Transcatheter Arterial Embolization of Angiographically Visible and Occult Renal Capsular Artery Hemorrhage in 28 Patients

Hyo Jung Park, MD, Ji Hoon Shin, MD, Ki-Chang Han, MD, Hyun-Ki Yoon, MD, Gi-Young Ko, MD, and Kyu-Bo Sung, MD

ABSTRACT

Purpose: To evaluate the effectiveness and safety of transcatheter arterial embolization to control bleeding from the renal capsular artery (RCA).

Materials and Methods: Embolization was performed in 28 patients (14 men; mean age, 49.7 y). Presence and type of previous invasive procedures, initial presentation, and coagulation profile were reviewed. Any preceding abdominal computed tomography (CT) findings were analyzed. Angiographic findings were categorized as active bleeding, suspicious for bleeding, or no bleeding. Technical and clinical success and clinical outcomes were evaluated. Changes in hemoglobin level and transfusion volume of packed red blood cells (pBRCs) before and after embolization were evaluated with the paired *t* test and Wilcoxon signed-rank test, respectively.

Results: Technical and clinical success rates of therapeutic embolization for active bleeding (n = 11) were 90.9% and 80%, respectively. One case of technical failure (5.9%) and 3 cases of postembolization bleeding (18.7%) were noted in the prophylactic embolization group in patients with suspicion of bleeding (n = 13) or no bleeding (n = 4). Transient renal insufficiency occurred in 4 patients (14.3%). The average hemoglobin level and volume of transfused pBRCs changed from 8.1 g/dL to 9.9 g/dL and from 871 mL to 543 mL, respectively ($P < .05$). Extravasation of contrast media or acute hematoma in the right subhepatic or perirenal space on CT was noted in 21 patients (78%).

Conclusions: Embolization can provide an effective and safe method to control RCA bleeding. Perirenal invasive procedures and signs of active or recent right subhepatic or perirenal hemorrhage should raise the suspicion of an RCA source.

ABBREVIATIONS

BUN = blood urea nitrogen, DSA = digital subtraction angiography, INR = International Normalized Ratio, NBCA = n-butyl cyanoacrylate, pRBC = packed red blood cell, PVA = polyvinyl alcohol, RCA = renal capsular artery

The renal capsular artery (RCA) is a small artery that courses along the renal margin and anastomoses freely with the intraparenchymal arteries of the kidneys and retroperitoneal arterial branches. The RCA is composed of the superior, middle, and inferior branches that arise from the inferior adrenal artery, renal artery, and gonadal artery, respectively. When evaluating the renal arterial system, primary attention is usually directed to the main renal artery and the intraparenchymal branches. However, the RCA may also provide the primary arterial supply to a renal malignancy or important collateral supplies in the case of renal ischemia. Moreover, the RCA is an important source of iatrogenic bleeding. According to Jung et al (1), the RCA is one of the most frequent sites of postoperative hemorrhage following orthotopic liver transplantation.

However, the specific causes and clinical implications of bleeding from the RCA are not yet clearly established. Angiography with transcatheter arterial embolization

From the Department of Radiology and Research Institute of Radiology, University of Ulsan College of Medicine, Asan Medical Center, 86 Asan-byeongwon-gil, Songpa-gu, Seoul 138-736, Korea. Received October 22, 2015; final revision received and accepted March 13, 2016. Address correspondence to J.H.S.; E-mail: jhshin@amc.seoul.kr

None of the authors have identified a conflict of interest.

J Vasc Interv Radiol 2016; 27:973–980

http://dx.doi.org/10.1016/j.jvir.2016.03.024

can be primarily considered as a diagnostic and treatment option for RCA bleeding, but we are aware of no studies that have examined its efficacy and clinical outcomes. Therefore, the purpose of the present study was to retrospectively evaluate the effectiveness and safety of transcatheter arterial embolization to control possible bleeding from the RCA.

MATERIALS AND METHODS

Patient Selection

The hospital institutional review board approved this retrospective study, and the requirement for informed consent was waived. The data collection system identified a total of 574 patients who had the word "capsular" in their transcatheter arterial embolization reports between May 2002 and August 2014. A text review was performed in two steps by one of the authors (H.J.P.). First, cases of chemoembolization (n = 187) were excluded to select cases of transcatheter arterial embolization performed for suspicion of bleeding. Second, cases in which the target vessel was the RCA were collected, which resulted in 28 patients who were finally included in the study.

Clinical Manifestations

The data used in this study were obtained from the electronic medical records. The mean age of the patients was 50 years ± 9.4 (range, 16–67 y). The male: female ratio was 1:1 (14 men [mean age, 49.7 y; range, 34–62 y] and 14 women [mean age, 49.6 y; range, 16–67 y]). The clinical characteristics of the patients are summarized in Table 1. Previous invasive procedures most often performed included liver transplantation (n = 22; Fig 1), followed by renal biopsy (n = 3), percutaneous nephrostomy (n = 1), and percutaneous intraabdominal catheter insertion to drain collected fluid (n = 1; Fig 2). Spontaneous bleeding developed in one patient as a result of kidney rupture. The mean interval between previous invasive procedures and angiography was 7.3 days ± 5.0 (range, 0–23 d). The initial presentations included positive signs of bleeding on abdominal computed tomography (CT; n = 5), sudden bloody discharge from the catheter (n = 5), decrease in blood pressure (n = 2; one from 124/83 mm Hg to 95/61 mm Hg and the other from 133/83 mm Hg to 84/69 mm Hg; both occurred over a period of < 12 h), right flank pain (n = 1), and decrease in hemoglobin level (n = 1; from 7.9 g/dL to 5.0 g/dL in 24 h). In half of all cases (n = 14), signs of bleeding on CT and sudden bloody discharge from the catheter coexisted. Twenty-one patients had coagulopathy (75%). Of these 21 patients, 20 were liver transplant recipients and one was diagnosed with systemic lupus erythematosus. All these patients had coagulopathy for at least 6 months, and the coagulation profile remained unchanged before and after the embolization despite transfusion of platelets and fresh frozen plasma. The mean amounts of transfused platelets to the 21 patients during the 3 days before and after the procedure were 9.79 U and 10.07 U (1 U = 320 mL), respectively, and the mean amounts of transfused fresh frozen plasma during the same periods were 4.93 U and 3.96 U (1 U = 400 mL), respectively.

Table 1. Clinical Characteristics of Study Patients

Characteristic	Value
Laboratory findings	
Hemoglobin level (g/dL)	
Mean	8.13
Median	8
Range	5–10.9
Platelet count ($\times 10^3/mm^3$)	
Mean	90
Median	44
Range	21–519
INR	
Mean	1.32
Median	1.17
Range	0.98–2.21
Coagulopathy	
Present	21 (75)
Absent	7 (25)
Past medical disease	
Liver cirrhosis	13 (46)
Hepatocellular carcinoma	8 (28.6)
Fulminant hepatitis	1 (3.6)
Renal-cell carcinoma	1 (3.6)
SLE nephritis	1 (3.6)
Nephrotic syndrome	1 (3.6)
Polyarteritis nodosa	1 (3.6)
GIST of stomach	1 (3.6)
Renal calculi	1 (3.6)
Previous surgery or procedure	
Liver transplantation	22 (78.6)
Renal biopsy	3 (10.8)
Percutaneous nephrostomy	1 (3.6)
Percutaneous intraabdominal tube	1 (3.6)

Note–Values in parentheses are percentages.
GIST = gastrointestinal stromal tumor; INR = International Normalized Ratio; SLE = systemic lupus erythematosus.

CT Acquisition and Analysis

Abdominopelvic CT images were obtained with Siemens CT scanners (SOMATOM Sensation 16, SOMATOM Definition, SOMATOM Definition Flash, and SOMATOM Definition AS+; Siemens, Erlangen, Germany) and GE CT scanners (LightSpeed 16, LightSpeed Plus, and LightSpeed VCT; GE Healthcare, Milwaukee, Wisconsin). Intravenous contrast media (120–150 mL of 300–370 mgI/mL nonionic contrast agent/iopromide; Ultravist 300 or Ultravist 370; Bayer Schering Pharma, Leverkusen, Germany]) was administered at a rate of