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Prophylactic absorbable gelatin sponge embolization for angiographically occult splenic hemorrhage

Mohammed F. Loya MD[a,*], *Suneet Mangat MD*[a], *Giovanni C. Santoro DO*[a,b], *Alexander Martynov MD*[a], *Salman S. Shah MD*[a]

[a] *Department of Radiology, NuHealth, Nassau University Medical Center, East Meadow, NY 11554, USA*
[b] *Department of Biomedical Sciences, New York Institute of Technology College of Osteopathic Medicine, Old Westbury, NY 11568, USA*

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ABSTRACT

Nonoperative management of traumatic splenic hemorrhage includes the targeted administration of embolic agents. In certain instances where computed tomography angiography cannot exclude a bleed, prophylactic embolization with absorbable gelatin sponge has been used. In this retrospective case series review, we characterized the demographic data and clinical outcomes associated with 4 patients who underwent prophylactic transarterial splenic artery embolization after blunt abdominal trauma. Embolization was employed in cases where computed tomography angiography findings suggested at least a moderate splenic injury, and simultaneously where hemorrhage was not apparent during fluoroscopic angiography. Periprocedural hemodynamic status, technical success, and postoperative complications are discussed. The goal of this report was to discuss the safety and efficacy of prophylactic gelatin sponge embolization for occult splenic hemorrhage. In cases where a hemorrhagic site might be occult, this approach has the potential to minimize bleeding complications and the need for further intervention.

Introduction

Given the advancement and availability of imaging modalities and minimally invasive techniques, interventional radiology (IR) has assumed a role in cases of abdominal and pelvic trauma [1]. Nonoperative management of traumatic splenic hemorrhage has expanded to include transcatheter vascular embolization. In certain instances, these procedures have been shown to reduce vascular complications compared with

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* *Corresponding author.*
E-mail address: mloya@numc.edu (M.F. Loya).
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conventional surgical management [2–6]. Here, we describe the use of gelatin sponge embolization in cases were computed tomography angiography (CTA) showed evidence of hemorrhage that was not visualized during fluoroscopic angiography.

Generally, when CTA findings indicate an ongoing hemorrhagic process, fluoroscopic arterial angiography can be performed. If active contrast extravasation or pseudoaneurysm is seen on angiography, IR-guided embolization can be attempted. A potential limitation exists, however, because conventional angiography confirms only 80%-90% of imaging findings [7]. Although the lack of contrast visualization likely indicates the cessation of active bleeding due to interim internal tamponade, it is important to consider the possibility that hemorrhage has been masked by another cause, namely, vasospasm. Additionally, diagnostic CTA limitations with temporal resolution can preclude detection of subtle hemorrhage. For example, developing arterial transection and pseudoaneurysm might be missed if imaging is obtained early on [7]. In these instances, a therapeutic gray area exists. If fluoroscopic angiography fails to identify a bleeding site and there is still a high degree of clinical suspicion for hemorrhage, prophylactic embolization for an occult bleed should be considered.

This discussion is particularly relevant to splenic hemorrhage, because the spleen is the most commonly injured organ during blunt abdominal trauma [8]. Management in these cases is determined by several factors, including hemodynamic status, grade of injury, and presence of contrast extravasation on initial imaging. For hemodynamically stable patients, nonoperative management constitutes the standard of care [9–11]. However, this conservative approach fails in upward of 12%-15% of patients [9,11–13]. Given these data, prophylactic IR-guided embolization with absorbable gelatin sponge (Gelfoam) has the potential to reduce the need for further radiological or surgical intervention, especially in cases where hemorrhage cannot necessarily be excluded. Despite the lack of an official consensus on when to employ this approach, the general safety and efficacy of gelatin sponge embolization [14] may warrant expansion of its use in cases where an occult bleed cannot be excluded. In this retrospective case series review, we examined the outcomes of prophylactic embolization for CTA-evident splenic injury in several patients admitted to our level 1 trauma center.

Materials and methods

Institutional review board approval was obtained and a retrospective case series review was carried out. Our picture archiving and communication system and electronic medical record were accessed and used to identify patients who received prophylactic absorbable gelatin sponge embolization of the splenic artery after blunt abdominal trauma between March 2012 and July 2017 (n = 4). We would like to note that this sample represents a small subset of all patients undergoing splenic embolization during this time period. This sample specifically includes patients who underwent gelatin sponge embolization when CTA-evident hemorrhage was not confirmed in the IR fluoroscopy suite.

We categorized our sample based on injury mechanism, hemodynamic status, and nonoperative management. Additionally, demographic information, pertinent diagnostic imaging, and reported clinical outcomes were reviewed and summarized. These data were descriptive in nature because this small sample was not amenable to statistical analysis. All information was obtained via retrospective chart review. Each case was assessed for hemodynamic status and the need for additional intervention. Patients were also assessed for postprocedural complications, such as splenic infarction or abscess. In all 4 cases, prophylactic splenic artery embolization was successfully performed. Individual patient courses are described further. A comprehensive summary of interventional and clinical information can be seen in Table 1.

Patient/Case A

Patient A was a 45-year-old man presenting to the emergency department (ED) after a high-velocity motor-vehicle collision (MVC). The patient was stable upon admission with a recorded blood pressure and heart rate of 106/52 and 72, respectively. A contrast-enhanced whole-body CT scan was obtained during the early portal venous phase after rapid injection of intravenous contrast. Images revealed several rib fractures and perisplenic hematoma. Contrast extravasation was noted on CTA, suggesting active splenic vascular injury (Figs 1A and B). Splenic injury was classified as grade 3 according to guidelines from the American Association for the Surgery of Trauma (AAST) [15]. IR was consulted and subsequent transarterial splenic angiography was performed after discussion with the trauma team. Femoral access was obtained using the Seldinger technique. A 5-French angled taper 0.038 in. (0.97 mm) hydrophilic cobra glide catheter (Terumo Medical Corporation, Somerset, NJ) was used to gain access to the celiac artery. Thereafter, selective angiographic runs were performed for vessel mapping. The splenic artery was then accessed utilizing a 0.035 in. (0.89 mm) angled glide catheter (Terumo Medical Corporation, Somerset, NJ). Selective angiography was again performed at this vascular level. Images obtained at multiple viewing angles did not demonstrate significant contrast extravasation or pseudoaneurysm formation (Fig. 1C). After discussion with the admitting team, it was determined that patient A might benefit from prophylactic embolization of the splenic artery. A 50% normal saline, 50% ioversol solution was created and mixed with Gelfoam (Pfizer, New York, NY) pledgets using syringes connected by a 3-way stopcock. A small volume of the resultant slurry was injected into the proximal splenic artery under fluoroscopic guidance until sluggish flow was observed, indicating that embolization of distal arterial branches had likely occurred. The main splenic artery remained patent (Fig. 1C). Postembolization hemodynamic stability was maintained. Chart review did not reveal any significant embolization-related complications. No additional surgery or intervention was preformed, and patient A was successfully discharged from the hospital.

Patient/Case B

Patient B was a 27-year-old man presenting to the ED after a high-velocity MVC. The patient was stable upon admission with