

A Complication of Femoral Arterial Cannulation in a Patient Undergoing Cardiopulmonary Bypass

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Catheterization of needle puncture of the femoral artery may result in hemorrhage, occlusion of proximal and/or distal vessels, formation of false aneurysms, or formation of hematoma at the puncture site. Incidences of reported complications have ranged from 0.8¹ to 2.2 per cent.² Higher incidences are associated with coronary angiographic procedures, which carry the additional risks of myocardial infarction, cerebrovascular accident, aortic perforations, ventricular fibrillation, and anaphylactic reaction to the contrast medium.³

Thrombosis is the most common complication. It usually occurs at the site of needle puncture, and often results from prolonged direct pressure applied to control bleeding.^{4,5} The incidence of thrombosis has been greatly reduced by rigid adherence to protocols designed to preserve distal pulses in the ipsilateral limb.^{5,6}

False aneurysm and massive hematoma have been reported.^{1,6} Their occurrence is usually attributed to inadequate or absent digital pressure over the arterial puncture site. Careful adherence to the technical procedures has reduced these complications significantly.

Perforation with hemorrhage is not uncommon; it usually responds to conservative management,^{1,4} and is usually directly related to manipulation of the catheter.

Anticoagulation measures necessary for the patient on cardiopulmonary bypass significantly increase risks of hemorrhage from any site of arterial puncture. We wish to report our experience with one such patient.

REPORT OF A CASE

A 27-year-old black woman who had a provisional diagnosis of Marfan's syndrome was brought to the operating room February 17, 1977, for resection of a 4-cm aneurysm of the ascending

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aorta and replacement of an incompetent aortic valve. The patient reported a history of slight dyspnea and occasional anginal pain on exertion. The history was otherwise unremarkable. Physical examination revealed loud systolic and diastolic murmurs and a hyperkinetic precordium; electrocardiography showed left ventricular hypertrophy; results of laboratory studies were unremarkable. Preoperative blood pressure was 140/90 torr.

The patient received 10 mg morphine sulfate, 50 mg, hydroxyzine, and atropine sulfate, 0.6 mg, iv, an hour before operation. Anesthesia was induced with 15 mg diazepam and 3 per cent enflurane. Tracheal intubation was facilitated by succinylcholine, 100 mg, iv, and anesthesia was maintained with enflurane in 40 per cent oxygen-nitrous oxide. Ventilation was controlled by a volume-limited ventilator. The ECG recorded cardiac rate and rhythm; an esophageal stethoscope was used to monitor heart sounds, and thermistor probes were placed in the esophagus and rectum. A #7-French quadruple-lumen flow-directed balloon-tipped thermodilution catheter was positioned in the pulmonary artery, as confirmed by transduced pressure-wave patterns. Pulmonary arterial and pulmonary capillary wedge pressures were 23/12 and 12 torr, respectively. Cardiac output was 3.9 l/min prior to the surgical procedure. Blood pressures during induction ranged from 150/90 to 120/70 torr; pulmonary capillary wedge pressures remained between 10 and 15 torr.

Two attempts were made to catheterize the femoral artery at the level of the inguinal ligament with an Angiocath 19-gauge, 12-cm catheter. This catheter yielded central aortic pressures with the best frequency response. Pulsatile flow of bright red arterial blood was obtained, but the flexible catheter could not be passed into the lumen. Cannulation of the left radial artery was then accomplished. Manual pressure was applied to the femoral puncture sites for 5 min, and no hematoma formation was seen.

The operative procedure, which consisted of aortic graft and valve replacement during cardiopulmonary bypass and potassium-induced cardioplegia, was accomplished without difficulty, and the patient was successfully removed from cardiopulmonary bypass. During the closing procedure, abdominal distention was noticed; passage of a nasogastric sump partially relieved this distention. The patient was taken to the recovery area successfully maintaining her own perfusion, with a positive fluid balance of 1.5 l from cardiopulmonary bypass. The clotting profile of blood drawn 30 minutes after administration of protamine sulfate revealed that no heparin was present and that the patient had adequate platelet and fibrinogen levels, with normal prothrombin time and partial thromboplastin time.

In the recovery room the patient had slight hypertension, decreased pulmonary capillary wedge pressure, and low cardiac output, which responded promptly to administration of colloid and crystalloid fluids. Over the next 24 hours in the recovery area the patient received 11 units of packed erythrocytes, 15 units of fresh frozen and stored plasma, 5 units of crystalloid, and platelets and cryoprecipitate as dictated by serial clotting factor profile. Drainage from the chest was minimal, and urinary output averaged about 100 ml/hour, while the abdominal distention increased.

On the evening of the first postoperative day, vital signs deteriorated, with progressive hypotension, abdominal distention increased. The decision to explore the abdomen was made, and the patient was immediately taken to the operating room. Exploratory laparotomy revealed a massive retroperitoneal hematoma that compressed the mesenteric artery and inferior vena cava and impeded venous return from the abdomen and lower extremities. The hematoma apparently originated from two puncture sites in the external iliac artery 2 cm above the inguinal ligament. The artery appeared otherwise grossly normal.

Upon evacuation of 5.6 l of clotted blood from the area of the hematoma and the infusion of 2 units of plasma, the blood pressure rose to preoperative levels. The abdomen was closed and the patient was returned to the recovery area.

After a prolonged stay in the surgical intensive care area, the patient was returned to the cardiac postoperative ward, where recovery was uneventful.

DISCUSSION

The normalcy of the clotting profile throughout the procedures suggests that the etiology of the hematoma was physical rather than related to defective coagulation. Any puncture of the external iliac artery just above the inguinal ligament can result in retroperitoneal hemorrhage that will be unnoticeable unless it is massive. Although puncture of the femoral artery below the ligament makes threading of the flexible catheter more difficult, bleeding in this more confined space will be noticed much earlier, and the appropriate therapy can be instituted. Punctures should be

attempted at least 3 cm below the level of the inguinal ligament.

When any catheter is withdrawn from the femoral puncture site, manual pressure sufficient to control bleeding, but not sufficient to decrease peripheral pressure, should be applied for at least 15 minutes, or longer when necessary to control bleeding. The area should be included in the operative field so that any subsequent hemorrhage and/or hematoma can be quickly observed. Should bleeding persist, surgical exploration of the area may be necessary to discover and repair any damaged vessels.

REFERENCES

1. Bolasney BL, Killen DA: Surgical management of arterial injuries secondary to angiography. *Ann Surg* 174:962-964, 1971
2. Shah A, Gnoj J, Fisher VJ: Complications of selective coronary arteriography by the Judkin's technique. *Am Heart J* 90: 353-359, 1975
3. Page HL, Campbell WB: Percutaneous transfemoral coronary arteriography prevention of morbid complication. *Chest* 67:221-225, 1975
4. Morris T, Bouhoutsas J: The dangers of femoral artery puncture and catheterization. *Am Heart J* 89:260-261, 1975
5. Silverman JF, Wexler L: Complications of percutaneous transfemoral coronary arteriography. *Clin Radiol* 27:317-321, 1976
6. Seidenberg B, Harwitt ES: Retrograde femoral aortography: Surgical complications in 26 cases. *Ann Surg* 163:221-226, 1963