Vascular access in cardiac implantable electronic devices: a systematic review and network meta-analysis

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Background: Despite the increasing number of cardiac implantable electronic devices (CIED) implantations worldwide, gaps in the evidence base on the optimal venous access to perform the procedure still exist and direct comparisons of different techniques are lacking.

Purpose: The aim of this study was to compare the acute and long-term safety and efficacy of the three main vascular access modalities (i.e. subclavian vein puncture [SVP], cephalic vein cut-down [CVC], axillary vein puncture [AVP]) used during CIEDs implantations.

Methods: A systematic review of the literature and network meta-analysis were performed searching Pubmed/MEDLINE databases for relevant articles using the following search strategy, without language restrictions: ((cardiac implantable device) OR (pacemaker) OR (ppm) OR (defibrillator) OR (icd) OR (resynchronization) OR (crt)) AND ((venous access) OR (subclavian) OR (axillary) OR (cephalic)). Randomized and non-randomized studies comparing one or more of the outcomes of interest, between at least two discernible groups (SVP, CVC and AVP), were included in the present analysis and SVP competitive arm was used as the reference group. The primary endpoints were safety outcomes, which included: 1) pneumothorax, 2) pocket haematoma, 3) lead failure, including both acute (dislodgment) and chronic (fracture, subclavian crush syndrome) events, 4) infective complications. Success rate, defined either by successful cannulation of the vein or by successful lead placement was a secondary outcome.

Results: Forty studies (33, 83% non-randomized) were selected and a total of 166782 patients (median age 69.2 years, 65.2% males) followed up for a median of 18 months (IQR 11-51) were included. Both AVP and CVC showed a significant reduction in the risk of pneumothorax compared to SVP (AVP: OR 0.12, 95% CI 0.05-0.28; CVC: OR 0.18, 95% CI 0.15-0.22) but no significant differences between treatment arms concerning bleedings (AVP: OR 1.11, 95% CI 0.52-2.37; CVC OR 1.16, 95% CI 0.60-1.88) or infective complications (AVP: OR 1.00, 95% CI 0.47-2.14; CVC OR 0.67, 95% CI 0.31-1.44) were observed. Compared to SVP, AVP was significantly superior concerning the risk of lead failure (OR 0.42, 95% CI 0.27-0.67) while CVC showed a nearly statistically significant reduction in risk of lead complications (OR 0.73, 95% CI 0.52-1.02), see figure 1. Success rate did not differ significantly between treatments arms albeit CVC showed a trend towards a higher risk of need for alternate venous access compared to AVP (3.56, 95% CI 0.89-14.21).

Conclusions: Considering the lower risk of pneumothorax and lead failure, AVP and CVC should be preferred over SVP to achieve venous access during CIEDs implantation taking into account the higher success rates associated with AVP.

Figure 1