Temporary Transvenous Pacing and Femoral Vein Thrombosis


SUMMARY  The true incidence of thrombosis and pulmonary embolism in patients requiring temporary transvenous pacing via the femoral vein is unknown. Twenty-nine patients, mean age 66.2 years (range 38–79 years) who required temporary pacing were studied by bilateral contrast venography and perfusion lung scanning after removal of the pacing catheter. The patients were subdivided into two subgroups based on hemodynamic status. There was no statistical difference between the two groups with respect to mean age or the time the pacemaker catheter was in place and all patients were placed on low-dose heparin therapy. Ten patients (34%) had venographic evidence of thrombosis; six of them (60%) showed lung scan evidence of pulmonary emboli. The hemodynamically compromised group consisted of seven patients, six (85%) of whom had thrombosis; three of these six (50%) had pulmonary emboli. Of the 22 patients in the hemodynamically stable group, four (18%) had thrombosis and two of these (50%) had pulmonary emboli. Venous thrombosis, with subsequent pulmonary emboli, is a serious complication of temporary transvenous pacing using the femoral approach, despite the use of prophylactic low-dose heparin.

TEMPORARY TRANSVENOUS endocardial pacing is a simple, safe and effective means of treating both high-grade atrioventricular block and selected cardiac dysrhythmias. Several venous routes are available for the insertion of the pacing electrode. These include both cutdown and percutaneous techniques using either the brachial, subclavian, internal jugular or femoral veins.

Recently the percutaneous transfemoral venous technique has been advocated as a simple method that is free of significant complications. Lumia and Rios reported that the overall complication rates for the brachial and femoral approaches were statistically similar, 9.1% and 7.8%, respectively. In their series, phlebitis was clinically evident in 18.8% of patients in whom the brachial vein was used, while the femoral approach did not produce clinically evident phlebitis. However, pulmonary emboli were clinically detected only in patients in whom the femoral vein was used. Weinstein et al. prospectively studied 100 consecutive patients who required temporary pacing and in whom the femoral vein was used. Thrombophlebitis and thromboembolism were not complications of the femoral route.

This study was designed to prospectively analyze the incidence of femoral vein thrombosis, with subsequent pulmonary embolization, in patients who required temporary transvenous pacing using the percutaneous femoral technique.

Materials and Methods

The study group included 34 consecutive patients admitted to the cardiac intensive care unit who required temporary transvenous pacing. In five patients we could not collect the entire database, so they were omitted from the study. The final study population, therefore, included 29 patients (ages 38–79 years, mean 66.2 years). The indications for pacing are listed in table 1.

After giving informed consent, the patients were taken to a special procedures room where a pacemaker electrode catheter (Cordis #6F) was inserted using the percutaneous Seldinger technique via the right femoral vein. The left femoral vein was used in one patient because of technical difficulties. The pacemaker catheter was advanced into the right ventricle under fluoroscopic control. The patient was then returned to the intensive care unit and started on heparin, 5000 IU subcutaneously every 8 hours. The patients were kept in the cardiac intensive care unit until the pacemaker catheter was removed.

At the time of insertion the hemodynamic status of the patients was assessed, using blood pressure, urine output, level of consciousness and status of the peripheral circulation. Patients were classified as being hemodynamically compromised if their blood pressure was less than 100 mm Hg systolic and if they had decreased urine output (less than 30 ml/hour), evidence of peripheral vasoconstriction (cold, clammy, ashen skin) and a clouded sensorium. Patients with normal clinical variables were categorized as being hemodynamically stable.

Within 12 hours of removal of the pacemaker catheter, bilateral contrast venograms were performed using the technique described by Thomas et al. The venograms were interpreted blindly by two independent radiologists. If the venograms were positive a lung scan was performed using standard techniques. The scans were interpreted blindly by two independent experienced observers. If the perfusion study showed a defect, a ventilation study was performed utilizing xenon-133 in oxygen. Pulmonary embolism was diagnosed only if the perfusion defect ven-

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Table 1. Patient Profile

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*Patient died; autopsy performed.

Abbreviations: IMI = inferior myocardial infarction; AMI = anterior myocardial infarction; ASMI = anteroseptal myocardial infarction; VT = ventricular tachycardia; LBBB = left bundle branch block; RBBB = right bundle branch block; LAH = left anterior hemiblock; AF = atrial fibrillation; SSS = sick sinus syndrome; S = hemodynamically stable; C = hemodynamically compromised; LLL = left lower lobe; RLL = right lower lobe; RUL = right upper lobe; N = negative; BLL = bilateral lower lobes; L = left; R = right.

Before the venograms the patients were assessed clinically, with specific emphasis on the clinical detection of venous thrombosis and pulmonary embolism. In two patients who died, the femoral vein and pulmonary artery were explored at autopsy.

The control group consisted of 15 matched patients who were admitted to the cardiac intensive care unit and who did not need pacing. These patients underwent bilateral contrast venography at discharge from the cardiac intensive care unit and had perfusion lung scans.

Statistics

The t test for unpaired data was used to test the significance of any differences found between the hemodynamically stable and compromised groups.

Results

Patient Data

Table 1 is a list of the data base for the patient population. Twenty-nine patients are the basis of this report. The average age of the entire study population
was 66.2 \pm 10.6 years. The pacemaker catheter was in place 1–18 days (mean 6.0 \pm 3.7 days). Ten patients (34%) had venographic or autopsy evidence of thrombosis. Six of these patients (60%) had either perfusion lung scan or autopsy evidence of pulmonary embolism.

The subgroup of patients who were hemodynamically compromised consisted of seven patients (24% of the total population). The mean age of this subgroup was 65.1 \pm 8.0 years. The pacemaker catheter was in place an average of 8.3 \pm 5.0 days. In this subgroup, six (85%) had radiologic evidence of thrombosis, of whom three (50%) subsequently developed pulmonary emboli; two (67%) of these pulmonary emboli were completely silent. Only one patient (17%) had clinical evidence of thrombosis.

In the hemodynamically stable group (22 patients) the average age was 66.5 \pm 11.4 years. The pacemaker catheter was in place an average of 5.3 \pm 3.0 days. This group had an 18% incidence of thrombosis (four patients); two patients (50%) had pulmonary emboli that were clinically silent.

There was no significant difference between the two subgroups in terms of age or length of time the pacemaker catheter was in place.

The control patients had a mean age of 67 \pm 10 years and were in the cardiac intensive care unit an average of 5.2 \pm 3 days. None of the patients in the control group had venographic or scan evidence of thromboembolic disease.

**Discussion**

Since its introduction 20 years ago, temporary endocardial transvenous pacing has become accepted as the treatment of choice for high-grade blocks and selected dysrhythmias. However, many sites are available for the insertion of the pacemaker catheter, leading to some confusion regarding the best and safest means of insertion. The best method should be one that is safe, quick, and has a low rate of dislodgement. Accordingly, several authors have popularized the transfemoral approach using the percutaneous Seldinger technique.

Weinstein et al. prospectively surveyed 100 consecutive patients requiring temporary transvenous pacing in whom the transfemoral approach was used. Autopsies were performed on eight patients, none of whom showed evidence of thrombophlebitis or pulmonary emboli. The other 92 patients had no clinical evidence of thrombophlebitis or pulmonary emboli. Cheng studied the incidence of complications in 100 consecutive patients, and he also did not find any clinical evidence of thromboembolism. These studies failed to demonstrate venous thrombosis or pulmonary embolism in their patient populations because they relied on clinical evidence for the diagnosis of complications. The clinical detection of thrombosis is very difficult. The only patient in our study who showed clinical evidence of thrombosis had complete obstruction of the femoral vein on the side of the pacemaker insertion. The remaining patients with thrombi had a patent femoral vein and did not have clinical evidence of thrombosis.

Meister et al. expressed concerns that thrombophlebitis might complicate the transfemoral approach and therefore placed all their patients on low-dose heparin. In a letter to the editor, Cohen et al. reviewed their experience with transfemoral pacing in 80 consecutive nonanticoagulated patients and concluded that thrombophlebitis was a clear hazard of the procedure. They suggested that all the patients be placed on anticoagulants.

The results of our study clearly show that thrombosis is a serious complication of the transfemoral approach. Thirty-four percent of the study population developed venographic or autopsy evidence of thrombosis while on low-dose heparin. When the patients were further subdivided into either hemodynamically compromised or stable subgroups, the hemodynamically compromised group had an incidence of 85%, vs 18% for the stable group. Only one patient (17%) had clinical evidence of thrombophlebitis. Other factors, such as age, sex or the length of time the catheter was in place, did not seem to affect the incidence of thrombosis. The patients who had venographic or autopsy evidence of thrombosis at the site of pacemaker insertion did not have evidence of thrombosis on the other side.

Looking into the origin of thrombi confined to the lower limb, Stamatakis et al. examined the venograms of 952 patients suspected of having either deep vein thrombosis or pulmonary embolism. Four hundred seventy-five (49.9%) patients had venographic evidence of either a major (popliteal vein and above) or a minor (limited to calf) thrombosis. Major thrombi occurred more frequently on the left. In our study, patients who had right-sided thrombi did not have evidence of thrombosis on the left; patients who were negative by venography on the right side were also negative on the left. Thus, the pacemaker catheter appears to be the cause for the increased incidence of right femoral thrombosis in our select population. This anatomic localization of the thrombus corresponds to that often encountered in patients with hip fractures or pelvic disease, in whom low-dose heparin has been shown to be of little value. Gallus et al. showed that low-dose heparin decreases the incidence of deep vein thrombosis from 22.5% to 2.6% in patients after myocardial infarction. All of our patients were on low-dose heparin, so it is again evident that the cause was the pacemaker catheter.

Figure 1 is an example of an isolated iliofemoral thrombus at the site of pacemaker lead insertion. A large thrombus partially fills the lumen, starting in the distal portion of the femoral vein and extending into the iliac vein. The left leg deep veins and the veins distal to the thrombus were completely normal. Figures 2 and 3 show the perfusion and ventilation lung scans in this same patient. In the right upper lobe, a large defect is visible, which ventilates normally. Repeat examination performed 2 weeks later (fig. 4) showed a normal perfusion scan.

Pulmonary embolism is difficult to diagnose...
because many of the signs and symptoms are non-specific. Pulmonary angiography is the most specific test for the documentation of pulmonary embolism; however, its value is limited because of its associated morbidity and high cost. Combined ventilation-perfusion studies have been shown to be highly sensitive and specific for detecting pulmonary emboli. All of our patients who had pulmonary emboli had large
segmental or lobar defects that ventilated normally.

Although the femoral approach is a quick and easy means of advancing the pacemaker catheter into the right ventricle, the high incidence of thrombosis, especially in the hemodynamically compromised group, weakens its appeal. The hemodynamically stable group had a much lower incidence of thrombosis (18%); however, both groups had a 50% incidence of pulmonary embolization. This finding is not surprising; Kakkar et al. demonstrated that pulmonary emboli occur more frequently in patients with proximal major thrombi. The overall percentage of patients with iliofemoral thrombosis developing a pulmonary embolus was identical in both groups (50%), although the frequency of thrombosis in both groups was different. In the stable subgroup one may still want to use the femoral route, keeping in mind that there is a significant (18%) incidence of thrombosis. These patients could be monitored with noninvasive techniques such as with Doppler flow probes, allowing for change in site if there is objective evidence of thrombus formation. It must be pointed out, however, that studies have failed to demonstrate that other sites are free from thromboembolic complications.

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References

Temporary transvenous pacing and femoral vein thrombosis.
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