 90° and supported, as done intraoperatively. A level was used to ensure the 90° angle and proper alignment of the arm. A medial longitudinal incision was made over the posterior humerus to expose the triceps brachii muscle. Dissection through the triceps brachii was performed and the radial nerve was identified along with the profunda brachii vessels. Six measurements were taken utilizing a Polhemus electromagnetic digitizer (Figure 1).



(Figure 1 - Identification of landmarks used for measurement)

Results

The mean distance from the medial epicondyle to the midpoint of the medial crossing of the radial nerve humerus is 17.26cm (95%CI 16.77 – 17.75). The distance of the lateral epicondyle to the midpoint of the radial nerve at the lateral crossing is 12.61cm (95% CI 12.23-12.99). Both the medial and lateral measurements were shorter in female patients ($p < 0.01$).

	All Specimens	Right Arm	Left Arm	Male	Female
Medial radial nerve → Medial Epicondyle	17.26cm ± 0.49cm	17.26cm	17.25cm	17.71cm	16.40cm
Lateral Radial Nerve → Lateral Epicondyle	12.61cm ± 0.38cm	12.74cm	12.48cm	12.88cm	12.11cm

Table 1. Results

Discussion

If the localization of the radial nerve is not accurate, it could have disastrous iatrogenic consequences in orthopedic surgery. The most common complication in the posterior approach of the humerus is radial nerve palsy in a striking 11.53% of patients.³ Recent studies have shown greater variability in radial nerve localization. The Carlan et al. study showed the distance from the radial nerve to the lateral epicondyle to be 10.9 ± 1.5 cm.² The Jain et al. study showed the distances from the medial and lateral epicondyles to be 18.5 ± 0.79 cm and 11.34 ± 0.41 cm respectively.⁴ Both the Jain et al. and the Carlan et al. studies may not be reliable measurements however due to discrepancies in their measurement methodology, but they do shed light on the notion that the Gerwin et al. standards should be reexamined. Improving upon the past methods of studies, we used a Polhemus electromagnetic digitizer to accurately measure the radial nerve, are working towards a larger sample size of 50 arms, and used both left and right arms. Our goal in this work is to provide a more accurate measurement to localize the radial nerve for orthopedic surgeons in hopes of reducing iatrogenic radial nerve damage during approaches to the humerus.

Sources

- Gerwin M, Hotchkiss RN, Weiland AJ. . Alternative Operative Exposures of the Posterior Aspect of the Humeral Diaphysis. *The Journal of Bone and Joint Surgery-American Volume*. 1996;78(11):1690–1695.
- Carlan D, Pratt J, Patterson JM, Weiland AJ, Boyer MI, Gelberman RH. The radial nerve in the brachium: an anatomic study in human cadavers. *J Hand Surg Am*. 2007 Oct;32(8):1177-82. doi: 10.1016/j.jhsa.2006.07.001. PMID: 17923300.
- Yin P, Zhang L, Mao Z, Zhao Y, Zhang Q, Tao S, Liang X, Zhang H, Lv H, Li T, Tang P. Comparison of lateral and posterior surgical approach in management of extra-articular distal humeral shaft fractures. *Injury*. 2014 Jul;45(7):1121-5. doi: 10.1016/j.injury.2014.02.034. Epub 2014 Mar 12. PMID: 24685053.
- Jain RK, Champawat VS, Mandlecha P. Danger zone of radial nerve in Indian population - A cadaveric study. *J Clin Orthop Trauma*. 2019 May-Jun;10(3):531-534. doi: 10.1016/j.jcot.2018.02.006. Epub 2018 Feb 21. PMID: 31061584; PMCID: PMC6492309.

Scan me

