Review Article

Outcomes and complications of embolization for gastrointestinal bleeding

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A B S T R A C T

Gastrointestinal bleeding is a common medical emergency with significant morbidity and mortality. Although endoscopic treatment was recommended as the first-line approach, it is often limited in real clinical practice. Over the past few decades, transcatheter arterial embolization has become a major treatment modality for the management of gastrointestinal bleeding that is refractory to endoscopic management. This review aims to describe the outcomes and complications of transcatheter arterial embolization for gastrointestinal bleeding.

Keywords: Gastrointestinal bleeding; Transcatheter arterial embolization

Introduction

Since the introduction of transcatheter arterial embolization (TAE) in the 1970s, it has been widely used for the management of acute gastrointestinal bleeding (GIB). GIB is categorized as upper GIB (UGIB) and lower GIB (LGIB), with the Treitz ligament used as an anatomical landmark to differentiate between the two. Outcomes and complications of TAE differ somewhat between the two. The vascular supply to the stomach and duodenum is quite rich, which can make successful embolization more challenging but decrease the incidence of post-embolization ischemia. In TAE for LGIB, post-embolization ischemia is a major concern and intermittent bleeding often causes management difficulties.

UGIB

In a review published in 2010 that identified 15 studies (including a total of 829 patients), TAE of UGIB showed a technical success rate of 93% (range, 62%–100%), a clinical success rate of 67% (range, 52%–94%), a rebleeding rate of 33% (range, 9%–66%), and a 30-day mortality rate of 28% (range, 4%–46%). A wide range of these outcomes is probably due to different etiologies. A recent multicenter study also reported high technical and clinical success rates of TAE for peptic ulcer bleeding. In a systemic review of TAE versus surgery, there were no significant differences in the mortality rates; however, TAE had higher rebleeding rates than surgery. Coagulopathy is a representative clinical predictor of rebleeding, and increases the odds ratio up to 19.5 for clinical failure. Other possible causes are shock, low hemoglobin concentration, massive transfusion, and longer time to angiography. In the technical predictors, using only coils can increase the rebleeding rate. Although coil embolization is precise, it is limited to embolizing the distal branch of the small target artery due to its profile and can be just proximal embolization; bleeding can resume through collateral channels.

Theoretically, N-butyl cyanoacrylate (NBCA) might be a good solution to overcome the clinical and technical predictors of rebleeding. Because NBCA is a liquid embolic agent, it can not only reach the distal branches of the small target artery but also embolize the collateral channels that cannot be embolized using coils. NBCA can polymerize and occlude a vessel immediately after contact with ions in the blood or tissue despite the presence of any underlying coagulopathy. Recently, two large studies and a meta-analysis were published, which introduced that TAE for UGIB with NBCA was safe and effective. In UGIB, duodenal bleeding had a worse outcome than gastric bleeding probably due to rich collateral channels, and superselective embolization using a smaller microcatheter could improve the outcome of TAE for duodenal bleeding because NBCA can be delivered through a smaller microcatheter.
Because it is a fundamentally endovascular procedure, access site hematoma, vessel injury related to catheter manipulation, contrast-related problems, and nephrotoxicity can occur in TAE for UGIB.

Although TAE for UGIB is generally considered safe due to a rich collateral blood supply to the stomach and duodenum, significant ischemia can occur when collateral channels were damaged from previous surgery or radiotherapy within the same area or when very small particles or liquid agents such as NBCA extensively penetrate too deeply into the vascular bed, overwhelming the collateral vessels and leading to extensive or nontarget embolization. Moreover, Lang reported 25% incidence rate of duodenal stricture when NBCA was infused at the muscular branch level of duodenum probably because of the ischemic injury of the muscle layer.

**LGIB**

In patients with LGIB who are hemodynamically stable, colonoscopy is recommended as the first-line approach because it can be used for diagnosis and treatment. However, it is often limited by inadequate bowel preparation or active bleeding that can interfere with detecting the bleeding focus. The frequency of small bowel bleeding cannot be understated, which is approximately 5% to 10% of all patients presenting with GIB. Bookstein et al. first described TAE for LGIB in 1974. Although high rates of bleeding control were achieved, it carried an unacceptably high rate of bowel infarction and postembolization ischemia because of a weaker anastomotic blood supply to the lower gastrointestinal tract compared to the upper gastrointestinal tract. In 1990s, technical advances in microcatheter and embolic agents facilitated superselective embolization for LGIB. Kuo et al. introduced superselective microcoil embolization for LGIB in 2003, reporting a complete clinical success rate of 86% but a minor ischemic complication rate of 4.5%.

NBCA also has advantages as a primary embolic agent for the selective embolization of LGIB as well as UGIB (Fig. 1). It can be delivered through a smaller microcatheter for selective embolization and more distally than the point of a microcatheter tip. This enables the occlusion of a bleeding focus distal to the small arteries through which a microcatheter cannot pass. Referring to an animal study, ischemic bowel injury was relatively tolerable in superselective NBCA embolization involving three or fewer vasa recta. In a systematic review and meta-analysis, superselective NBCA embolization of LGIB showed a technical success rate of 97.8%, a clinical success rate of 86.1%, and a major complication rate of 6.1%.

**Conflicts of Interest**

No potential conflict of interest relevant to this article was reported.

**References**

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