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A novel technique for ligation of the cephalic vein reduces hemorrhaging during a two-in-one insertion of dual cardiac device leads

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ABSTRACT

The cutdown technique for the cephalic vein is a common access route for transvenous cardiac device leads (TVLs), and sometimes one cephalic vein can accomodate two TVLs. We examined a novel ligation technique to balance the hemostasis and lead maneuverability for this two-in-one insertion. A total of 22 patients scheduled for cardiac device implantations with two or more leads were enrolled. The ipsilateral cephalic vein was identified for inserting the TVLs with a cutdown. If two TVLs could be introduced into one cephalic vein, hemostasis was established by ligating the venous wall between the TVLs. We measured the amount of hemorrhaging per minute and the operators assessed the lead maneuverability before and after the ligation. We successfully implanted cardiac devices in 15 patients (68%) with this novel method, whereas only one TVL could be introduced via the cephalic vein in 7 patients. As for the successful patients, hemorrhaging from the gap was significantly reduced (5.6 ± 7.3 to 0.41 ± 0.36g/min, $p = 0.016$) after the novel ligation. The lead maneuverability was well maintained so there was no difficulty placing the leads into the cardiac chambers in all cases. No major complications were observed. In the present study, the novel ligation method provided significant hemostasis as well as a preserved maneuverability. It could be an optional choice for insertion of multiple TVLs.

1. Case

Transvenous leads(TVLs) have allowed more physicians to perform implantations of cardiac implantable electronic devices(CIEDs) without a complicated surgical expertise.[1)] The cephalic vein access is considered preferable because device leads undergo less shear stress from the surrounding tissue, and this route provides a safer access than the conventional deep venous puncture [1–3]. In some cases, one cephalic vein allows two TVLs to be inserted [4,5]. In the present study, we examined a novel ligation method to establish hemostasis in this situation.

We enrolled 22 consecutive patients who had received their first CIED implantation requiring multiple TVLs between August and December 2014 in our facility. The implantation was performed in the following method. A 4–6cm incision was placed in the upper pectoral region under local anesthesia. The cephalic vein was identified in the fat tissue of the deltopectoral groove for the cutdown, and two hydrophilic guidewires were inserted from a small incision on the venous wall. Before the sheath insertion, a 5-0 PROLENE suture(Ethicon, Inc., US) was passed through the vein transversely between the guidewires. The TVLs were usually introduced into the heart chambers using peel-away sheaths(Medikit Corporation, Tokyo, Japan), which were inserted over the guidewire if possible. The distal portion of the cephalic vein was simply ligated to be sacrificed. If the introduction of two TVLs was successfully achieved, the 5-0 suture was ligated to shrink the gap as illustrated in Fig. 1A. The completion of the ligation is shown in Fig. 1B. After hemostasis, the TVLs were manipulated to position them in the target cardiac chambers and lead maneuvability was assessed. The amount of hemorrhaging was obtained by measuring the increase in the weight of gauze absorbing blood in the pocket

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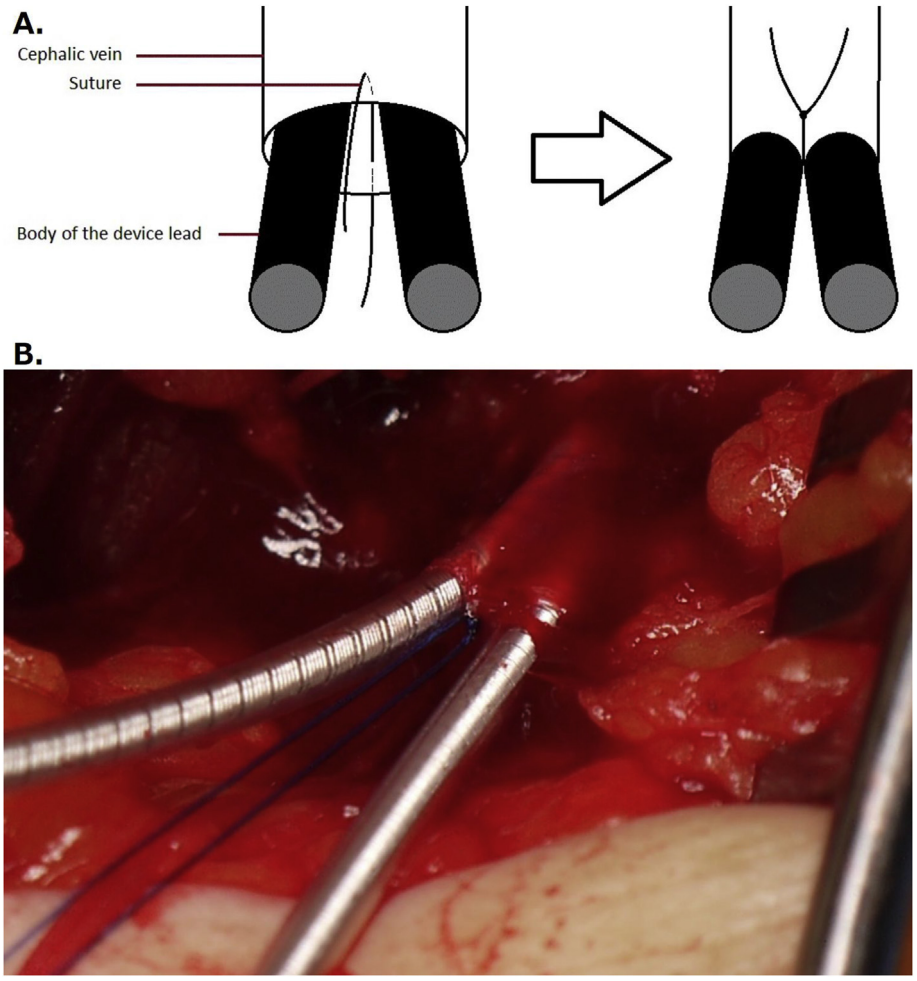

Fig. 1. A. Scheme describing the insertion of two leads into the same vein. 1) The suture was passed through the venous wall between the two guidewires, then the leads were introduced into the cephalic vein. 3) The suture was ligated to shrink the gap. **B.** Actual practice of the novel ligation. The gap between the two leads was completely closed by a 5-0 PROLENE suture.

for 1 minute, which was measured just before and after the ligation.

A total of 22 patients (73.0 ± 9.7years, 9 females) were included in this study. The simultaneous insertion of two TVLs was successful in 15 patients(68%, Group A), whereas 7 patients(32%) only had one TVL inserted into one of the cephalic veins(Group B). As for Group B, because the size of the target vein was not large enough to insert a second TVL, the second TVL was introduced by an axillary puncture. The implanted CIEDs included 4 dual-chamber implantable defibrillators(2(13%) in Group A vs. 2(29%) in Group B, $p = 0.565$). Antithrombotic agents were given in 10 patients(67%) in Group A and 2 patients(28%) in Group B($p = 0.172$).

We successfully performed the novel ligation technique in all patients in Group A. There were no differences between Group A and Group B, except for the body mass index (23.0 ± 3.1 vs. 20.7 ± 1.3kg/m^2, $p = 0.018$). In Group A, the hemorrhaging after the ligation was markedly reduced as compared to that pre-ligation(5.57 ± 7.29 to 0.41 ± 0.36g/min, $p = 0.016$). The post-ligation hemorrhaging was similar in Group A and Group B (0.41 ± 0.36 vs. 0.48 ± 0.30g/min, $p = 0.635$), while hemostasis was well achieved in Group B. All ligation procedures were accomplished within 1 minute including the suture to the vessel and ligation procedure. The operators, who consisted of four physicians, reported that the novel ligation technique did not impair the lead maneuverability even after hemostasis and posed little difficulty to acquire. No acute complications were observed during/after the procedures.

To the best of our knowledge, our ligation technique after the simultaneous insertion of two TVLs into one cephalic vein has not been described previously. In the present study, we found that 1) hemorrhaging from the gap between the two TVLs was decreased by the novel ligation and successfully controlled, 2) the lead maneuverability was well preserved after the ligation.

Once two TVLs were successfully introduced, the major step for hemostasis may have been the proximal ligation of the whole cephalic vein. However, in the present series of cases, we performed another fashion of the ligation to shrink the gap between the TVLs and venous wall. A significant reduction was confirmed by the novel ligation method without difficulty, while the lead maneuverability was not compromised after acceptable hemostasis was achieved. We would like to propose two possible advantages of our technique: 1) as the suture was passed through the vessel before inserting the TVLs, there was no possibility to injure the lead body or vessels by the needle, and 2) the present method achieved hemostasis by placing the ligation between the two TVLs, which reduced the lead-to-lead friction, whereas the tight conventional proximal ligation may increase the friction and impair the lead maneuverability. This novel method may provide an additional option and can be adapted to other vessel candidates, such as the retro-pectoral veins [6,7]. Our novel ligation technique might not

be always the best one, however, it might provide a significant choice for physicians.

This study had three limitations. First, this was a retrospective observational study with a limited number of subjects at a single center. Second, there were no follow-up data. Third, we did not perform any other techniques for the two-in-one insertion for a comparison.

In the present study, the novel ligation method provided acceptable hemostasis and maneuverability after the simultaneous insertion of two TVLs into one cephalic vein.

Conflicts of interest

None.

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