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## Effectiveness of Ultrasound-Guided Radial Artery Puncture Versus Traditional Palpation Technique: A Meta-analysis and Trial Sequential Analysis

Zhang, LL; Li, AH; Duan, D.

### Corresponding author:

Duan Di

13688277675@163.com

### Author Affiliation:

Jianyang Chinese Medicine Hospital.

### ADMINISTRATIVE INFORMATION

**Support** - None.

**Review Stage at time of this submission** - Completed but not published.

**Conflicts of interest** - None declared.

**INPLASY registration number:** INPLASY202610077

**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 22 January 2026 and was last updated on 22 January 2026.

### INTRODUCTION

**R**eview question / Objective This systematic review and meta-analysis aims to assess the effectiveness of ultrasound-guided radial artery puncture versus traditional palpation in adults. The study focuses on determining whether ultrasound guidance enhances clinical outcomes, including first-attempt success rate, overall success rate, and reduces the number of attempts and hematoma incidence.

**Rationale** Radial artery puncture and catheterization, which are commonly performed in anesthesiology, emergency departments, and ICUs for continuous blood pressure monitoring and arterial blood gas analysis.

**Condition being studied** Adult patients undergoing radial artery puncture, regardless of underlying diseases, type of surgery, or clinical indications for the procedure.

### METHODS

**Participant or population** Adult patients undergoing radial artery puncture, regardless of underlying diseases, type of surgery, or clinical indications for the procedure.

**Intervention** Ultrasound-guided radial artery puncture, which uses real-time ultrasound imaging to assist in locating the artery, ensuring accurate puncture and reducing complications.

**Comparator** Traditional palpation technique, where the puncture site is identified by tactile sensation without the aid of ultrasound.

**Study designs to be included** Randomized controlled trials.

**Eligibility criteria** (1) Randomized controlled trials (RCTs) comparing ultrasound-guided radial artery puncture with traditional palpation technique. (2) Participants aged  $\geq 18$  years. (3) Studies reporting

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at least one of the following outcomes: first-attempt success rate, overall success rate, number of puncture attempts, incidence of hematoma formation.

**Information sources** Databases searched include PubMed, Embase, Cochrane Library, Web of Science. The search covered studies published until January 8, 2026, using keywords related to radial artery puncture, ultrasound guidance, palpation technique, and randomized controlled trials.

**Main outcome(s)** First-attempt success rate, overall success rate, number of attempts, and hematoma formation incidence.

**Quality assessment / Risk of bias analysis** Study quality was assessed using the Cochrane Risk of Bias Tool (RoB 1.0) across seven domains: random sequence generation, allocation concealment, blinding, incomplete outcome data, selective reporting, and other biases.

**Strategy of data synthesis** Meta-analyses were conducted using RevMan 5.4 and Stata 17.0 software. Dichotomous outcomes were expressed as risk ratios (RR) with 95% confidence intervals (CI), and continuous outcomes as mean differences (MD) with 95% CI. Trial sequential analysis (TSA) was performed to assess evidence sufficiency.

**Subgroup analysis** Subgroup analyses were conducted according to operator experience, research setting, publication year, and total sample size.

**Sensitivity analysis** A leave-one-out approach was used to assess the stability of pooled estimates.

**Country(ies) involved** China.

**Keywords** radial artery puncture; ultrasound guidance; palpation; meta-analysis; GRADE; publication bias.

**Contributions of each author**

Author 1 - Lingli Zhang.

Author 2 - Aihua Li.

Author 3 - Di Duan.