Introduction: Central venous access is required in the perioperative setting for various reasons, including monitoring hemodynamic status and drug administration. Current guidelines strongly recommend the use of ultrasound (US) when central venous catheterization is performed through the internal jugular vein. Although US use for catheterization through the subclavian vein has been well described, evidence for its use is not well known. We thus conducted a systematic review and meta-analysis to determine the efficacy and safety of US-guided subclavian vein catheterization compared to the traditional “blind” landmark method.

Methods: A systematic search of Medline, EMBASE, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews and CINAHL was performed (to December 2011) along with a manual search of reference lists of retrieved articles. Only randomized control trials of US compared to landmark technique for subclavian catheterization in adult populations were considered. All forms of US were included [dynamic two-dimensional (2-D) US, static 2-D US, and Doppler]. Studies using tunneled catheters, pacemakers, or pediatric populations were excluded. Outcomes included efficacy (reported as failure of catheterization) and adverse events (pneumothorax, inadvertent arterial puncture, hematoma, malposition, arrhythmia, nerve injury, cardiac tamponade). Data extraction was done in duplicate independently. Failure of catheterization was analyzed with inverse variance random effects modeling and expressed as risk ratios (RR) and 95% confidence intervals (CI) while adverse event data was analyzed according to Peto’s method and expressed as odds-ratios (OR) and 95% CIs.

Results: 333 studies were reviewed and 8 met inclusion criteria (n=2013 participants). Four used dynamic 2-D US (n=568), 1 used static 2-D US (n=821), and 3 used Doppler-guided insertion techniques (n=624). All studies reported on failure of catheterization. Pooled analysis of all studies demonstrated no difference in failure of catheterization between the ultrasound group and the landmark method (RR 0.85, CI 0.48-1.51, n=2013). Pooled analysis of only studies using dynamic 2-D US demonstrated a trend favouring ultrasound-guidance (0.24 RR, 95% CI 0.04-1.56; n=568). Three of the 4 dynamic 2-D US studies defined adverse events a priori. Use of dynamic 2D-US compared to the blind landmark technique significantly decreased pneumothorax (OR 0.20, 95%CI 0.06-0.65; n=497), decreased inadvertent arterial puncture (OR 0.21 95% CI 0.08-0.57; n=497), and decreased hematoma formation (OR 0.24 95% CI 0.10-0.59; n=497). There was no significant difference between the two groups for malpositioning (OR 0.75 95% CI 0.41-1.37; n=497). There was insufficient data to analyze other adverse events.

Discussion: Dynamic 2D US-guided subclavian catheterization significantly improves patient safety compared to the traditional landmark technique. It reduces risk of pneumothorax, inadvertent arterial puncture, and hematoma. Overall successful catheterization rates between US and landmark techniques are similar. In conclusion, this data supports the regular use of dynamic US for subclavian catheterization in order to reduce adverse events.