Case Report

Successful Bleeding Control by a Combined Conventional Surgical Approach and Video-Assisted Surgery: A Case Report

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The use of central venous catheters (CVCs) nowadays is a routine practice in the treatment of severely acute-diseased children. However, the procedure still carries a risk of morbidity, and severe complications are reported. When respiratory and/or hemodynamic instability develop after the procedure, prompt patient evaluation to exclude iatrogenic damage is mandatory, regardless of the primary patient condition. If a vascular injury related to CVC placement procedure is detected, the availability of an interventional radiologist and/or any surgical facilities plays an important role in the management of this life-threatening complication. We report the case of a 12-year-old boy hospitalized in the Pediatric Intensive Care Unit of our hospital for a severe motorveicle accident, who, about 30 minutes from the percutaneous CVC placement, developed tachycardia, hipoxemia, and hypotension. A chest X-ray confirmed the right positioning of the catheter, the presence also of a large left hemothorax. Interventional radiology took place, but it failed to stop the bleeding. Urgent anterolateral thoracotomy was performed while the patient was kept in a supine position because of a cervical spine luxation. During surgery, bleeding was found coming from the thoracic dome and because of a tear next to the left subclavian artery. Access to that area was technically difficult; after blood and clots were removed, multiple attempts to obtain the hemostasis failed, and definitive control of the hemorrhage was achieved only by video-assisted thoracic surgery (VATS). The postoperative period was uneventful. In this study, the authors discuss the management of this kind of complication and the value of a combined surgical approach (conventional, with a minimal access surgery procedure such as VATS) in the treatment of thoracic vascular injuries related to the insertion of a percutaneous CVC. To the best of our experience, this is the first time in which this combination of procedures has been reported in the literature. (Ann Thorac Cardiovasc Surg 2009; 15: 253–256)

Key words: central venous catheter, percutaneous cannulation, vascular injury, hemothorax, video-assisted thoracic surgery

Introduction

The percutaneous cannulation of a central vein (PCCV) is one of the most commonly performed procedures in pediatrics, and it is now commonplace in the care of chronically and critically ill children. Although it is considered relatively safe and reliable, several authors have experienced many immediate and long-term complica-

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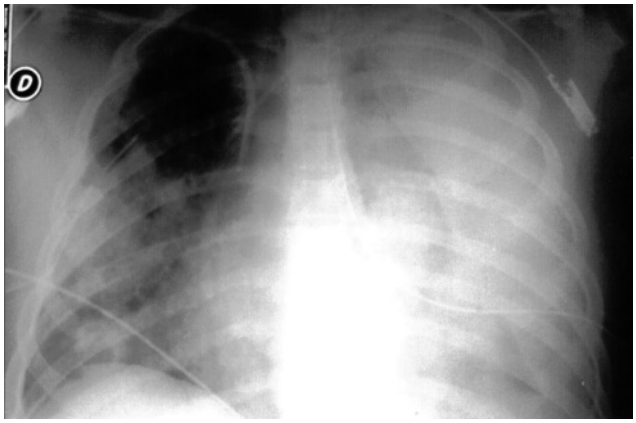

Fig. 1. Significant left hemothorax following the central venous catheter positioning in the left subclavian vein.

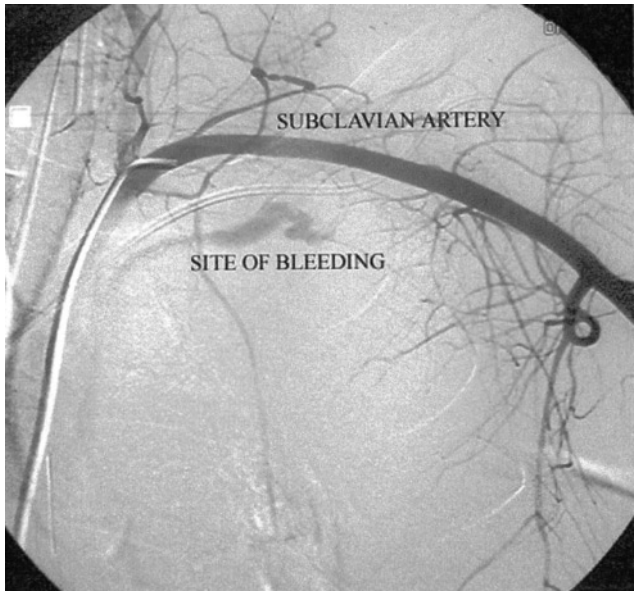

Fig. 2. Selective arteriography showing a site of bleeding next to the left subclavian artery.

tions, most of them minor, but a few cases were serious and life-threatening.[1–4] The technical aspects of the procedure should be strictly followed. Prompt evaluation of the clinical status coupled with radiological investigations and/or surgical evaluation for urgent treatment must be considered upon the occurrence of any deviation from patient hemodynamic stability during or after the procedure. We describe a case of massive hemothorax with hypovolemic shock following a central venous catheter (CVC) insertion in a critically ill child. The hemorrhage was successfully controlled only by a combination of the conventional surgical approach with a minimal access surgery procedure, such as video-assisted thoracic surgery (VATS), pursed after the failure of an interventional radiological approach.

Case

A 12-year-old boy was the victim of a severe motorcycle crash. He was found unconscious with cardiac arrest, and before being transferred to our hospital, he was intubated and resuscitated on the road. Upon admission into our Pediatric Intensive Care Unit (PICU), his hemodynamic status was stable. Radiological investigations showed head injuries with tentorial hemorrhage, multiple cerebral areas of ischemic injury and cerebral oedema, C2–C3 vertebral luxation without spinal cord injury, multiple right rib fractures, and right tension pneumothorax that was immediately drained. A rigid orthopedic device was applied to allow cervical spine stabilization, and a percutaneous CVC was inserted through the left subclavian vein. The first attempt to position a double lumen 7 F diameter CVC failed; the guide wire, the dilator, and the catheter were easily positioned, but the lack of blood reflux from the catheter was an indication to remove it. A second attempt appeared to be uncomplicated.

A scheduled postprocedural chest X-ray confirmed the right positioning of the catheter and the presence of a large hemothorax (Fig. 1). Only a few minutes later, the patient developed hemodynamic instability with tachycardia, hypoxia, and hypotension . A 30 F chest tube was inserted percutaneously, and 1,300 cc of blood was evacuated. One hour later, despite intensive fluid resuscitations and vasopressive drug administration, his hemodynamic status continued to deteriorate. A new chest X-ray showed the persistence of a large hemothorax. The patient was transferred to the angiographic suite for endovascular hemostasis. A vascular blush was detected along and next to the left subclavian artery, albeit no precise bleeding source could be clearly identified (Fig. 2). Therefore after some unsuccessful attempts to stop bleeding by particle embolization, the patient was urgently transferred to the operating room. Until that time he had received 2 L both of crystalloids and colloids, 10 U of packed erythrocytes, 1.2 L of fresh frozen plasma, and 2 pools of platelets to maintain satisfactory arterial blood pressure. Because of the cervical spine luxation, the orthopedic device fixed on the thorax was not removed. A left anterolateral thoracotomy at the sixth intercostal space was performed with the patient kept in a supine position, head and shoulders neutral, and arms by the side. At surgery,

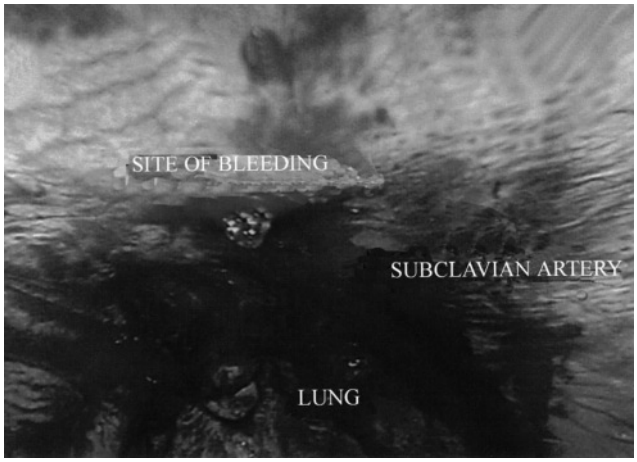

Fig. 3. Active bleeding next to the left subclavian artery.

bleeding was found to come from the dome of the thorax and was related to a tear next to the left subclavian artery. Access to that area was technically difficult: after a removal of blood and clots, a temporary and unsatisfactory hemostasis was achieved by finger pressure. A thoracoscope (Karl Storz optic, 5 mm 30°) was then introduced through the thoracotomy to the upper thorax. The thoracoscope magnification clearly revealed the bleeding site (Fig. 3). A laparoscopic needle holder was introduced via thoracotomy, and under the thoracoscopic view, a 4/0 prolene X stitch was placed on the pleural surface at the tear site, thus achieving a definitive arrest of the hemorrhage. The postoperative course was uneventful. Three weeks after surgery, the patient underwent the scheduled neurosurgical procedure, and 1 month after admission to our PICU, he was discharged to a long-term care residency.

Discussion

Exhaustive data regarding the hemorrhagic complication rates from PCCV in pediatric patients are still lacking. In a review of a 10-year experience with pediatric patients, Johnson et al. found a 0.5% incidence of hemothorax and no mortality with CVC placement.[5] Other authors reported higher complication rates[1,2] with potentially lethal or fatal complications, mostly resulting from hemothorax and cardiac perforation with subsequent cardiac tamponade.[4,6,7] In a reference made through an American Pediatric Surgical Association directory questionnaire about CVC placement for acute life-threatening events submitted to pediatric surgeons, 18 out of 19 reported cases occurred after a percutaneous stick of the vessel; a thoracotomy for hemothorax was performed on 16 children (11 survivors), and vascular injury to the subclavian artery or vein was noted in most of the operations.[1] Multiple and/or failed attempts at primary site and catheter misplacements are independent risk factors of bleeding during PCCV. The age and sex of the patient, type of catheter, primary disease, and indication for cannulation appears to be unrelated to an increase of complications.[5] General anesthesia, strict adhesion to a well-established technique, appropriately size-matched catheter, Trendelenburg position with arms by the side and shoulders braced and pulled down with a small pillow beneath the vertebral column between the scapulae, respect of traditional landmarks, interrupting the procedure if resistance is encountered when passing the guide wire or the sheet,[8] and the use of real-time ultrasound venipuncture have been reported to reduce the incidence of hemorrhagic complications.[9,10]

When a severe thoracic hemorrhage occurs after an inadvertent subclavian artery puncture, the management of this life-threatening complication includes percutaneous arterial stentgrafting, intra-arterial balloon compression, percutaneous arterial embolization, and finally surgical repair. In our patient, we first attempted to stop bleeding by interventional radiology. The percutaneous particle embolization technique was chosen since the artery stenting was not indicated because no precise subclavian artery tear was detected at angiography. We can only speculate that most probably some subclavian artery collateral or the first intercostal artery was damaged during the PCCV. In the literature, massive hemothorax has been reported to be a primary contraindication for VATS, and for this reason we planned a conventional surgical approach. At surgery, bleeding was found to come from the dome of the pleural cavity. Access to that area is technically difficult also during elective surgery; in our patient a further major limitation was derived from the mandatory supine position on the operating table. That was due to the orthopedic device we had to keep in place during the operation to avoid cervical spine damage, being the surgical exploration of the thorax feasible only through an antero-lateral thoracotomy.

The presence of active and profuse arterial bleeding from the thoracic dome resulted in the failure of all attempt to obtain an efficacious control of the hemorrhage, even after the complete removal of blood and clots from the thorax. Lastly, the definitive control of the hemorrhage was achieved only by means of VATS. A 5 mm

30° thoracoscope was introduced throughout the thoracic incision up to the thoracic dome, and with this optical angulation and magnification, the site of the bleeding was easily identified. As mentioned above, we too agree that VATS is not a safe procedure as a primary surgical option in a hemodynamically unstable patient because of an iatrogenic hemothorax. Nevertheless, we believe that in this critical surgical setting the combination of a traditional surgical approach with a new technology like VATS is the key to success that otherwise would be unlikely by the use of standard thoracotomy alone, as depicted in our patient.

Conclusion

An injury of subclavian vessels may be challenging to a surgeon. In this critical surgical scenario, all technical facilities must be available to gain the control of bleeding. The combination of an urgent thoracotomy and VATS was rarely reported in the literature, but as depicted in this case report, it must be considered in this critical surgical setting.

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