Acta orthop. scand. 48, 353–355, 1977

ARTERIAL EMBOLIZATION FOR RADICAL TUMOR RESECTION

D. PATEL, O. CROTHERS, W. H. HARRIS, A. WALTMAN, N. FAHMY & R. CAREY

Departments of Orthopedic Surgery, Radiology, Oncology, and Anesthesia of the Massachusetts General Hospital, and the Harvard Medical School, Boston, Massachusetts, USA.

Two contemporary measures, selective transarterial embolization (Almgard et al. 1973) and controlled hypotensive anesthesia (Davis et al. 1974), have been combined in an effort to reduce the risk of operative bleeding in a case of massive bone and muscle resection of a highly vascular carcinoma lesion in the proximal third of the femur. This approach may be helpful in such cases.

Key words: bone neoplasia resection; controlled hypotension; selective arterial embolization

Accepted 25.iii.72

Severe hemorrhage during radical operations for excision of malignant lesions remains a potential, serious risk. A case is reported in which an effort to reduce this risk was made by combining preoperative transarterial embolization and intraoperative-induced hypotensive anesthesia. The operation involved resection of the proximal half of the femur with surrounding muscles and insertion of a proximal femoral replacement total hip implant.

CASE REPORT

A 48-year-old man was admitted for treatment of a metastatic lesion of the left proximal femur. Eight months previously he began having intermittent aching in his left knee. Three months later, x-ray examination revealed an osteolytic lesion of the left proximal femur. No primary lesion could be identified. Open biopsy of the femoral lesion was performed at another hospital. During this relatively minor surgery, blood loss was impressive. Two units of blood had to be given and the small biopsy wound had to be packed in order to obtain hemostasis. Pathological evaluation of the specimen revealed "metastatic carcinoma—primary unknown". Mithramycin[1] was begun and 3000 rad of supervoltage Cobalt 60 radiation were given. Two months later he was placed in a spica cast because of increasing pain in his left hip, and he was begun on vincristin sulfate[2], Cyclophosphamide[3] and 5-fluorouracil[4]. When admitted to the Massachusetts General Hospital pain in his hip was intolerable despite being in the spica cast. X-ray films revealed substantial extension of the tumor with two pathologic fractures, one in the femoral neck and another in the proximal femoral shaft (Figure 1).

Again a primary focus could not be identified, nor other secondary lesions. It was decided to resect the proximal femur and surrounding soft tissues *en bloc* and to perform replacement arthroplasty with a custom Mueller proximal femoral replacement prosthesis. Prophylactic

[1] Mithracin, Pfizer, Inc., New York, New York.
[2] Oncovin, Eli Lilly and Company, Indianapolis, Indiana.
[3] Cytoxan, Mead Johnson Laboratories, Evansville, Indiana.
[4] Fluorouracil, Roche Laboratories, Nutley, New Jersey.

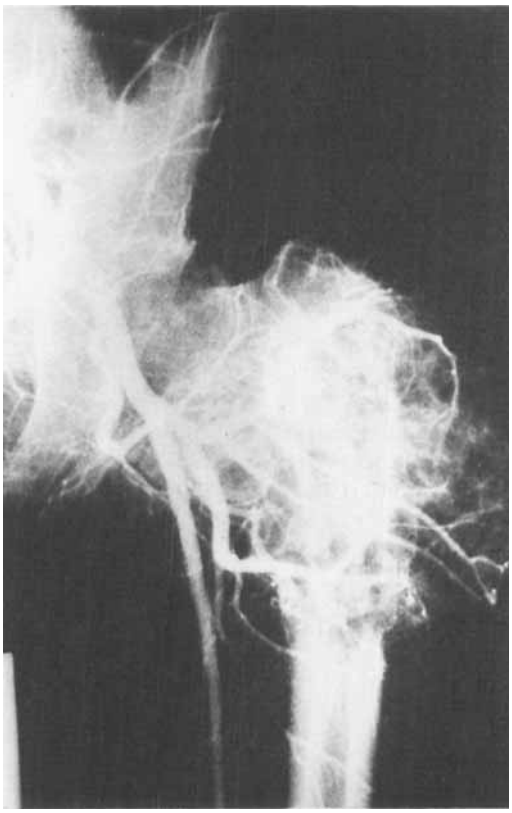

Figure 1. Arteriogram of the left hip region showing marked vascularity of the metastatic lesion.

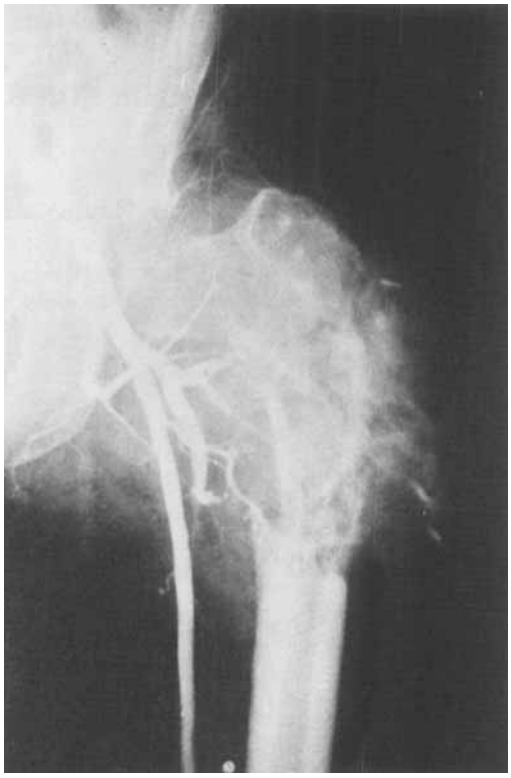

Figure 2. Repeat arteriogram immediately after introduction of Gelfoam clot showing obstruction of the major arteries going to the tumor. The extensive destruction of bone and the two pathologic fractures in the subtrochanteric region can be seen on this film.

anticoagulation with warfarin[5] was instituted because of high thromboembolic risks following total hip replacement surgery (THR) (Coventry et al. 1973), because his operation was to be more extensive than the usual THR, and because he was to be in bed for 6 weeks postoperatively.

A catheter was introduced via the opposite femoral artery to study the vascularity of the tumor, the major feeding vessels, and the collateral circulation. Arteriography of the left common iliac, external and internal iliac arteries demonstrated that the major supplying vessels arose from external iliac. Little collateral circulation was present. At the same time absorbable gelatin sponge[6] fragments were introduced transarterially as emboli to occlude the major feeding vessel (Figure 2). In order to avoid an increase in collateral circulation the surgery was performed within 24 hours.

The following day, under halothane[7] general anesthesia, controlled hypotension was induced with pentolinum tartrate[8]. The tumor was excised *en bloc* and the custom design total hip replacement was performed (Figure 3). The excised mass was $20 \times 11 \times 7$ cm. Total measured intraoperative blood loss was 2,500 cm^3. One unit of blood was given preoperatively because his hematocrit was 29 per cent. He received six units the day of surgery and one unit of blood 9 days postoperatively. Total blood replacement during this admission was eight units.

The postoperative course was benign. No com-

[5] Coumadin, Endo Laboratories, Garden City, New York.

[6] Gelfoam, The Upjohn Company, Kalamazoo, Michigan.

[7] Fluothane, Ayerst Laboratories, New York, New York.

[8] Ansolysen, Wyeth Laboratories, Philadelphia, Pennsylvania.

Figure 3. Antero-posterior roentgenogram of the left hip area showing the proximal femoral replacement total hip arthroplasty.

plications of the angiography, the embolization, or induced hypotensive anesthesia occurred. Six weeks postoperatively ambulation was begun. The microscopic diagnosis was "highly vascular, poorly differentiated adenocarcinoma, probably of gastrointestinal origin". No primary lesion was found. Thirty-six months after his operation he was ambulatory, with one cane, had no pain, and had returned to work. The lesion had not recurred.

DISCUSSION

Three factors contributed to the reduced blood loss in the excision of this highly vascular tumor, namely, induced hypotensive anesthesia, selective arterial embolization, and *en bloc* excision. A prospective, controlled series is needed to prove a significant reduction had occurred and to establish which of the three factors was most valuable. However, the experience during the biopsy in this case and experiences with other similar replacement operations with induced hypotensive anesthesia and preoperative selective arterial embolization suggest strongly to the authors that these measures were helpful.

Stener (1962) described the method of temporary arterial occlusion for the purposes of reducing operative bleeding and to lessen the risk of the tumor spreading. However, this method of temporary occlusion requires an abdominal incision in addition to the large incision needed in this case to remove the tumor. Since preoperative arteriography was necessary for evaluation of the vascularity of the tumor, little extra time or risk was involved in arterial embolization while the catheter was in place for this study. Arterial embolization preoperatively has been used in reducing the circulation to malignant tumors in urologic surgery (Almgard et al. 1973).

REFERENCES

Almgard, L. E., Fernstrom, I., Haverling, M. & Ljungqvist, A. (1973) Treatment of renal adenocarcinoma by embolic occlusion of the renal circulation. *Brit. J. Urol.* **45**, 474–479.

Coventry, M. D., Nolan, D. R. & Beckenbaugh, R. D. (1973) "Delayed" prophylactic anticoagulation: A study of results and complications in 2012 total hip arthroplastics. *J. Bone Jt Surg.* **55**-A, 1487–1492.

Davis, N. J., Jennings, J. J. & Harris, W. H. (1974) Induced hypotensive anesthesia for total hip replacement. *Clin. Orthop.* **101**, 93–98.

Ring, E. J., Waltman, A. C., Athanasoulis, C. A. Smith, J. C. & Baum, S. (1974) Angiography in pelvic trauma. *Surg. Gynec. Obstet.* **139**, 375–380.

Stener, Bertil (1962) Reduction of operative bleeding in the thigh by temporary occlusion of the common iliac artery. *Acta chir. scand.* **123**, 360–364.

Correspondence to: Dinesh Patel, M.D., 266 Beacon Street, Boston, Massachusetts 02116, USA.