

### Complications of femoral venous catheterization in critically ill patients

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**C**entral venous catheters are being increasingly used in both Intensive Care Units (ICUs) and general wards. Unfortunately, their use is associated with adverse events that are both hazardous to the patients and expensive to treat. More than 15% of patients who receive these catheters have complications. In this report, a 67-year-old lady, a known case of diabetes mellitus, hypertension and ischemic heart disease, was admitted to the hospital with complaints of faulty bowel habits and nausea for the past 3-months, with periumbilical abdominal pain. Ultrasound of the abdomen showed a distended gall bladder with non-obstructing choledocholithiasis with a dilated common bile duct. Barium enema did not show any obstruction. Accordingly, endoscopic retrograde cholangio-pancreaticography (ERCP) was carried out for the patient. Post ERCP, the patient developed high fever and drowsiness, and later became unresponsive and suffered major desaturations with acute respiratory distress. She was shifted to the ICU on mechanical ventilation. She was hypothermic (36.6°C), hypotensive (blood pressure 40/30mm Hg) with a mean arterial pressure of 32 mm Hg, on maximum inotropic support, heart rate was 116/minute, with cold extremities and pain in the left hypochondriac region. She was diagnosed to have septic shock secondary to cholangitis. The patient was resuscitated with intravenous fluids. A left femoral venous line was inserted after 3 unsuccessful attempts. Since the patient was coagulopathic, she developed an expanding hematoma in the left groin, which increased gradually in size within a few hours. The girth of her thigh increased to 73 cm and the patient's hemoglobin dropped from 9.2 g/dL to 4.5 g/dL. Doppler ultrasound was carried out; it showed a large hematoma (**Figure 1**) with subcutaneous edema in the femoral vein, but a good flow was noted in the femoral and popliteal arteries. Next day her condition deteriorated further and went into multi-organ failure. A pulmonary artery catheter (Swan-Ganz) was inserted. Although intense supportive care was given, the patient developed disseminated intravascular coagulopathy (DIC) and expired. Percutaneous central venous catheterization (PCVC) is a commonly used procedure in medical practice today. It provides a



Figure 1 - Doppler ultrasound of a large hematoma with subcutaneous edema in the femoral vein.

temporary venous access for fluid maintenance, hemodynamic monitoring, intravenous medications, hemodialysis, and total parenteral nutrition (TPN). Although safety and efficacy of this techniques are well documented, numerous serious and potentially fatal complications may result. The most important risk factors for developing these complications are patient characteristics (morbidity, underlying disease and local anatomy), the expertise of the doctor performing the procedure, and nursing care.

Mechanical complications are reported to occur in 5-19% of patients, infectious complications in 5-26%, and thrombotic complications in 2-26% of patients.<sup>1</sup> Of the serious complications that have been reported, pneumothorax and hematoma occurring in up to 5% of these cases are the most common. Catheterization of femoral vein is preferred when injuries above the diaphragm are suspected, or patient is coagulopathic. It may be the first choice in hemodynamically unstable patients. A femoral venous catheter must be changed to either an internal jugular or a subclavian line due to the incidence of thrombosis (as high as 40%).<sup>2</sup> The choice of insertion site can influence the incidence and type of such complications. Femoral venous catheterization is associated with a greater risk of infectious and thrombotic complications than subclavian catheterization in ICU patients.<sup>2</sup> Thrombosis rates vary from 6.6-25%, complete thrombosis of the vessel is reported in 6% of cases. Risk of pulmonary emboli from the upper extremity range from 9-36% whereas from the central lower extremities it can be as much as 50%.<sup>2</sup> The risk of catheter-related thrombosis varies according to the site of insertion. Subclavian venous catheterization carries the lowest risk of catheter-related thrombosis (1.9%). Varying reports are present in the literature regarding infection. Earlier reports stated greater infection rates with the femoral approach, but recent

literature suggests this may not be true.<sup>2</sup> However, good preparation of the area with the use of maximal sterile-barrier precautions, and administration of antibiotic via the catheter all can decrease the rate of catheter-related bloodstream infections.<sup>1</sup> An arterial puncture, hematoma, and pneumothorax are the most common mechanical complications during the insertion of central venous catheters. Overall, internal jugular catheterization and subclavian venous catheterization carry similar risks of mechanical complications. Hematoma and arterial puncture are common during femoral venous catheterization. Mechanical complications are most likely during catheterization at the femoral site, the internal jugular or subclavian venous route should be chosen unless contraindicated. However, the rate of serious mechanical complications (such as pneumothorax requiring insertion of a chest tube or hemorrhage requiring blood transfusion or surgery) associated with subclavian insertion is similar to that associated with femoral insertion.<sup>1</sup> The most common mechanical complication is a femoral or retroperitoneal hematoma, up to 1.3%. Risk factors for mechanical complications include the duration of insertion and placement during the night. Use of the Doppler-assisted introducer needle provided a statistically significant decrease in cannulation failures, especially when cannulating obese patients or patients with coagulopathy. It is of more benefit during internal jugular venous catheterization, it reduces the number of mechanical complications, the number of catheter placement failures, and the time required for insertion.<sup>3</sup> However, its use during subclavian venous catheterization has had mixed results in clinical trials, probably for anatomical reasons. Arterial puncture is easy to identify, in normotensive patients with normal oxygen saturation, by the pulsatile flow into the syringe and the bright red color of the blood. If there is any doubt regarding placement of the introducer needle, an 18 gauge, single lumen catheter can be inserted over the wire and into the vessel, then it can be connected into a pressure transducer to confirm the presence of venous waveforms and venous pressure. Or a

simultaneous samples of blood can be drawn to measure the gases; one from the catheter and another from the artery. If there is a substantial difference in the oxygen tension, the catheter should be located in the vein.<sup>1</sup> Inexperience operator has been correlated with increased incidence of complications and insertion failures. Eisenhower et al<sup>4</sup> showed that the majority of complications have occurred when inexperienced house staff did the catheterizations. These operators had a major mechanical complication rate of 4.8%, while more experienced operators had a rate of 2.6%.<sup>4</sup> In a similar study, insertion complications and failure rates were significantly higher for physicians who had carried out fewer than 50 catheterizations.<sup>5</sup> Experienced physicians succeeded in cannulation in approximately 90% of attempts, with a complication rate of 5.4%.<sup>5</sup>

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