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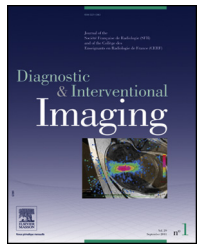

ORIGINAL ARTICLE /*Genito-urinary imaging*

The short- and long-term effectiveness of transcatheter arterial embolization in patients with intractable hematuria

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KEYWORDS
Transarterial embolization;
Effectiveness;
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Abstract
Purpose: Selective transarterial embolization (TAE) of the internal iliac artery is a well-known alternative technique to control intractable bladder hemorrhage (IBH). We explored the short- and long-term effectiveness of, and clinical outcomes after, TAE in patients with IBH.
Materials and methods: In this retrospective study, we reviewed the hospital records of 18 IBH patients non-responsive to conservative medications who underwent TAE between January 2003 and May 2014. The early- and long-term effectiveness of TAE was investigated in the context of hematuria control, complications, mortality, requirement for blood transfusions, and hematocrit level.
Results: Sixteen of the 18 patients underwent endovascular treatment; the technical success rate was 88%. TAE allowed complete remission in 16 patients (100% clinical success). On follow-up, mean hematocrit ($P = 0.003$) and hemoglobin ($P = 0.005$) levels significantly improved. Thirteen of the 16 patients (81%) required no further emergency admission after TAE during a mean follow-up period of 18.1 months (range, 3—105 months).
Conclusion: TAE is a feasible, effective, and safe technique in both the short- and long-term for the treatment of IBH.

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Intractable bladder hemorrhage (IBH) is a serious complication in patients with carcinoma and an important cause of morbidity and mortality [1—4]. Various conditions including urogenital pelvic malignancies, radiation cystitis, chemotherapy-induced hemorrhagic cystitis, and urinary tract infections, can trigger IBH [5]. Medical treatment of acute hemorrhage includes bladder irrigation with saline, alum, or formalin, or bladder hydrodistension. When a conservative approach fails, ligation of the internal iliac artery or cystectomy may be required [5]. Elderly patients living under poor conditions constitute most cases, leading to high morbidity associated with surgical procedures. Given the relatively low effectiveness of medical approaches to treat IBH [4,6,7], minimally invasive procedures are preferable. Selective transarterial embolization (TAE) of the internal iliac artery is a well-described alternative technique used to control severe hematuria, and has been successfully applied over many years to treat bladder hemorrhage associated with terminal pelvic malignancy [1,8]. Although many reports on TAE to treat IBH have appeared, most are case reports or small case series, and long-term outcomes after TAE remain unclear [9—13]. In the present study, we explored the short- and long-term effectiveness, and clinical outcomes, of patients who underwent TAE to prevent IBH.

Materials and methods

This study was approved by our institutional Ethics Committee. The medical records of 18 IBH patients who underwent TAE of the internal iliac artery/arteries between January 2003 and May 2014 were retrospectively analyzed. We retrieved data on gender, age, manifestations of the disorder and other associated conditions, procedure used, hematuria control, angiographic findings before and after TAE, response to TAE, complications, follow-up duration, and short- and long-term effectiveness. A total of 18 patients (14 males, 4 females) were included. The mean age of all participants was 67 years (range, 18—92 years). The cause of bleeding was bladder cancer in six patients, prostate cancer in six, radiation cystitis in two, cervical cancer with bladder invasion in two, endometrial cancer with bladder invasion in one, and hemorrhagic cystitis in one (Table 1). In all patients, conservative modalities including continuous irrigation of the bladder using a three-way catheter and endoscopic interventions, were tried for a mean of two days (range, 1—3 days), but failed. Surgery was not an option for 15 patients (83%) with significant comorbidities. Only three patients had no comorbidities (17%). Of all patients, eight had coronary artery disease and diabetes mellitus, three chronic obstructive pulmonary disease, three coronary artery disease and hypertension, and one chronic kidney disease. Eleven patients had been using acetylsalicylic acid (ASA) prophylactically, but this medication had been withdrawn to prevent possible hemorrhagic insult. Blood specimens were collected from all patients to exclude any coagulopathic disorder, and prophylactic antibiotics were given prior to TAE.

Table 1 Demographical data on factors lead to hematuria.

Cause of hematuria	Number of patients
Prostate cancer	6 (33%)
Bladder cancer	6 (33%)
Cervical cancer	2 (11%)
Endometrial cancer	1 (6%)
Radiation cystitis	2 (11%)
Hemorrhagic cystitis	1 (6%)
Total	18

All embolizations were performed by two specialists experienced in interventional radiology. After obtaining written informed consent, intervention was initiated by entering the femoral artery. Angiography was performed using a 5F pig-tail catheter to identify any abnormal vascularization of the pelvic region. Cobra or Simmons type-2 catheters were selectively placed in the internal iliac arteries. Vascularization status in the context of hematuria was evaluated and prostatic/vesical branches superselectively catheterised using 2.9 Fr coaxial microcatheters. Polyvinyl alcohol (PVA) particles 300—500 μm in diameter were employed for distal embolization. Next, particles 500—700 μm in diameter were injected to embolize more proximal abnormal vessels.

When vesical or prostatic arteries could not be selectively catheterised, we performed particulate embolization combined with coil blockade. We first occluded distal branches at their ostia with preservation of the flow of normal vesical or prostatic branches; this steered particles into abnormal branches to prevent distal particulate embolization of normal branches and thus reduce clinical complications. Coil blockade was performed with the aid of 0.018-inch fibre or soft platinum microcoils of various lengths and diameters. When it was impossible to selectively catetherize the principal distal branches of the anterior division of the internal iliac artery, the catheter tip was left in the anterior division of that artery and embolization performed at that point using 0.035-inch steel coils of appropriate diameter or mechanically disrupted using absorbable, gelatin sponge powder, regardless of whether bleeding was evident angiographically. At the end of each intervention, the technical status of the procedure was reviewed angiographically. Identical procedures were performed on the opposite side via an ipsi- or contra-lateral puncture (Figs. 1 and 2). Although we planned bilateral superselective PVA embolization, only 11 of the 16 patients could undergo this procedure. Selective proximal coil occlusion of the anterior divisions of internal iliac arteries was performed in two patients, and both arteries were occluded in one patient. Coil blockade was performed in one patient (Table 2). Patients were followed-up in terms of the short- and long-term effectiveness of the procedures used to control hematuria, complications, mortality, need for blood transfusions, and hematocrit level. The post-treatment follow-up period was 3—105 months (mean, 18.1 months). Statistical analysis was conducted using Sofa Statistics software version 1.4.3 (http://www.sofastatistics.com). Between-group comparisons were made using Student's *t*-test and a *P* value less than 0.05 was considered to reflect statistical significance.