Unintended Transthoracic Pulmonary Artery Cannulation: A Complication of Central Line Insertion

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Central venous cannulation is associated with a number of complications, including unintended arterial puncture. The likelihood of such a complication is increased in the presence of abnormal or distorted anatomy, and it is important that the anesthesiologist be able to recognize and safely manage these complications. To our knowledge, there have been no reports of unintended transarterial pulmonary artery cannulation during central venous catheter insertion. We report such a case occurring in a patient presenting for major spinal instrumentation.

Case Report

The patient, a 14-yr-old, 32-kg girl with a history of a thoracic meningomyelocele (closed in the neonatal period) presented for Luque rod insertion for correction of an extreme thoracolumbar kyphoscoliosis. She was otherwise in good health, was taking no medications, and was known to have a latex allergy. A right-sided ven-

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References

triculoperitoneal shunt had been inserted previously. Physical examination revealed a wheelchair-bound 14-yr-old girl with a dramatic kyphoscoliosis producing a shortened, compressed thorax. Preoperative pulmonary function testing demonstrated a significant restrictive defect (FEV₁ = 52% predicted, FVC = 49% predicted). The preoperative electrocardiogram results were normal. Preoperative sedation was declined by the patient.

In the operating room, routine monitors including an electrocardiogram, noninvasive blood pressure monitor, pulse oximeter, and axillary temperature probe were applied, and peripheral venous access was established. Anesthesia was induced with 150 mg intravenous thiopental, 20 μg intravenous sufentanil, and 4 mg intravenous pancuronium, and nasal tracheal intubation using a 5.5-mm-ID cuffed endotracheal tube was accomplished. After intubation, two peripheral intravenous catheters, and a right radial arterial catheter were inserted. Anesthesia was maintained with 0.6–0.8% isoflurane and 60% N₂O in oxygen.

Central venous cannulation was attempted with a 5.0-French single-lumen catheter set (Cook 5.0-French single-lumen C PUMY-501-J-Z, 16 G, 15 cm). Using the 7.0-cm 18-G introducer needle, cannulation of the left internal jugular vein was attempted as the triculoperitoneal shunt traversed the right side of the patient’s neck. The vein was easily located with the 18-G introducer needle; however, it was impossible to pass the J-tipped guidewire beyond the level of the clavicle. After four unsuccessful attempts to advance the guidewire, this approach was abandoned, and a left subclavian vein approach was attempted. The 18-G introducer needle was inserted just lateral to the curvature at the midpoint of the clavicle and directed toward the sternal notch. On the third attempt, good return of dark blood was obtained. The J-tipped guidewire was advanced easily, followed by easy insertion of the dilator. The single-lumen catheter was then advanced easily into the vessel. Throughout the procedure, the patient remained hemodynamically stable, and the lungs were easily ventilated.

A postinsertion chest roentgenogram, performed because of the difficulty encountered with the catheter insertion, demonstrated an abnormal position of the catheter, which protruded 2–3 cm beyond the right heart border into the right hemithorax. The pressure waveform obtained was that of a pulmonary artery with pressures of 18/9 mmHg. Right pulmonary arterial placement of the catheter tip was confirmed by injection of contrast material through the catheter (fig. 1).

The surgical procedure was deferred and a general surgical consultation obtained. A decision was made to remove the catheter in the operating room. The trachea was reintubated with a 28-French (RUSCH 116100) left-sided, double-lumen endotracheal tube positioned with the assistance of a fiberoptic bronchoscope.

The 5.0-French catheter was removed under fluoroscopic observation with intermittent injection of contrast material. After withdrawal of the catheter from the right pulmonary artery, contrast extravasated into the left lung parenchyma. As the catheter was withdrawn further, contrast filled the left subclavian vein and finally outlined the left pleural space. A left thoracostomy tube was placed after removal of the catheter. After a 30-min observation in the operating room, during which there was no evidence of bleeding from the airway or the thoracostomy tube, the patient was transferred to the intensive care unit for observation. Before the patient left the operating room, the endotracheal tube was changed to a 6.5-mm-ID cuffed, single-lumen tube.

**Fig. 1. Right pulmonary arterial placement of catheter tip as confirmed by injection of contrast material.**

Followup chest roentgenograms showed slight widening of the mediastinum. Echocardiography revealed a very small pericardial effusion. After a precautionary period of observation, mechanical ventilatory support was discontinued on the first postoperative day, and the trachea was extubated.

**Discussion**

Unintended transarterial pulmonary artery cannulation during central venous catheterization has not been previously described. Arterial puncture is a relatively frequent complication of central venous access via the internal jugular vein occurring in 1.9–4.2% of attempts.¹² Methods described to confirm correct catheter placement include comparison of the flow and appearance of the aspirated blood to arterial blood, blood gas analysis, and transducing the pressure waveform via the catheter or Seldinger needle placed as an introducer for the guidewire.²³ In our case, the pulmonary artery appeared to have been entered after initial cannulation of the left subclavian vein. Whether it was the 7.0-cm 18-G introducer needle or the dilator that exited the subclavian vein and perforated the pulmonary artery is not known. As the pulmonary artery is part of a low-pressure system and contains deoxygenated blood, identification of a pulmonary arterial cannulation was made more difficult. Although the chest roentgenogram suggested pulmonary artery catheterization, it was not until we had recorded intravascular pressures and obtained the angiogram that pulmonary artery catheterization was confirmed.
Most often an unintended arterial puncture may be managed simply by the application of direct pressure. In this case, however, the pulmonary artery was not accessible to direct pressure. We opted to manage the catheter removal in a similar fashion to that of a pulmonary artery rupture associated with pulmonary artery catheterization. A double-lumen endotracheal tube was inserted to isolate potential hemorrhage to the involved lung. The double-lumen tube would have facilitated the selective application of PEEP if hemorrhage had occurred. A surgical team was trained to perform an urgent thoracotomy should the patient have uncontrolled blood loss on removal of the catheter. Had hemorrhage occurred, its management would have been complicated by the absence of a balloon to inflate proximal to the puncture site. Also, if the bleeding had been significant enough to have warranted thoracotomy and surgical exploration, there would no longer have been a catheter present to assist in localizing the site of blood loss.

This case report demonstrates the importance of confirmation of correct catheter positioning before utilization, particularly when the catheter insertion has been technically difficult or the anatomy is unusual. The observation of blood color and flow characteristics as a method to identify arterial cannulation is unreliable. We would recommend that vascular pressure in the Seldinger needle or small catheter used to introduce the guidewire be transduced and the pressure waveform examined to confirm venous cannulation, especially when technical difficulties or anatomic abnormalities exist. This case also serves to emphasize the need to carefully consider the risk-to-benefit ratio of invasive monitoring techniques, particularly in the presence of grossly distorted anatomy. Although the additional information provided by the measurement of filling pressures would have been useful, the proposed procedure could have been performed safely with arterial pressure monitoring and large-bore intravenous access. If the malpositioned catheter had gone unrecognized and had catheter removal not been carried out in a prepared, controlled setting, diagnosis and appropriate management of a pulmonary hemorrhage, had it occurred, would have been significantly delayed.

References

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