Closure of the subclavian artery puncture site with a percutaneous suture device after removal of an arterial pacemaker lead

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We describe the closure of a subclavian artery puncture site with a percutaneous suture device after removal of a pacemaker lead 1 week after its inadvertent positioning in the left ventricle via the subclavian artery. The lead was retracted from the left ventricle into the aorta and linked to a guiding catheter introduced via femoral artery access. The lead and the guiding catheter were removed from the artery to the subclavian area. This manoeuvre allowed the placement of a percutaneous arterial suture device (Perclose) to close the puncture site.

KEYWORDS
Arterial pacemaker lead; Inadvertent positioning; Closure of arterial puncture site; Perclose suture device

Case report

A 75-year-old patient was referred by a community hospital for removal of a pacing lead inadvertently inserted into the left ventricle via the subclavian artery 1 week before.

Indication for pacemaker placement was symptomatic bradyarrhythmia. Routine echocardiography demonstrated left ventricular placement of the lead and mild aortic regurgitation.

The diagnosis was confirmed by angiogram, showing entry of the lead into the subclavian artery laterally from the origin of the right vertebral and carotid artery (Figures 1 and 2). High-dose heparin therapy was started 5 days before and continued during the lead extraction to minimize the risk of thrombo-embolization, requiring effective closure of the arterial puncture site to control bleeding.

An arterial suture device (Perclose, Abbott Laboratories, Redwood City, CA, USA) was used, which is approved for the closure of 5–8 F puncture sites and recommended by the manufacturer for vessels of at least 4.5 mm lumen diameter. To introduce the device into the artery, a wire needs to be inserted through the puncture site.

After the pacemaker pocket had been opened and the generator disconnected, a regular stylet was introduced into the lead (lead diameter 2.1 mm, equal to 7 F) and it was removed from the left ventricle into the aorta by traction. There it was fixed to a 6 F multipurpose guiding catheter introduced via a femoral artery approach using a PCI wire (HTB, 300 cm, Guidant) formed into a loop resulting in a snare-like configuration. The lead and the guiding catheter were retracted together out of the subclavian artery into the subclavian area. A 0.035 guide wire was then inserted into the distal end of the guiding catheter as it emerged from the pocket (Figure 3).

The guiding catheter was then retracted back into the aorta, leaving the wire in the subclavian artery. Via this wire, the suture device was placed and the puncture site sutured. Fluoroscopic examination showed complete closure of the puncture site (Figure 4).

The subclavian vein was punctured and a new lead was inserted into the right ventricle and connected to the generator. Finally, the femoral puncture site was also closed with an arterial suture closure device. The patient was discharged 2 days later in good condition.

Discussion

Inadvertent placement of a pacing lead in the left ventricle via the subclavian artery is a rare complication of cardiac pacemaker placement. If not diagnosed and corrected intraoperatively, arterial placement of a pacing lead increases the risk of thrombo-embolization and if it is not removed, lifelong anticoagulation should be considered, as this seems to be effective in the primary and secondary prevention of thrombo-embolic complications.

Thrombus formation on the lead can occur within days after the implantation of right-sided pacing leads, but we found no reports describing early thrombus formation on arterial leads. Fibrous tissue formation on the lead has been observed within months after implantation, and
this might become a source of thrombo-embolization during percutaneous removal.

If cardiac surgery has to be performed for other indications, surgery appears to be the best choice to remove the lead and to prevent thrombo-embolic complications. In the absence of other indications for cardiac surgery, an attempt to remove the lead by endovascular intervention is reasonable, avoiding thoracotomy and possible clavicular resection. If this should fail, surgery remains as the alternative option.

The risk of thrombo-embolic complications during percutaneous removal remains unclear: no thrombo-embolic complication has been reported in the literature addressing percutaneous removal of arterial leads, but this is only scant.\textsuperscript{1,4} Transthoracic and transoesophageal echocardiography failed to detect reliably the presence or absence of thrombi to determine the safety of percutaneous lead extraction.\textsuperscript{3} Therefore, percutaneous removal of the lead should be considered only early after implantation, and heparin therapy should be begun as soon as possible. Once heparin treatment has been established, control of bleeding at the arterial puncture site needs special attention, and removal techniques that may lead to enlargement of the puncture site should be avoided. For this reason, the use of conventional or laser sheaths does not seem to be advantageous, even though it remains unclear whether or not retraction of the lead and the connected guiding catheter as described here might also lead to the enlargement of the puncture site.

Techniques for the closure of subclavian artery puncture sites have been more frequently described in the context of central venous catheter misplacement. Here, internal compression with balloons or suture devices has been used and, in the case of pseudoaneurysms and haemorrhage, stent grafts have been successfully implanted.\textsuperscript{5–8} To close the arterial puncture site following lead extraction, internal compression with balloons has been described.

Once high-dose heparin therapy is established, internal compression with a balloon only may not be sufficient to
close an arterial puncture site. Stent grafts are feasible and safe, but do imply the risk of development of restenosis and therefore may not be the first choice option.

For the closure of arterial puncture sites, collagen-based devices, nitinol clips, and suture-based devices are available. All of them are designed and approved for the closure of femoral artery puncture sites. If they are used in a different vessel, the different anatomical situation needs to be taken into consideration. Collagen-based devices leave a collagen sponge on top of the artery to seal the puncture site, and this sponge needs up to 90 days to dissolve. Because of the tight anatomy of the subclavian area and the close relationship between subclavian artery and vein, this sponge might compromise the subclavian vein and lead to the development of a subclavian vein thrombosis. A nitinol clip is, in our opinion, difficult to place accurately on top of the subclavian artery because of the tight anatomy, the lack of flexibility of the device, and its straight, rather than angled, shape. Taking these considerations into account, a suture-based device appears to be the most feasible option.

In the case of closure device failure, the approach described allows the placement of a stent graft via the femorally introduced guiding catheter, which still remains in the aorta after the closure device is placed.

To our knowledge, this is the first description of closure of the arterial puncture site after extraction of a misplaced pacing lead with a percutaneous suture device. In this situation, use of the Perclose suture device proved to be feasible and safe.

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References