

Internal mammary artery injury after central venous catheterization

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Objective: We describe an infrequent but potentially lethal complication: an iatrogenic injury of the internal mammary artery after central venous catheterization.

Design: Report of cases.

Setting: Pediatric intensive care unit.

Patients: The first patient we report on is a 3-yr-old girl who was severely neurologically damaged and was admitted to the pediatric intensive care unit for aspiration pneumonia and septic shock. Immediately after vein cannulation on the left internal jugular vein, the patient suffered hypotension and cardiac arrest, secondary to an adequately drained massive hemothorax. Restoration of spontaneous circulation was initially achieved, and the patient was transferred to the angiographic suite. Selective angiography during cardiopulmonary resuscitation for a second cardiac arrest revealed a laceration of the internal mammary artery. Resuscitation was not successful, and the patient died. The second case reported is a 7-yr-old girl admitted for bone marrow transplantation. She was electively taken to the angiographic suite for central venous insertion. An infraclavicular approach of the right subclavian vein was attempted, but radioscopy showed the guidewire inside the pleural space. Soon thereafter,

the patient became hypotensive and was in shock. Radioscopy showed a large pleural effusion and a massive hemothorax was drained. Selective angiography demonstrated an injured internal mammary artery was embolized. Hemodynamics improved, and the patient was transferred to the pediatric intensive care unit, where she was extubated 12 hrs later.

Interventions: None.

Conclusions: Central venous catheter placement in the intrathoracic vein may cause potentially lethal complications in the form of an injury to the internal mammary artery. Hypotension during or immediately after the procedure should be a warning of a serious adverse event, such as massive hemothorax, that may compromise life. Adequate drainage of the pleural cavity may not completely relieve vascular compression if some of the bleeding from an injured internal mammary artery is extrapleural. Early diagnosis and treatment by selective embolization of the injured vessel in interventional radiology is the first therapeutic choice and may be life saving. (*Pediatr Crit Care Med* 2007; 8:489–491)

KEY WORDS: internal mammary artery; central venous catheter; embolization; hemothorax

Complications related to central venous catheter (CVC) placement into the thoracic vein tend to be underestimated and may eventually be harmful (1). Our objective is to report an infrequent but potentially lethal complication: iatrogenic injury of the internal mammary artery (IMA) during CVC catheterization.

Our institutional review board waived the need for informed consent for this study.

CASE REPORTS

Patient 1. A 3-yr-old girl, 15 kg, who was severely neurologically damaged secondary to progressive metabolic encephalopathy was admitted to the pediatric intensive care unit (ICU) with a diagnosis of aspiration pneumonia and septic shock. She developed multiorgan failure, and 48 hrs later, she needed renal replacement therapy. The parents refused limitation of care. General surgery advised against peritoneal dialysis because of the history of previous surgeries. A decision was made to catheterize the patient's left internal jugular vein with a 5-Fr catheter and replace the femoral catheter she already had for dialysis. Her coagulation profile was as follows: platelet count (10^3 cells/mm³), 135; prothrombin time, 50%; partial thromboplastin

time, 57 secs. The left internal jugular vein was approached at the apex of the sternocleidomastoid triangle. During the first attempt, blood was obtained in the syringe and the guidewire was advanced with difficulty, resulting in the needle and wire being removed. Immediately after, the patient became hypotensive and her arterial saturation dropped. Air entry decreased in the left chest. A catheter was inserted over the needle to drain a probable pneumothorax. The patient did not improve. Fluid boluses were started, and vasopressor drugs and the ventilator setting were increased. A chest tube was placed, and a moderate amount of blood was obtained. The patient's condition continued to deteriorate, and she suffered a cardiac arrest. Restoration of circulation was achieved after a few minutes. A second chest tube was inserted, and the patient was transferred to the angiographic suite. She had another cardiac arrest, and cardiopulmonary resuscita-

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tion was started again. Active bleeding from the laceration of the left IMA near its origin in the subclavian artery was diagnosed through selective angiography (Fig. 1). The patient did not respond to cardiopulmonary resuscitation and died. Radioscopy showed a white left chest with a mediastinal shift to the opposite side.

Patient 2. A 7-yr-old girl, 30 kg, with a diagnosis of myelodysplasia was admitted to the hospital for bone marrow transplantation. She was electively taken to the angiographic suite for placement of a CVC. Her coagulation

profile was as follows: platelet count (10^3 cells/mm³), 45; prothrombin time, 85%; partial thromboplastin time, 37 secs. She was initially intubated, and an infraclavicular approach was attempted in the right subclavian vein with a 7-Fr catheter. After the first puncture, the guidewire was advanced, but radioscopy demonstrated its position inside the pleural space. It was removed, and a new attempt was begun in the left internal jugular vein. The catheter was inserted without difficulty, but during the procedure, the patient became hy-

potensive and was in shock. Radioscopy showed a 5-cm right pleural effusion. A right chest tube was placed, and a significant amount of blood was obtained. Fluid resuscitation was started at the same time that selective arterial angiography was initiated. Active bleeding from laceration of the right IMA was diagnosed (Fig. 2), and embolization with coils allowed the hemorrhage to be stopped (Fig. 3). Hypovolemia was controlled in the angiographic suite with the infusion of 1 L of normal saline, four units of platelets, and two units of packed red blood cells (hematocrit had dropped from 32% to 11%). The patient was transferred to the pediatric ICU, intubated, and ventilated. Her clinical course was unremarkable, and mechanical ventilation was discontinued 12 hrs later.

DISCUSSION

Although hemothorax is an uncommon complication of CVC placement in pediatric patients, it may be life threatening (1–3). The report of these two patients describes an infrequent but potentially lethal complication. Iatrogenic injury of the IMA should be included in the differential diagnosis of catastrophic situations following CVC insertion, which necessitates selective arterial embolization be considered of great value for its management.

Similar complications have been described regarding attempts at cannulation of the internal jugular vein (4) and the subclavian vein (5, 6). There are also reports of fatal hemothoraces related to CVC placement (1, 2), in which the source of bleeding was not described, probably because of the difficulties in performing diagnostic or therapeutic procedures owing to the rapid sequence of adverse events. The insertion of the CVC into the femoral vein avoids these types of complications and is not associated with episodes of catheter-related sepsis (7).

In both patients, the first sign that something serious had occurred was arterial hypotension. The first patient went rapidly into cardiac arrest, despite the pleural space being drained, fluids being infused, and vasopressor drugs being adjusted. The initial response to cardiopulmonary resuscitation was adequate, but a new arrest occurred during transport to the angiographic suite. A laceration of the IMA was diagnosed, but there was no

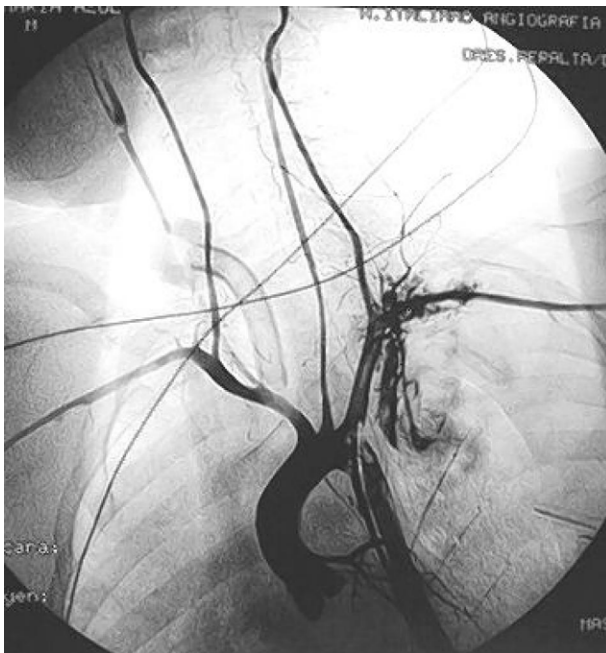


Figure 1. Patient 1: Laceration of the left internal mammary artery.

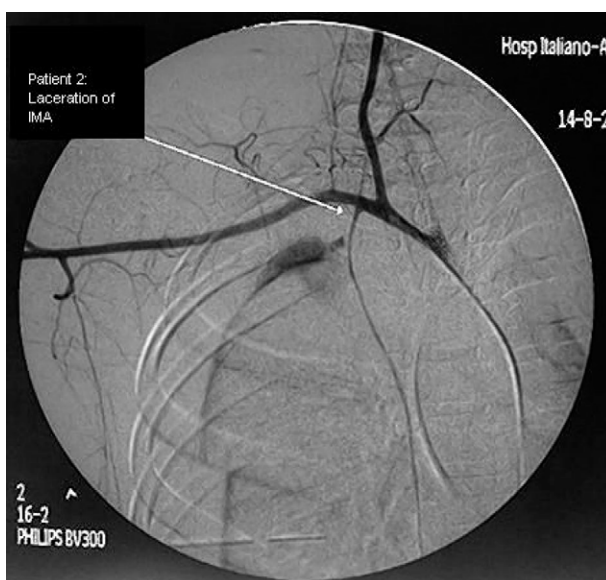


Figure 2. Patient 2: Laceration of the right internal mammary artery (IMA).

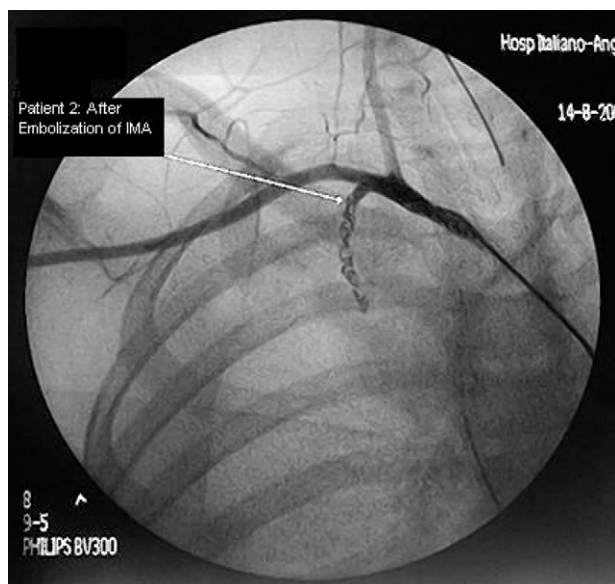


Figure 3. Patient 2: Embolization of the right internal mammary artery (IMA).

time to repair it. Injuries of the IMA can produce extrapleural hematomas because of the artery's anatomical location (8, 9). For this patient, the injured IMA may have produced not only the hemothorax, but also an extrapleural bleeding that caused compression of the mediastinal vessels and cardiovascular collapse, which could not be relieved by adequately draining the pleural space (10). Central venous pressure, documented after the chest was drained and before the second cardiac arrest, was 20 cm H₂O—2.5 times higher than the starting values.

The second patient's IMA was injured in the angiographic suite. We believe this was a determinant for the good outcome, because the complication was immediately treated with selective embolization of the IMA, which has been shown to be an effective alternative to conventional surgical management (11) and, therefore, makes it the first therapeutic choice. Scheduled placement of the CVC in pediatric ambulatory or ward patients has been performed in the angiographic suite by pediatric surgeons for several years. This policy has facilitated early diagnosis and treatment of potential complications. A small group of pediatric ICU patients, in whom difficult central venous access is anticipated, are also transferred to the angiographic suite for the procedure.

Another way to facilitate CVC insertion is with ultrasound guidance. Its usefulness to improve the rate of can-

nulation of the internal jugular vein has been demonstrated (12), although this benefit is not very clear in young pediatric patients (13, 14). Ultrasound guidance is not a routine practice for cannulation of central veins in emergency situations in our pediatric ICU, although it is frequently used for cannulation of the internal jugular vein in scheduled procedures in the angiographic suite.

In summary, CVC placement into intrathoracic veins may cause potentially lethal complications as an injury of the IMA. Hypotension during or immediately after the procedure should be a warning of a serious adverse event, as massive hemothorax may compromise life through compression of mediastinal vessels and cardiovascular collapse. Adequate drainage of the pleural cavity may not completely relieve vascular compression if some of the bleeding from an injured IMA is extrapleural. Early diagnosis and treatment by selective embolization of the injured vessel in interventional radiology is the first therapeutic choice and may be life saving. The angiographic suite may be the best setting for scheduled placement of a CVC for immediate response to possible complications (15, 16).

REFERENCES

1. Bagwell C, Salzberg A, Sonnino R, et al: Potentially lethal complications of central

- venous catheter placement. *J Pediatr Surg* 2000; 35:709–713
2. Casado Flores J, Barja J, Martino R, et al: Complications of central venous catheterization in critically ill children. *Pediatr Crit Care Med* 2001; 2:57–62
3. Waddington M, Mullins G: Early complication of pediatric central venous cannulation. *Paediatr Anaesth* 2005; 15:1001–1005
4. Abbott G, Evans P: Therapeutic embolization of an internal mammary artery damaged by placement of a central venous catheter. *Br J Anaesth* 2001; 86:143–145
5. Kulkarni R, Moreyra AE: Left internal mammary artery perforation during Swan Ganz catheter insertion. *Cathet Cardiovasc Diagn* 1998; 44:317–319
6. Hama Y, Kaji T, Fujii M, et al: Internal mammary artery injury following subclavian vein catheterization. *Emerg Radiol* 2005; 11: 170–172
7. Garcia Teresa MA, Casado Flores J, Delgado Dominguez MA, et al: Infectious complications of percutaneous central venous catheterization in pediatric patients: A Spanish multicenter study. *Intensive Care Med* 2007; January 19 [Epub ahead of print]
8. Portel L, Hilbert G, Gruson D, et al: An opacity in the chest following a subclavian catheterization. *Eur Respir J* 1998; 11:982–985
9. Mohlala ML, Vanker EA, Ballaram RS: Internal mammary artery haematoma. *S Afr J Surg* 1989; 27:136–138
10. Ortega Carnicer J, Ambrós Checa A, Diarte De Miguel J, et al: Taponamiento mediastínico agudo y derrame pleural bilateral masivo tras cateterización venosa central. *Med Intensiva* 2006; 30:297–298
11. Whigham CJ, Fisher RG, Goodman CJ, et al: Traumatic injury of the internal mammary artery: Embolization versus surgical and nonoperative management. *Emerg Radiol* 2002; 9:201–207
12. Hind D, Calvert N, McWilliams R, et al: Ultrasonic locating devices for central venous cannulation: Meta-analysis. *BMJ* 2003; 327:361
13. Arai T, Yamashita M: Audio-Doppler guidance using a small-caliber Doppler probe for internal jugular venous puncture for central venous catheterization in infants and children. *Paediatr Anaesth* 2004; 14: 744–747
14. Leyvi G, Taylor DG, Reith E, et al: Utility of ultrasound guided central venous cannulation in pediatric surgical patients: A clinical series. *Paediatr Anaesth* 2005; 15: 953–958
15. Lee M, Mossop P, Vrazas J: Central venous catheter placement by an interventional radiology unit: An Australian experience. *Australas Radiol* 2007; 51:35–41
16. Tseng M, Sadler D, Wong J, et al: Radiologic placement of central venous catheters: Rates of success and immediate complications in 3412 cases. *Can Assoc Radiol J* 2001; 52:379–384