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Original Article

Prospective study to develop surface landmarks for blind axillary vein puncture for permanent pacemaker and defibrillator lead implantation and compare it to available contrast venography guided technique

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ABSTRACT

Objective: To develop surface landmarks for blind axillary vein puncture for pacemaker lead implantation.

Methods and results: Patients for routine coronary angiography were counseled for participating in our study. 20 patients who gave consent were taken up for axillary venogram after proper positioning at the time of coronary angiogram. The venograms of these 20 patients, were reviewed and the landmarks were used to develop a blind axillary puncture technique. Success rate of 100% was achieved with surface landmark guided axillary vein puncture. The implantation time while using surface landmark guided axillary puncture was not significantly longer than when venography based approach was used. Another interesting observation made from the study was that increasing BMI had a positive correlation with the time taken for venous access, the fluoroscopic time and the volume of contrast used, all the associations being statistically significant. Thus, the surface landmark guided technique is more safe and expeditious in non obese patients and probably in pediatric patients as well. Moreover, the new surface landmark guided approach is a significant safety step in terms of reducing the unwanted and avoidable radiation exposure to the hands.

Conclusion: The results of this study demonstrate that placement of endocardial permanent pacemaker and ICD leads via the developed surface landmarks is effective and safe and is devoid of the harmful effects of radiation and contrast exposure.

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1. Introduction

Although device therapy is increasingly a subspecialty in its own right, permanent pacemaker (PPM) implantation remains one of the core skills of cardiologists. Although varied approaches for transvenous permanent pacemaker implantation have been in use since the early 1960s, controversies still exist regarding which approach affords minimal complications yet provides easy access to the central venous system.[1]

Subclavian vein puncture has the beauty of being simple and quick to use. Unfortunately, it is associated with both acute and longer term complications.[2–8] Pneumothorax and subclavian crush phenomenon can be serious complications, the latter especially in ICD systems.[7] Cephalic vein cutdown, free of the latter complication, can still fail in 25–50% of cases.[9,10] Moreover, cephalic vein is not a good modality for negotiation of multiple leads.

Contrast/fluoroscopic guided axillary vein puncture has a number of advantages.[2,3,6,7]

However, these techniques have certain limitations.

1) Requirement of adequate peripheral venous access.
2) Small risk of contrast nephropathy and anaphylactic reaction (1:40,000–1:100,000).
3) Harmful effects of radiation exposure to the hands.
4) Requirement of a C arm, which may not be feasible in developing countries, especially in the peripheries.

To overcome these limitations we attempted to develop surface landmarks for blind axillary vein puncture.

2. Patient population and methods

Patients for routine coronary angiography were counseled for participating in our study. 20 patients who gave consent were taken up for axillary venogram after proper positioning at the time of coronary angiogram. The venograms of these 20 patients, as shown in Fig. 1, were reviewed and the landmarks were used to develop a blind axillary puncture technique.

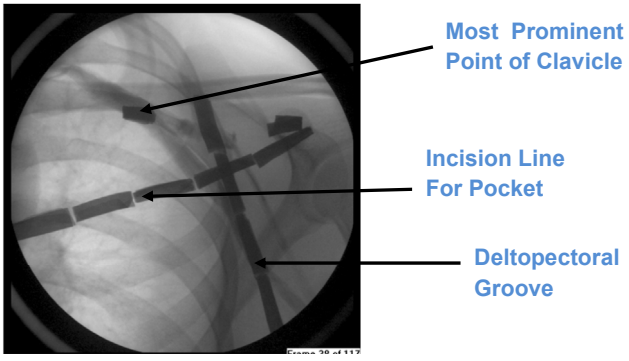

Fig. 1 – Contrast venography for surface landmark localization. Radioopaque markers placed at the deltopectoral groove, proposed incision line and most prominent point of the clavicle to define their relation with axillary vein.

Patients for routine pacemaker implantation were counseled for participating in our study. An informed consent was taken after explaining the procedure in detail. 20 patients who agreed were enrolled into the study. All the punctures were done by two experienced operators. The study population was randomized to two groups – A and B. In group A, contrast guided axillary puncture was done. In group B, the developed blind axillary puncture technique was tried.

2.1. *Contrast guided axillary vein puncture*

A total of 10 cc of contrast dye diluted 1:1 with normal saline to reduce viscosity and facilitate the bolus injection was injected via an ipsilateral peripheral vein and flushed with 20 cc of saline. The opacified axillary vein was then punctured under fluoroscopy, at the border or medial to the rib cage margin, with repeated boluses of semi-diluted contrast material if needed (as shown in Fig. 2). In case of unsuccessful puncture, a subclavian puncture was performed.

2.2. *Development of blind surface landmarks*

Review of venographies performed in antero-posterior projection indicated that the axillary vein usually coursed about one to one and a half fingerbreaths medial and parallel to the deltopectoral groove and pointing towards the most prominent point of the clavicle (Fig. 3).

The needle was placed in a pocket created two fingerbreaths below the clavicle and aligned one and a half fingerbreadths medial and parallel to the deltopectoral groove at an angle of 60° to the skin surface. The needle was then advanced in the direction of the most prominent point of the clavicle until blood was aspirated. In the event of failure to aspirate blood the procedure was repeated with serial cranial advancement of the needle till the most prominent point of the clavicle was reached. If venous access was still not obtained the needle was re-placed at the starting point and the procedure repeated with slight lateral realignment of the needle.

2.3. *Blind axillary vein puncture*

The developed blind axillary puncture technique was used. If venous access was not obtained within approximately 120 s, contrast guided puncture was done as previously described, to minimize the risk of complications.

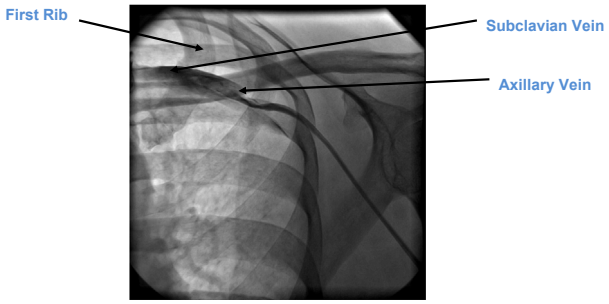

Fig. 2 – Contrast injection to guide axillary vein puncture.