

SELF ASSESSMENT ANSWERS

Evaluation of intermittent capture in a patient who has undergone an urgent temporary transvenous pacemaker lead insertion

Q1: Describe the ECG (fig 1; see p 431)

The post-procedure ECG shows paced rhythm with complete right bundle branch block morphology and right inferior axis shift (fig 1 below: RR' complex in V1; QS complex in S1, aVL and V5; R in aVR and aVF). If one sees such an ECG pattern in a paced patient, then one must think of a malpositioned lead that stimulates the heart from the left ventricle.

Q2: What do you see in the fluoroscopic view (fig 2; see p 431)?

The fluoroscopic view taken after temporary pacemaker lead insertion clearly shows a malpositioned temporary pacemaker lead (fig 2 marked as B) in the coronary sinus and another lead in the right ventricle (fig 2 marked as A). The left anterior oblique view is especially important to locate and verify the course of the lead that goes to the left side of the heart. As is seen on the right anterior oblique view, the tip of the lead lies on the epicardial surface of the left ventricle. Because it is epicardially located on the left ventricle and unstably positioned, it might be responsible for inefficient and intermittent capture as well as for an elevated capture threshold. Subsequently, a second pacing lead (fig 2 marked as A) was inserted through the contralateral femoral vein in the right ventricle and the malpositioned lead was pulled out.

Discussion

Either permanent or temporary pacemaker applications are currently being used in various emergency or cardiology departments all around the world. Physicians working in these facilities should know how to apply a temporary pacemaker and be able to manage its proper function as well as deal with problems. One of these problems might be inadvertent malpositioning of the pacing lead in the left ventricle instead of the right ventricle. It often occurs when the physician doesn't know the anatomy well and overlooks some important points during positioning of the pacemaker lead. Malpositioning of the pacing lead in the coronary sinus and through the patent foramen ovale into the apex of the left ventricle has been previously reported.^{1,2}

This rare complication of pacemaker lead insertion should be suspected by observation of the right bundle branch block morphology on ECG and the unusual orientation of the lead body on fluoroscopy or chest radiography. After puncturing the subclavian vein, the guidewire should be directed into the inferior vena cava first before inserting the sheath. Care must be taken not to enter the arterial system. When using the femoral vein route one should first rotate the lead clockwise and then push it into the right ventricle or go into the superior vena cava and then pull the lead back to avoid entering the coronary sinus. If the ECG during implantation is insufficient for the interpretation of

the presence or absence of right bundle branch block morphology, a 12 lead ECG with ventricular capture should be recorded immediately after the procedure by applying a magnet or testing the device with the programmer.¹ If there is still doubt about the lead position, then a two dimensional echocardiography (either transthoracic or transoesophageal) should be performed because it is the imaging method of choice for proper diagnosis.

The post-procedure ECG (fig 1; see p 431) in our patient clearly shows paced right bundle branch block morphology and rightward as well as inferiorly directed QRS axis that might help us to locate the stimulation site—namely, the high lateral epicardial left ventricular region. The fluoroscopic view (fig 2; see p 431) also demonstrates the unusual leftward orientation of the pacing lead suggestive of lead malpositioning in the coronary sinus or its tributaries. After confirming malpositioning of the pacing lead in the coronary sinus, as is seen in fig 2, a second temporary pacing lead was inserted through the contralateral vein into the right ventricle and the malpositioned lead in the coronary sinus was safely pulled back.

Malpositioning of the temporary pacing lead in the coronary sinus may be responsible for loss of capture, high capture thresholds, perforation, and thrombus formation. However, inadvertently implanting a permanent pacing lead in the left ventricle by the routes mentioned above may cause more troublesome and unwanted events such as thromboembolism. In such circumstances both lead removal and anticoagulant therapy are recommended therapeutic modalities.

In conclusion, physicians or residents applying temporary pacemakers should be aware of the potential problems and complications of this procedure. Although rarely observed, lead malpositioning may result in troublesome events. Therefore, after every temporary or permanent pacemaker procedure the physician should check the proper function and location of the pacing system with the aid of simple diagnostic tools such as a 12 lead ECG, chest radiography, fluoroscopy, and echocardiography.

Final diagnosis

Malpositioning of a temporary pacing lead in the coronary sinus.

References

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Adolescent girl with back pain

Q1: What abnormalities are seen on the radiological investigations (see figs 1-3; p 432)?

The plain radiograph shows a right thoracolumbar scoliosis with apex at L2. The bone scan shows intense activity over left side of the second lumbar vertebra. The computed tomogram shows widened left superior

articular facet (black arrow) of L2. A lesion with a central nidus and surrounding sclerosis is seen. The inferior articular facet (white arrow) is normal. Radiographs of her pelvis (not shown) confirmed that she was skeletally mature.

Q2: What is the likely diagnosis and how does it usually present?

The diagnosis is osteoid osteoma involving the left superior articular facet of L2 vertebra. Osteoid osteomas are benign bone tumours. The lesion commonly presents between the ages of 10 and 25 years and has a male preponderance.¹ The proximal femur is the commonest location followed by tibia and the posterior arch of vertebra.² Patients with lesions in the spine typically present with painful scoliosis and, less commonly, with varying degrees of radicular leg pain.¹ The pain is usually severe, frequently in the night, and is not aggravated by exercise or position. Movements of spine are often painful. Salicylates are usually helpful in relieving the pain. The scoliosis is typically described as C shaped curve. The lesion is usually found at the apex on the concave side of the curve.³ The radiological diagnostic features of osteoid osteoma are described in box 1.

Discussion

In children and adolescents complaints of back pain (box 2), especially painful scoliosis, should be taken seriously. Painful scoliosis may signify a tumour or spinal cord anomaly.⁴ Bone scanning is an excellent screening method for the adolescent with back pain.

The investigation of a painful spine in children (particularly if pain persists) should begin with blood tests including full blood count, inflammatory markers, and conventional radiographs. If the clinical and radiological features suggest an osteoid osteoma, isotope bone scanning should be the investigation of choice to confirm this. Computed tomography aids in delineating the lesion better and helps in preoperative planning. If

Box 1: Radiological diagnostic features of osteoid osteoma⁵

- A sharp round or oval lesion.
- Less than 2 cm in diameter.
- A homogeneous dense centre.
- A peripheral radiolucent zone of 1-2 mm.

Box 2: Differential diagnosis of painful spine in children and adolescents¹

- Congenital: spondylolisthesis.
- Inflammation: Sheuermann's disease, rheumatoid arthritis, reactive arthritis.
- Infection: pyogenic, tuberculosis.
- Traumatic: fractures, spondylolysis.
- Disc prolapse.
- Metabolic: rickets/osteomalacia.
- Tumours: primary and secondary.

the bone scan is negative and the cause of the pain is still unknown, magnetic resonance imaging will help to rule out pathologies such as spinal cord anomalies, adolescent disc prolapse, and tumours.

Scoliosis develops in osteoid osteoma secondary to paraspinal muscle spasm.⁶ The nidus of osteoid osteoma is richly vascularised and innervated. This is thought to account for the relief with salicylates.²

Even though the natural history of osteoid osteoma may be one of spontaneous remission, the treatment of spinal osteoid osteoma is surgical removal of the nidus by en bloc excision. This is because the time interval before remission may range from two to eight years and the scoliosis can become structural during this period.⁶

Percutaneous radiofrequency ablation is gaining popularity in the treatment of osteoid osteomas. However, spinal osteoid osteomas should only be treated by radiofrequency ablation if the nidus is located at least 1 cm away from vital structures, in order to prevent neurological complications.⁷ If the nidus is removed, the patient is usually relieved of pain at once.^{1,2} Scoliosis usually resolves completely if the excision is undertaken within 18 months of the start of symptoms.⁴ Complete excision of the lesion results in a cure and recurrence is very unusual.¹

Final diagnosis

Osteoid osteoma of superior left facet of second lumbar vertebra.

References

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IMAGES IN MEDICINE

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Charcot's foot: advanced manifestation of diabetic neuropathy



Figure 1 Clinical photograph of the left foot with "rocker bottom" deformity.



Figure 2 Radiograph of left foot with vertically displaced cuboid and destroyed tarsal and metatarsal bones.

A 48 year old man, a known diabetic for 14 years, who had poor compliance to treatment was admitted with left lower limb pain and deformity of his left foot for two months. He did not have a history of alcohol intake or promiscuity. On evaluation, he had bilateral loss of pain, touch, temperature, and vibration sense below the ankle joint. His vibration perception threshold was increased to 46 mV on the left side and 38 mV on the right side (normal <25 mV). The pressure sense tested with a SG 5.07 monofilament over both feet was impaired and he had "rocker bottom type deformity" of the left foot (fig 1). His body mass index was 24 kg/m². He was hypertensive and had bilateral advanced non-proliferative diabetic retinopathy. On investigation, random blood glucose was 26 mmol/l, serum creatinine 3.1 µmol/l, and 24 hour urine protein was 6.4 g. His Venereal Disease Research Laboratory test was negative and he had a normal total leucocyte count and erythrocyte sedimentation rate. Radiography of the left foot was suggestive of Charcot's foot (fig 2). ^{99m}Tc methylene diphosphonate (MDP) bone scan showed increased tracer uptake in the region of the left foot suggestive of increased osteoblastic activity (fig 3). Magnetic resonance imaging (MRI) of the left foot revealed diffuse soft tissue oedema with maintained subcutaneous fat and disorganised and malaligned tarsal bones. Subchondrial cyst, marrow oedema, and inferior displacement of cuboid (fig 4) were additional features. The overall picture was of chronic neuroarthropathic joint due to diabetes mellitus. He was advised to have a total contact cast followed by special footwear. Additionally calcium, vitamin D, and alendronate 40 mg per day were prescribed. Bisphosphonates have been used in the treatment of Charcot's foot because increased osteoclastic activity secondary to autonomic dysfunctions has been documented. Calcium and vitamin D were started to prevent bisphosphonate induced osteomalacia. Realignment surgery is planned.

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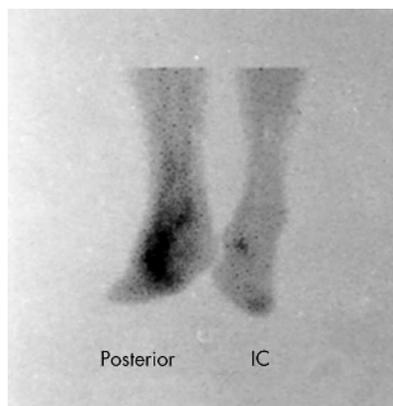


Figure 3 ^{99m}Tc MDP bone scan showing increased tracer uptake in the midtarsal region.



Figure 4 MRI of the left foot showing subcutaneous tissue oedema with malaligned tarsal and metatarsal bones and subchondrial cyst formation.