

Position-Dependent Ventricular Tachycardia Related to a Peripherally Inserted Central Catheter

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Recently, peripherally inserted central venous catheters (PICCs) have been widely used for venous access. Advantages of a PICC over centrally inserted central catheters include the virtual elimination of the risk of pneumothorax, hemothorax, and arterial puncture, along with a reduced risk of bleeding. However, the PICC has associated risks. We present 2 cases of body position-dependent ventricular tachycardia related to PICCs. These events occurred in patients with no prior history of cardiac

arrhythmia and were corrected by repositioning of the PICC. They serve to identify a potentially serious cardiac complication of the PICC that, to our knowledge, has not been described previously.

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ECG = electrocardiography; PICC = peripherally inserted central venous catheter; SVC = superior vena cava

In recent years, peripherally inserted central venous catheters (PICCs) have become widely used for venous access. Several large studies have shown that the PICC is safe and effective in various clinical settings.¹⁻⁷ A PICC is often placed with fluoroscopic guidance by intervention radiologists; however, at many institutions, including Mayo Clinic Rochester, specially trained nurses place the PICC at bedside, a strategy that may make the PICC a cost-effective alternative.^{1,8}

In placing a PICC, our nurses generally follow the procedure described in the instructions provided by the equipment manufacturer (Bard Access Systems, Salt Lake City, Utah). With the patient's arm abducted to 90°, the nurse estimates the length of the catheter to be inserted by measuring the distance from the insertion site on the arm to the head of the clavicle and then adds the distance from the head of the clavicle to the third intercostal space. The catheter is then cut to this length before insertion, with a goal of positioning the tip of the PICC within the superior vena cava (SVC). After placement, position is confirmed by radiography.

Advantages of the PICC over centrally inserted central catheters include the virtual elimination of the risk of pneumothorax, hemothorax, and arterial puncture, along with a reduced risk of bleeding since better hemostasis can be achieved.^{6,9} The PICC has risks, however, with the most frequently occurring complications being catheter malposition, accidental dislodgment, sepsis, occlusion, and

thrombophlebitis.^{2,7,9} Cardiac arrhythmia can occur. To our knowledge, there have been no previously reported cases of body position-dependent ventricular arrhythmias related to a PICC.

REPORT OF CASES

Case 1

A 33-year-old man was hospitalized for treatment of septic olecranon bursitis after oral antibiotic therapy had failed. He had no history of cardiac disease or palpitations and had not previously undergone electrocardiography (ECG). The treatment decision was a full course of intravenous cefazolin through a PICC. At bedside, a 4F single-lumen catheter was inserted into the left basilic vein to a length of 57 cm. Chest radiography confirmed that the catheter tip was in the SVC. Later that day, the patient began to experience palpitations while lying in the left lateral decubitus position. His blood pressure remained stable, but his pulse became irregular. No fluids or medications were being infused through the PICC at that time.

An ECG obtained while the patient was supine showed normal sinus rhythm; he was asymptomatic. Repositioning the patient in the left lateral decubitus position caused the patient to report palpitations once again, at which time an ECG showed frequent episodes of nonsustained ventricular tachycardia, with the longest recorded episode lasting 7 beats (Figure 1). The PICC was withdrawn approximately 2 cm, and the patient was again placed on his left side. He no longer complained of palpitations, although another ECG showed frequent single premature ventricular contractions (Figure 2). The PICC was withdrawn an additional 4 cm. With the patient in the left lateral decubitus position, an ECG showed normal sinus rhythm with no ectopic beats (Figure 3).

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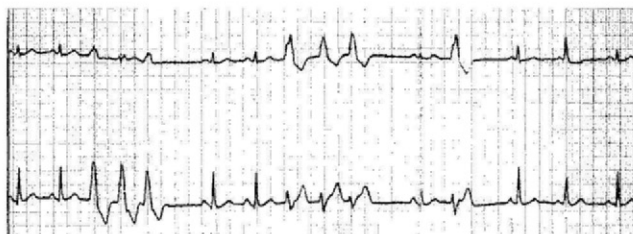


Figure 1. Electrocardiogram of patient 1 in the left lateral decubitus position, showing nonsustained ventricular tachycardia before withdrawal of the peripherally inserted central venous catheter.

Chest radiography confirmed that the position of the PICC tip was near the junction of the left innominate vein and SVC. The patient had no further episodes of palpitations during his hospital stay.

Case 2

A 64-year-old woman with renal cell carcinoma who had undergone spine surgery for excision of a metastatic lesion was admitted to the intensive care unit for treatment of bleeding due to disseminated intravascular coagulation. She had no history of cardiac disease other than treated hypertension. At admission, an ECG showed normal sinus rhythm.

Because the patient had poor peripheral venous access, a PICC was placed. At bedside in the intensive care unit, a 4F single-lumen catheter was inserted into the left basilic vein to a length of 53 cm. Chest radiography showed that the catheter tip was in the right atrium. The line was withdrawn 2 cm, and radiography confirmed that the tip was now in the SVC.

The next morning, the patient was placed in the left lateral decubitus position for dressing changes, and the cardiac monitor showed ventricular tachycardia (Figure 4). Her blood pressure remained stable. No fluids or medications

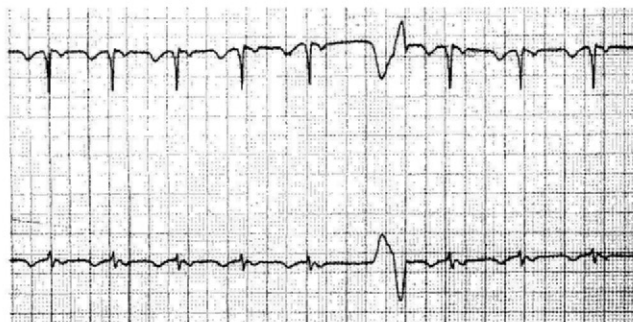


Figure 2. Electrocardiogram of patient 1 in the left lateral decubitus position, showing premature ventricular contraction after the peripherally inserted central venous catheter was withdrawn 2 cm.

were being infused through the PICC at that time. When returned to the supine position, she resumed normal sinus rhythm; however, when placed on her left side, she again developed frequent episodes of ventricular tachycardia, the longest episode lasting 12 beats. The patient remained asymptomatic throughout these episodes. The PICC was withdrawn approximately 2 cm, after which the patient maintained normal sinus rhythm when returned to the left lateral decubitus position. The tip of the PICC was in the mid-SVC on repeated chest radiography. She had no subsequent arrhythmia while the PICC remained in place.

DISCUSSION

Verdino et al¹⁰ reported 1 case of supraventricular tachycardia precipitated by a PICC that was improperly positioned with its tip extending into the right atrium. Arrhythmia occurs commonly with placement of central venous catheters; ventricular arrhythmias may occur in as many as 25% of patients during guidewire insertion.¹¹ In a series of 70 patients, Smith et al¹² noted 3 with premature ventricular contractions during insertion of a PICC. Artru and Colley¹³ observed ventricular ectopic beats in 5 patients in whom a PICC was initially inserted with its tip positioned in the right ventricle. Similar ectopic beats were noted in 1 patient in whom the tip was in the right atrium and in 1 in whom the tip was in the SVC. In their experience with 963 successful PICC insertions, Ng and colleagues⁷ found delayed complications (not at the time of insertion) of palpitations, premature ventricular contraction, or ventricular tachycardia in 4 patients.

The current 2 cases document ventricular tachycardia precipitated by body position changes with a PICC in place. The immediate correction of the arrhythmia with repositioning of the PICC strongly points to the PICC as the cause. The likely explanation for these events is advancement of the catheter tip, possibly extending into the

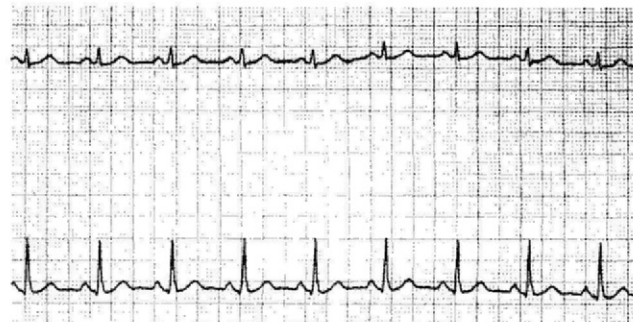


Figure 3. Electrocardiogram of patient 1 in the left lateral decubitus position, showing resumption of normal sinus rhythm after further withdrawal of peripherally inserted central venous catheter.

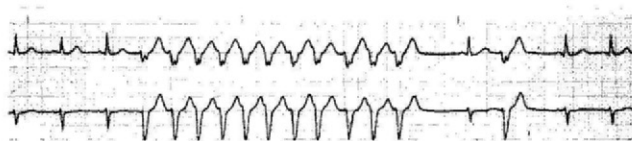


Figure 4. Electrocardiogram of patient 2 in the left lateral decubitus position, showing ventricular tachycardia before withdrawal of the peripherally inserted central venous catheter.

right ventricle with the change in position, although we have no documentation of the catheter position at the time of the arrhythmias. Arm movements, particularly adduction and flexion, have been shown to be capable of advancing catheters inserted through the antecubital veins as much as 9.5 cm.^{14,15} It has not been demonstrated previously that assuming the lateral decubitus position alters arm-vein catheter position. The arm movements made by our patients during their positional changes are unclear, but some degree of adduction and flexion is likely.

No report has described pronounced morbidity or mortality due to PICC-associated arrhythmia. However, in a series of 300 patients with subcutaneous infusion ports in the central circulation, Brothers et al¹⁶ reported a 0.9% incidence of arrhythmia requiring cardioversion. This highlights the potential seriousness of cardiac arrhythmias precipitated by central venous catheters and underscores the need for careful catheter placement. A discussion of the "ideal" position of the catheter tip is beyond the scope of this article. Having patients assume a lateral decubitus position with arm flexion immediately after PICC insertion may be reasonable for detection of arrhythmias and may allow repositioning more quickly.

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