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Arterial Embolization in the Management of Abdominal and Retroperitoneal Hemorrhage

KATHERINE A. O'HANLAN, M.D.,* JONATHAN TRAMBERT, M.D.,† LORNA RODRIGUEZ-RODRIGUEZ, M.D.,* GARY L. GOLDBERG, M.D., AND CAROLYN D. RUNOWICZ, M.D.*

*Department of Obstetrics and Gynecology, Division of Gynecologic Oncology, and †Department of Radiology, Albert Einstein College of Medicine of Yeshiva University, Bronx, New York 10461

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In the field of gynecologic oncology, surgical intervention has been the traditional management of postoperative abdominal hemorrhage. Recently, arterial embolization has been reported to effectively control vaginal hemorrhage associated with gynecologic malignancy, obstetrical trauma, and hysterectomy. This study reports the use of arteriographic embolization in the management of six cases of postoperative abdominal and retroperitoneal arterial hemorrhage. Analysis of these cases provides valuable information which enhances the safety and efficacy of this procedure. Results suggest that arterial embolization, by an experienced arteriographer, should be considered early in the postoperative management of abdominal hemorrhage in gynecology and gynecologic oncology. © 1989 Academic Press, Inc.

INTRODUCTION

Traditionally, postoperative abdominal hemorrhage has been managed by repeat surgical exploration. Alternative methods of achieving hemostasis might impact on the morbidity attendant to repeat surgery. In gynecology and gynecologic oncology, the use of arterial embolization has been limited to the control of vaginal hemorrhage in cases of advanced cervical malignancy [1], posthysterectomy vaginal cuff bleeding [2], and, recently, in a case of abdominal pregnancy [3]. In these circumstances, the anterior divisions of the internal iliac arteries were embolized. Indications for arterial embolization have multiplied as a result of the enhanced precision, efficacy, and safety of the procedure. Arterial embolization as primary therapy for postoperative abdominal and retroperitoneal hemorrhage has not been previously reported in gynecologic oncology.

There were six cases of postoperative abdominal hemorrhage managed by arterial embolization on the Gynecologic Oncology Service at the Albert Einstein College of Medicine from July 1985 to July 1987. Analysis of these cases is reported in this paper.

METHODS AND MATERIALS

Six patients underwent arterial embolization to control postoperative abdominal hemorrhage. Four patients had procedures performed for the treatment of gynecologic cancer. Two patients had postpartum intra-abdominal hemorrhage with the division of gynecologic oncology called in for consultation and management. In all cases, bleeding was clinically confined to either the retroperitoneum or the abdominal cavity.

All six patients had pelvic surgery. In the two obstetrical cases, the surgery was confined to the pelvis. Three patients underwent pelvic and para-aortic lymphadenectomy with a total abdominal hysterectomy and bilateral salpingo-oophorectomy. One patient additionally underwent upper abdominal cytoreductive surgery.

All angiographic procedures were performed by one radiologist (J.T.). Under sterile conditions, using local anesthesia, the angiographic catheter was percutaneously placed in the common femoral artery using the Seldinger technique [4]. When the surgery was confined to the pelvis, a pelvic aortogram was performed with the catheter tip just proximal to the aortic bifurcation. If the surgery had involved a para-aortic node dissection or debulking of upper abdominal tumor, an abdominal aortogram was additionally obtained. Selective studies of the lumbar arteries, posterior division of the internal iliac, hepatic and splenic arteries were also performed when the surgical procedures had involved these areas. Low-osmolality contrast media were utilized in studying the pelvis in order to minimize the discomfort associated

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with conventional high-osmolar contrast agents. Once an area of extravasation was demonstrated, the exact source of the extravasation was determined by superselective arteriography. If the source of extravasation could be superselectively catheterized, distal embolization was performed by injection of 1–2-mm Gelfoam pledgets (gelatin foam, Upjohn, Kalamazoo, MI) until arterial stasis was achieved. When superselective catheterization was not possible in patients with internal iliac artery anterior division bleeding, the superior gluteal artery was "protected" by proximal occlusion with a large Gelfoam plug, or steel coil. This prevented small embolic particles from flowing distally into the posterior division, while the remaining internal iliac artery was embolized with 1–2-mm Gelfoam pledgets. Collateral flow to the gluteal muscles was thus preserved, preventing ischemic symptoms. After embolization of the involved artery, a follow-up aortogram was routinely performed to assess the results.

RESULTS

The patients' age, diagnoses, surgical procedures, arteriographic findings, embolotherapy, and clinical outcome are summarized in Table 1.

Three of the six patients (Patients 1, 2, 3) were successfully embolized with hemostasis achieved.

Three patients (Nos. 4, 5, 6) required a surgical procedure to obtain hemostasis after embolotherapy. Patient 4 had contrast extravasation immediately to the right of the aortic bifurcation (Fig. 1). Selective study and distal embolization of the right third and fourth lumbar arteries, those thought to be closest to the site of extravasation, failed to achieve hemostasis. Persistent extravasation was identified from an ascending lumbar branch of the right iliolumbar artery. Severe respiratory compromise due to a hemoperitoneum mandated cessation of arteriography, and immediate reexploration. Surgery was im-

TABLE 1
Patient Data and Clinical Management

Patient	Surgery	Arteriography	Embolotherapy	Outcome
1. 52-years old Stage IV ovarian carcinoma	TAH/BSO Ileoascending colectomy with reanastomosis, sigmoid resection with reanastomosis, omentectomy, splenectomy	Left superior vesical artery extravasation	Bilateral distal embolization of internal iliac artery, anterior division	Hemostasis
2. 53-years old Stage IB cervical carcinoma	Rad. abd. hys./BSO and radical bilateral pelvic para-aortic lymphadenectomy	Right uterine artery extravasation	Distal embolization of right internal iliac anterior division branches	Respiratory embarrassment mandated surgical removal of blood clots. Hemostasis confirmed.
3. 31-years old Anterior low-lying placenta percreta	Caesarean section with cystotomy and repair	Saccular extravasation from uterine and superior vesical arteries	Distal embolization of bilateral internal iliac anterior division	Hemostasis
4. 60-years old Stage II endometrial carcinoma	TAH/BSO Bilateral selective pelvic and paraaortic lymphadenectomy	Extravasation lateral to right fourth lumbar vertebra	Distal embolization of L_3, L_4 arteries	Respiratory failure secondary to hemoperitoneum mandated reexploration prior to cannulation of iliolumbar radicle.
5. 57-years old Stage II endometrial carcinoma	TAH/BSO, omentectomy Bilateral selective pelvic and paraaortic lymphadenectomy	Extravasation lateral to third and fourth lumbar vertebrae	Distal embolization of left L_2, L_3, iliolumbar and internal iliac arteries	Persistent extravasation from small fourth lumbar radicle.
6. 28-years old Abdominal pregnancy	Laparotomy with delivery of a 34-week viable infant and cord ligation, placenta left *in situ*	Placental sinusoids filling from left internal iliac arteries, left lumbar radicles	Proximal embolization of bilateral internal iliac arteries	Removal of placenta facilitated by infarction, shrinkage, and involution from embolization.

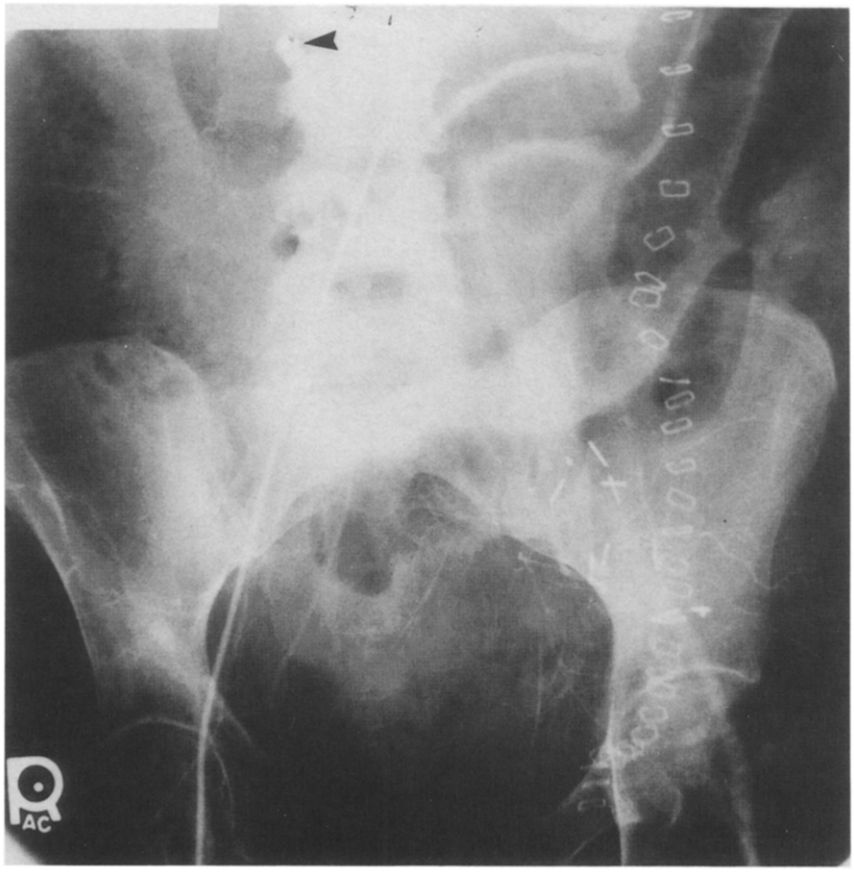

FIG. 1. Capillary phase aortogram of Patient 4 showing contrast extravasation to the right of the aortic bifurcation (arrowhead) adjacent to the fourth right lumbar artery.

mediately directed to the bleeding site as demonstrated by the arteriogram, thus achieving hemostasis.

Patient 5 demonstrated contrast extravasation to the left of, and slightly inferior to the aortic bifurcation (Fig. 2). Extravasation persisted after distal embolization of the second and third left lumbar, left iliolumbar, and remaining left internal iliac arteries. Surgical reexploration was directed to this site which revealed bleeding from a hypoplastic fourth lumbar radicle. Immediate hemostasis was achieved by placement of a hemoclip.

The arteriogram of Patient 6 demonstrated opacification of the sinusoids of the retained placenta, after delivery of a term abdominal pregnancy (Fig. 3). This patient was treated by bilateral proximal embolic occlusion of the anterior division of the internal iliac arteries. Persistent bleeding from placental separation was noted on the postembolization aortogram. At repeat laparotomy, removal of the placenta was facilitated by the involution caused by the embolotherapy.

Abdominal distension from intraperitoneal hemorrhage was noted prior to arteriography in two patients (Nos. 2, 5), both of whom eventually required reoperation for respiratory embarassment. One patient (No. 2) had already achieved arteriographically documented hemostasis and required only a mini-laparotomy for clot evacuation. The second patient (No. 5) required an emergency reexploration for clot evacuation prior to cannulation of the implicated retroperitoneal arteriole.

All six patients developed posttreatment fevers. Two patients had blood cultures which grew *Staphylococcus aureus*. All fevers responded promptly to intravenous antibiotic therapy. There were no other major complications attributed to embolotherapy.

DISCUSSION

Arterial cannulation for postoperative hemorrhage was popularized by Athanasoulis and associates. They reported the prolonged infusion of vasopressin into small gastrointestinal arterioles to achieve hemostasis [5]. Embolization with 1–2-mm Gelfoam pledgets was subsequently employed, as these form a semipermanent gelatin clot providing hemostasis in larger distal arterioles. Gelfoam embolization for treatment of vaginal hemorrhage

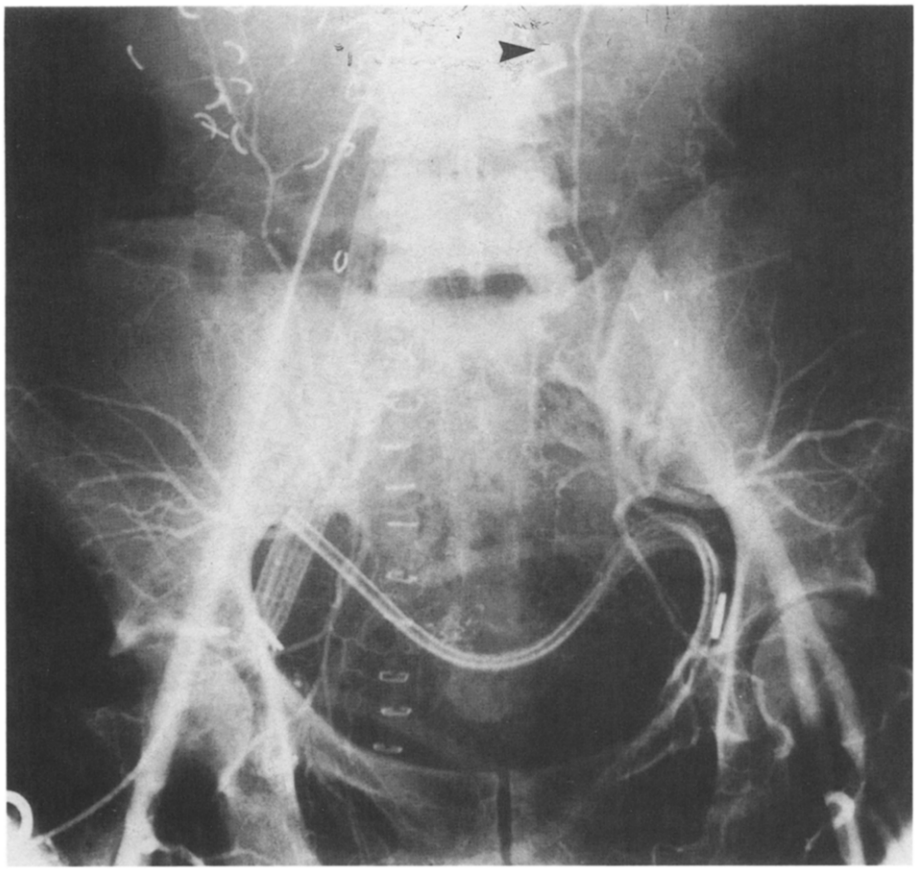

FIG. 2. Capillary phase aortogram of Patient 5 demonstrating contrast extravasation to the left of the aortic bifurcation (arrowhead) in the region of the para-aortic node dissection.

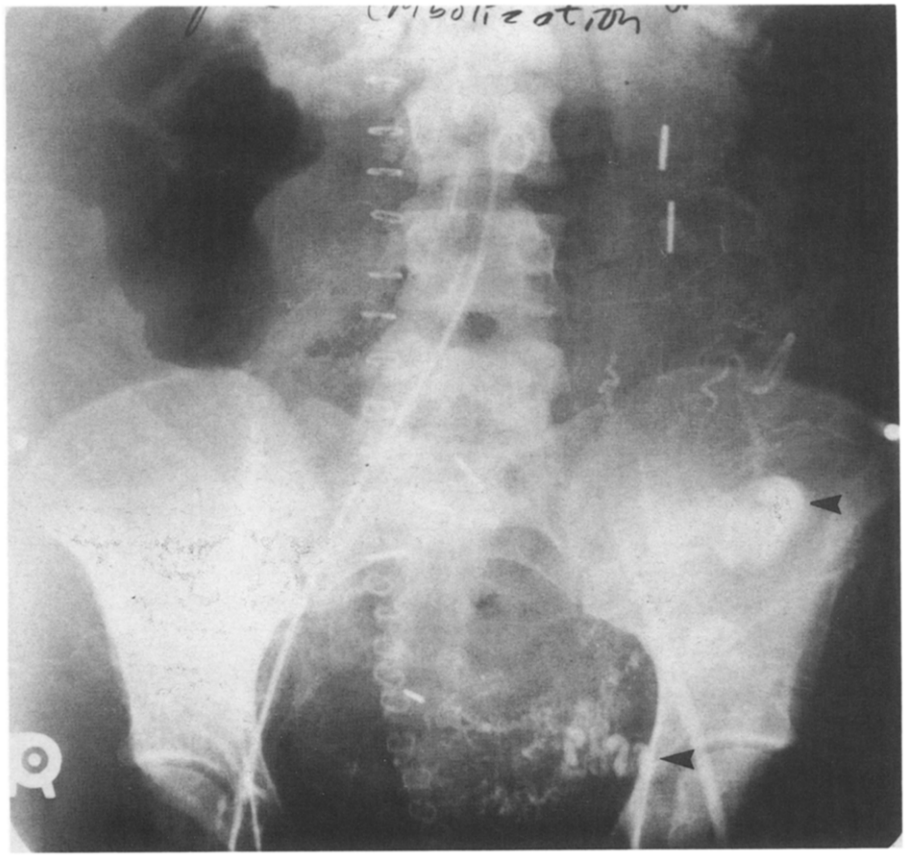

FIG. 3. Capillary phase aortogram of Patient 6 revealing placental sinusoids (arrowheads) filling from the left internal iliac and lumbar arteries. There is also a suggestion of filling from the left ovarian and lumbar arteries.

has proven successful in cases of posthysterectomy hemorrhage [6], postpartum hemorrhage [7], and bleeding associated with malignancies [1]. Arterial embolization has been found to be more successful than surgical exploration for control of retroperitoneal hemorrhage after traumatic lacerations to the obturator, iliolumbar, and deep circumflex iliac arteries [8]. In edematous postsurgical or posttrauma anatomy, the major advantages of arterial embolization over surgery include the ease of locating bleeding sites, and the avoidance of further tissue injury.

Arteriographic localization of contrast extravasation was successful in all of the six cases. Hemostasis was achieved in each case of bleeding from the internal iliac artery following distal embolization with small Gelfoam pledgets (Patients 1, 2, 3). Superselective catheterization of extravasation sites in the retroperitoneum near the aortic bifurcation (Patients 4, 5) proved to be more difficult than cannulation of the internal iliac branches. This difficulty is attributable to the numerous collateral sources in this region which include the lower lumbar, middle sacral, lateral sacral, and iliolumbar arteries.

In each of the cases requiring reoperation, the information obtained at arteriography directed the surgeon immediately to the site of bleeding, thus maximizing the efficiency and minimizing the time and morbidity of reoperation (Patients 4, 5, 6).

Posttreatment fever in two patients was attributed to blood cultures which grew *Staphylococcus aureus*. We now administer prophylactic antibiotics.

CONCLUSIONS

Early diagnosis of postoperative hemorrhage is essential to minimize patient morbidity and mortality. In patients with suspected postoperative abdominal or retroperitoneal hemorrhage, arteriographic embolization should be undertaken promptly and expeditiously. Hemostasis can be immediately verified by a follow-up arteriogram. When hemostasis cannot be achieved, the information gained from arteriography can direct the surgical reexploration and minimize morbidity and operative time.

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