Pacemaker placement and shoulder surgery: is there a risk?

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ABSTRACT

INTRODUCTION Surgery to the anterior aspect of the shoulder is performed by many surgical specialties but the techniques used by our cardiology colleagues for insertion of cardiac pacemaker wires are often not appreciated by the surgical community. The deltopectoral approach has been used for open pacemaker wire insertion for many years by cardiologists.

METHODS We surveyed a group of subspecialty shoulder surgeons as well as orthopaedic trainees to see if this approach for pacemakers is well recognised. We tried to assess what level of knowledge exists regarding pacemaker placement in general as well as specific risks.

RESULTS There appears to be a paucity of knowledge regarding pacemaker placement and related patient safety issues in both surveyed groups. There was no difference between the two groups, suggesting that the level of knowledge does not increase with experience and specialisation.

CONCLUSIONS There is the potential to cause harm to patients if the insertion site and type of device is not identified before commencing surgery in this region and steps must be taken to minimise any intra-operative risk. There is a risk from direct injury to the pacemaker and/or leads as well as the hazards of using diathermy in close proximity to a pacemaker. There must be more widespread dissemination of this information in order to minimise risks to patients with pacemakers in situ.

KEYWORDS

Pacemaker, artificial – Shoulder – Surgery – Subclavian vein

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The deltopectoral approach is a commonly used surgical approach to the shoulder region. During dissection the cephalic vein is encountered in the deltopectoral groove and is usually mobilised and retracted to allow access to the shoulder joint.

If the cephalic vein begins to bleed inadvertently it may be ligated and divided or cauterised with minimal risk of morbidity to the patient. The cephalic vein is also being used increasingly by cardiologists as the entry point for wire placement when inserting cardiac pacemakers, using a modified deltopectoral approach.

Parsonnet and Roelke describe how, historically, pacemakers were usually inserted by surgeons as it involved a thoracotomy or mediastinotomy but, with the advent of introducers and better pacing wire insertion equipment, this was steadily taken over by cardiologists using a percutaneous approach, commonly to the subclavian vein.¹ However, the subclavian vein approach is associated with a small risk of pneumothorax, subclavian thrombosis and subclavian ‘crush’ syndrome, a result of local pressure on the leads causing dysfunction.² A return to the cut-down technique for open insertion into the cephalic vein is therefore now the preferred route of access.

If the cephalic vein is ligated or damaged with a pacemaker wire in situ, there is the potential for direct damage to the pacing wire, compromising pacemaker function. Equally, previous shoulder surgery may mean pacemaker insertion via the cephalic vein is not possible. Diathermy is used routinely by the majority of surgeons during a deltopectoral approach and this also has potential risks to pacemaker function, especially if used in close proximity to the vessel in which the pacemaker wire is inserted.

Orthopaedic shoulder surgeons and orthopaedic trainees were surveyed to assess their awareness of these issues.

Methods

A questionnaire (Fig 1) was sent to members of the Watanabe Club, a national association of subspecialty orthopaedic shoulder surgeons, and to orthopaedic trainees on the Stanmore training programme. Completed questionnaires were received from 17 consultant shoulder surgeons (of a total of 24 club members) and 8 higher surgical trainees. The results for the two groups of respondents were compared. Photographs (Figs 1 and 2) demonstrate the barely

Figure 1 Questionnaire sent to orthopaedic higher trainees and consultants

1. Pacemaker wires can be inserted using:		
a. Subclavian vein	Yes	No
b. Axillary vein	Yes	No
c. Cephalic vein (deltopectoral groove)	Yes	No
d. Brachial vein (antecubital fossa)	Yes	No
2. Would you use diathermy to control bleeding from the cephalic vein?		
	Yes	No
3. If a pacemaker was in situ, would you still use diathermy?		
	Yes	No
4. If so, would it be:		
	Monopolar	Bipolar

perceptible difference between the incision for a cephalic or subclavian pacemaker.

Results

The responses from the consultants and trainees are shown in Tables 1 and 2. The possible use of the cephalic vein for insertion of a pacemaker wire was known by 11 of 17 shoulder surgeons (65%) and 5 of the 8 trainees (70%). However, nine consultant shoulder surgeons and three trainees incorrectly felt the brachial vein could be used, and nine consultants and three trainees were not aware of the possibility of insertion via the axillary vein. Two consultants were not aware of the subclavian vein as an entry point and one admitted no knowledge of pacemaker wire placement.

Similarly, the responses for the use of diathermy to the cephalic vein in the presence of a pacemaker (with any insertion site) were varied, with 4 consultants but no trainees using monopolar diathermy, 12 consultants and 6 trainees using bipolar diathermy, and 1 consultant and 2 trainees not using diathermy at all in the presence of a pacemaker.

Discussion

There are guidelines regarding the use of diathermy in patients with pacemakers and defibrillators³ but these are necessarily general due to the great variety of devices and the procedures included under the guidance. In agreement with this guidance we would recommend close liaison with a cardiologist before open or arthroscopic procedures around the shoulder to ascertain the entry point, if diathermy or radiofrequency may be safely used and, indeed, to confirm the type of device as rhythm monitors and defibrillators may look quite similar on a chest x-ray.

Samain *et al* have reported tachycardia associated with unipolar diathermy in a patient with a pacemaker.^{4,5} They have also reported a case of dislodging of the pacing wires

from the correct intracardiac position during arthroscopic surgery to the shoulder due to the pacemaker being displaced from its normal position. In our experience, the appearance on chest x-ray cannot determine the wire entry point and, equally, the surgical scar associated with pacemaker placement (Figs 1 and 2) cannot be used reliably.

Shimada *et al* described a technique for almost percutaneous insertion of the pacing wire into the cephalic vein by palpating a guidewire passed at the antecubital fossa in order to cut down with minimal dissection.⁶ This could further cause confusion about the presence and location of pacing wires as the scar would not look like a traditional deltopectoral scar.

Chen *et al* showed that the cephalic vein often does not lie directly in the deltopectoral groove and may be best localised with duplex ultrasonography,⁷ illustrating the difficulty in finding the cephalic vein in shoulders not previously operated on, and, therefore, the vein may be even more difficult to identify after a previous procedure in that region.

Lau described a variety of different methods of gaining venous access for placement of pacemaker/defibrillator leads.² The cephalic vein was again shown to be difficult to find, even with an open cut-down technique, sometimes requiring a guidewire being passed up from the vein at the antecubital fossa. It is advantageous to use an open approach to cannulate the cephalic vein as it is safer and more leads can be passed into the lumen compared with a percutaneous approach to the subclavian vein.

Wellman *et al* reported a case of an implantable cardiac defibrillator, used in patients who are at risk of sudden cardiac death, on the ipsilateral side of a cuff tear that was repaired arthroscopically.⁸ The implant was deactivated pre-operatively and then reactivated immediately post-operatively in order to reduce the risk of interference to it by the surgery. The patient developed tachycardia post-operatively, which settled with medical management. They suggest pre-operative radiographic evaluation of the

Figure 2 A typical recent deltopectoral approach scar following implantation of a pacemaker

Figure 3 Typical scars from previous subclavian insertion point pacemakers

Table 1 Response from consultants							
Consultant	Subclavian vein	Axillary vein	Cephalic vein	Brachial vein	Diathermy for cephalic vein	Diathermy if pacemaker	Diathermy type
1	yes	no	no	no	yes	yes	monopolar
2	yes	yes	no	no	yes	yes	bipolar
3	no	no	yes	no	yes	yes	bipolar
4	yes	yes	yes	yes	yes	no	none
5	yes	no	yes	yes	no	yes	bipolar
6	yes	yes	yes	yes	yes	yes	bipolar
7	yes	yes	yes	yes	yes	yes	bipolar
8	yes	no	no	no	no	yes	bipolar
9	yes	yes	yes	yes	yes	yes	monopolar
10	yes	yes	yes	yes	yes	yes	bipolar
11	yes	no	no	no	yes	yes	bipolar
12	yes	yes	yes	yes	yes	yes	monopolar
13	yes	yes	yes	yes	yes	yes	monopolar
14	yes	no	no	no	yes	yes	bipolar
15	?	?	?	?	no	yes	bipolar
16	yes	no	yes	yes	no	yes	bipolar
17	yes	yes	yes	no	no	yes	bipolar
Total	15	9	11	9	12	16	4 monopolar, 12 bipolar, 1 none

Table 2 Response from trainees

Registrar	Subclavian vein	Axillary vein	Cephalic vein	Brachial vein	Diathermy for cephalic vein	Diathermy if pacemaker	Diathermy type
1	yes	no	yes	no	yes	yes	bipolar
2	yes	no	yes	yes	yes	yes	bipolar
3	yes	yes	no	no	no	yes	bipolar
4	yes	yes	yes	yes	yes	no	bipolar
5	yes	no	no	no	no	yes	bipolar
6	yes	no	yes	no	yes	yes	bipolar
7	yes	no	no	no	no	no	
8	yes	yes	yes	yes	no	no	
Total	8	3	5	3	4	5	6 bipolar

implant position, with radio-opaque markers as necessary, and taking particular care with portal placement during arthroscopic surgery so as not to affect either the implant or the coiled up surplus length of electrode, which may not be so easy to palpate.

Conclusions

There is currently a varying level of awareness among orthopaedic shoulder surgeons and trainees that the potentially sacrificable cephalic vein is used with increasing frequency for pacemaker insertion. We feel that there should be greater dissemination of this pacemaker technique, not only to shoulder surgeons but to all surgeons who perform surgery around the shoulder and anterior chest wall, including arthroscopic surgery, so that they may know beforehand if a pacemaker has been inserted in this way. They will then be able to formulate a plan for dealing with the cephalic vein and the use of electrical surgical devices.

The results for consultants and trainees were similar overall, suggesting that despite subspecialisation in shoulder surgery, awareness of techniques used by other medical specialties does not improve with time.

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