BRITISH JOURNAL OF HOSPITAL MEDICINE
MMC Modernising Medical Careers

MODERNISING MEDICAL CAREERS

IN NEXT MONTH'S MMC SUPPLEMENT

Managing low self-esteem: a guide for the foundation year doctor

Duplex ultrasound examination of the venous system

Spontaneous oesophageal rupture

How to insert a temporary pacing wire

Introduction

Temporary pacing is indicated in emergency situations for treatment of brady- and tachyarrhythmias. Frequently these patients are haemodynamically unstable and so competency in temporary wire insertion is vital as immediate intervention is frequently required. Temporary pacing should form part of the procedural capabilities of any medical specialist registrar undertaking acute medical on call, especially those working in emergency medicine. F1 and F2 doctors should have be able to recognize a patient with indications for temporary pacing (*Table 1*) and diagnose complications of the procedure.

Procedure

The wire should be placed in a monitored environment with full cardiac resuscitation facilities available including a cardiac defibrillator. Central venous access is required for insertion of a temporary pacemaker. The most frequently used sites in order of preference are right internal jugular, right subclavian and femoral veins. The left internal jugular vein is more tortuous making passage of the wire more troublesome. The left subclavian site should be left clear of any wire as this is the most preferred site for permanent pacemaker insertion. The femoral veins are the least preferred site because there is a high incidence of infection and deep vein thrombosis.

In the cardiac arrest situation, rapid passage of the temporary wire from the leg into the right ventricle may be undertaken and a more sterile wire placed from a superior approach once the patient is stable. Most temporary wires can be passed through a 6F venous sheath.

Prepare the trolley with all the necessary equipment (*Table 2*). Place the patient in a well-lit area in the supine position. Attach the patient to a cardiac monitor. Use an ultrasound probe to locate the internal jugular vein in the neck which lies laterally and immediately adjacent to the internal carotid artery. This could be checked further by compressing the vein with the probe

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Table 1. Indications for temporary pacing

Symptomatic sinus bradycardia not responding to atropine	
Sinus arrest	
Symptomatic second degree heart block	
Complete heart block	
Acute myocardial infarction with	Asystole
	Symptomatic second degree heart block
	Trifascicular block
	Anterior myocardial infarction with asymptomatic second degree or complete heart block
	Symptomatic sinus bradycardia
Drug overdose (beta blockers, verapamil, digoxin)	
Torsades de pointes tachycardia	
Bradycardia-dependent tachycardia	
Recurrent ventricular tachycardia for overdrive pacing	
During permanent pacemaker box change for someone who is pacing dependent	

Table 2. Materials
Lignocaine 1%
10 cc syringes
Scalpel
Betadine prep solution
Sterile towels
Gauze sponges
16–18 and 21 gauge needles
Venous sheath with guide wire and haemostatic seal
Temporary pacing wire and pacemaker box
Lead apron, sterile gown, mask and gloves

and checking for arterial pulsations which are clearly visible in the artery. Place a mark with indelible ink over the venous site as a marker. If an ultrasound probe is not available, superficial markings could be used to locate the vein which lies laterally and superficially between the two sternal heads of the sternocleidomastoid muscle. Identification of the carotid pulsation by palpation will ensure that the initial puncture is made lateral to the artery. Clean and drape the patient with adequate exposure of the insertion site. Then follow these steps:

1. Infiltrate the site with lignocaine 1% starting from the apex of the triangle made by the two sternal heads of the sternocleidomastoid.
2. Attach the introducer needle to the syringe and prefill with 5 ml of local anaesthetic. Insert the needle at a 45° angle to the apex of the triangle and direct it laterally towards the ipsilateral nipple. You may infiltrate the area with a small amount of anaesthetic as you explore the area for the vein. Successful puncture is heralded by a gush of dark red non-pulsatile venous blood. Some physicians often use the green needle as they infiltrate with lignocaine to puncture the internal jugular vein as a landmark to guide the larger bore introducer needle which is a larger calibre.
3. Keeping the introducer needle in place, pass the guide wire through the needle. It should pass through without any hindrance. Ensure enough wire is left on the outside of the patient to pass the venous sheath over it.
4. Once the wire is in place, the needle is removed and a small nick is made in the skin at the insertion site with the scalpel before the venous sheath is threaded over the guide wire and inserted into the vein. Care should be taken to keep the depth of the guide wire constant as the sheath is passed over it to prevent irritation of the heart which would be detected as ventricular ectopics on the cardiac monitor. If there is difficulty in passing the wire of the venous sheath, then X-ray screening can be used to ensure the guide wire has passed into the superior vena cava.
5. Once in the vein, remove the haemostatic seal with the wire. Withdraw blood from the side port to check for free flow of blood and after removing air bubbles flush with normal saline.
6. Suture the venous sheath in place so that it is not displaced during insertion of a temporary wire.
7. Under fluoroscopy, a temporary wire is passed through the venous sheath into the heart using the J-shaped natural curve of the wire with the tip pointing towards the apex of the heart. If it does not pass through the tricuspid valve, the wire should be rotated towards the lateral wall of the right atrium and a loop formed by feeding an extra length of the wire. Once a loop is made, withdraw the wire slowly while rotating it at the same time. It will flip through the tricuspid valve at which point it should be advanced towards the apex of the right ventricle. Once in position a heel should be left on the wire in the right atrium (*Figure 1*). Occasionally, the wire may appear to head toward the left shoulder with no evidence of ventricular ectopy – this suggests the wire has entered the coronary sinus. It can be withdrawn and then re-introduced at the tricuspid valve level.
8. Attach the wire to the temporary pacemaker box and check the ventricular pacing threshold. This should be less than 1 V and stability should be assessed by asking the patient to take deep breaths or cough while pacing at 2x threshold to ensure adequate capture. A threshold of up to 1.5 V is acceptable if no other site can be found. If the threshold remains high despite what appears to be adequate placement, consider the possibility that the wire has passed under the diaphragm resulting in a radiologically good position but no ectopy during manipulation of the wire. The wire should be withdrawn and the tricuspid valve approached again. Twitching of the diaphragm at low outputs suggest perforation and the wire should be repositioned and the patient monitored to ensure that he/she does not develop tamponade.
9. Apply a sterile dressing over the venous sheath and the wire and loop the extra length of the wire outside the venous sheath over the skin and cover with an adhesive dressing. Often the sheath can be split and withdrawn and the temporary wire sutured to the skin directly. This reduces the risk of infection. There is no indication to give prophylactic antibiotics for temporary pacing wire insertion.

Post procedure

The temporary pacing generator should be set at an output of 3 V and on 'demand'. If the patient is in complete heart block or bradycardic, a rate of 70–80/min is ade-

Figure 1. Optimal temporary wire position: the shape of the wire is similar to a sock with the heel in the atrium and tip at the apex, the arch overlies the tricuspid valve annulus.

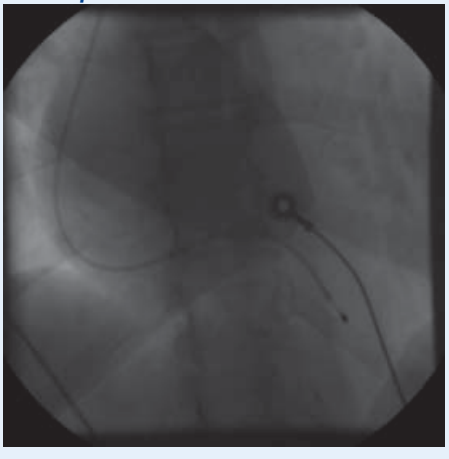


Table 3. Complications
Bleeding
Haematoma
Arterial puncture
Pneumothorax
Displacement
Cardiac tamponade
Septal perforation
Diaphragmatic pacing
Arrhythmias especially ventricular ectopics and runs of non-sustained ventricular tachycardia
Failure to sense or pace
Infection
Endocarditis
Death

quate. Patients who only have intermittent bradycardia or pauses and are haemodynamically stable in sinus rhythm may be set to a rate just below the patient's intrinsic heart rate.

A postoperative chest radiograph is required to exclude pneumothorax and check the final position of the wire.

Complications

Serious complications are recognized during temporary pacemaker insertion (*Table 3*). Most patients require this as an emergency life-saving procedure in an unstable condition. Even though no significant differences in procedural success and complication rates were found among cardiologists and emergency physicians (Birkhahn et al, 2004) doctors need to be experienced and trained in performing this procedure. A regional survey of procedures and complications revealed a complication rate of 22.9% in 144 procedures performed by cardiologist, cardiology trainees and experienced physicians (Betts, 2003).

Inappropriate lead position

A left bundle–branch block pattern should appear on the electrocardiogram when the pacemaker is turned on. A right bundle–branch block morphology alerts the operator to the possibility of septal perforation or misplacement of the lead in the left ventricle which could occur if the wire has traversed a patent foramen ovale or atrial septal defect or even a ventricular septal defect in case of acute myocardial infarction.

Failure to capture and oversensing

Failure to capture is heralded by pacing spikes which are not followed by QRS complexes (*Figure 2*). The threshold of the pacing wire should be checked on a daily basis and repositioned if it rises above 4 V. If there is failure to capture, the connections to the box and temporary wire should be checked. The output should be increased to 10 V and the wire repositioned. If diaphragmatic pacing occurs at low outputs, this suggests perforation and an echocardiogram should be performed to look for a pericardial effusion. Occasionally oversensing occurs as the temporary pacing box detects T waves and hence delays delivery of a pacing impulse. If this occurs at implant then the wire can be moved to an alternative site. Usually, reducing the sensitivity of the pacing generator is adequate.

Cardiac tamponade

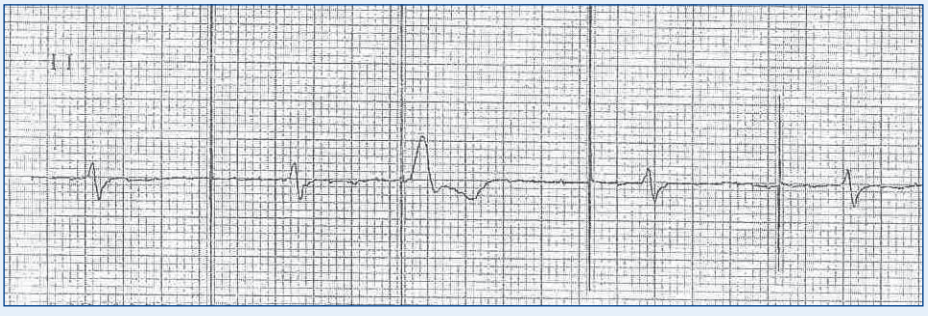
Occasionally, the wire can erode through the myocardium to cause tamponade, particularly in the context of acute inferior myocardial infarction. This should be treated by pericardial drain and repositioning of the temporary wire. Patients will complain of pericarditic chest pain, breathlessness and have an elevated jugular venous pressure with enlarged cardiac silhouette on chest X-ray. These features may develop slowly as a gradual myocardial rupture is developing. BJHM

Conflict of interest: none.

Betts TR (2003) Regional Survey of temporary pacing procedures and complications. *Postgrad Med J* **79**(934): 463–5

Birkhahn RH, Gaeta TJ, Tloczkowski J, Mundy T, Sharma M, Bove J, Briggs WM (2004) Emergency medicine-trained physicians are proficient in the insertion of transvenous pacemakers. *Ann Emerg Med* **43**(4): 469–74

Figure 2. Undersensing and failure to capture. The pacemaker was set to pace at 50 beats per minute and it is clear that pacing is being delivered despite a heart rate of 60/min only the third beat in the rhythm strip captures the ventricle.



KEY POINTS

- Temporary pacing should be performed by experienced individuals with a full understanding of the procedural indications and complications.
- Sterile technique with ability to rapidly obtain venous access via the internal jugular, subclavian or femoral venous routes is essential.
- Patients should be carefully monitored and reviewed post lead placement for delayed tamponade, pneumothorax or loss of capture.