

# Postpartum Hemorrhage from Extravasation or Pseudoaneurysm: Efficacy of Transcatheter Arterial Embolization Using *N*-Butyl Cyanoacrylate and Comparison with Gelatin Sponge Particle

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## ABSTRACT

**Purpose:** To evaluate the safety and effectiveness of transcatheter arterial embolization (TAE) using *N*-butyl cyanoacrylate (NBCA) for the treatment of active postpartum hemorrhage (PPH) and compare the efficacy of NBCA with gelatin sponge particles.

**Materials and Methods:** From January 2004 to September 2013, 26 patients with PPH underwent TAE using NBCA as the primary embolic material. All patients were actively bleeding, and 12 (46.2%) had coagulopathy. TAE was performed using 1:2–1:4 mixtures of NBCA and ethiodized oil with or without use of a coil or gelatin sponge. To compare the efficacy of NBCA with conventional embolic material, 50 patients with active bleeding who underwent TAE using gelatin sponge were also analyzed.

**Results:** Angiograms demonstrated pseudoaneurysm or extravasation or both. The technical and clinical success rates were 100% and 92.3% (24 of 26 patients), respectively, for NBCA and 98% and 86.0% (43 of 50 patients), respectively, for gelatin sponge. In the NBCA group, one patient recovered with conservative management, and the other patient died because of multiorgan dysfunction. There were no major or minor procedure-related complications.

**Conclusions:** TAE using NBCA as the primary embolic agent is an effective method for treating PPH with extravasation or pseudoaneurysm; NBCA is comparable to gelatin sponge particles. TAE using NBCA seems to fill pseudoaneurysms and make devascularization more effective than using gelatin sponge.

## ABBREVIATIONS

DIC = disseminated intravascular coagulation, NBCA = *N*-butyl cyanoacrylate, PPH = postpartum hemorrhage, TAE = transcatheter arterial embolization

Despite advances in intensive postpartum care, postpartum hemorrhage (PPH) remains a major cause of maternal morbidity and mortality (1). Initial treatment of PPH is performed by obstetricians and includes uterine massage, uterine packing, administration of uterotonic

agents, and transfusion. However, when these conservative methods fail, surgical or endovascular treatment is considered. Since its first description in 1979 (2), transcatheter arterial embolization (TAE) has been considered to be safe and effective for managing PPH with high clinical and technical success rates.

Absorbable gelatin sponge is the most widely used embolic material in TAE because it enables temporary occlusion for 3–6 weeks and recanalization of the target arteries when there are concerns that permanent embolic material could result in future infertility (3). However, TAE with gelatin sponge as the sole embolic material in patients with coagulopathy shows limited effectiveness in achieving successful hemostasis (4). In addition, in cases of active bleeding, such as in patients with pseudoaneurysm, use of a gelatin sponge may be insufficient for

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None of the authors have identified a conflict of interest.

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*J Vasc Interv Radiol* 2015; 26:154–161

<http://dx.doi.org/10.1016/j.jvir.2014.10.001>

effective treatment (5). When treating patients with coagulopathy or active bleeding, an alternative embolic material is required, and *N*-butyl cyanoacrylate (NBCA) may be a potent embolic material for definitive devascularization (4–6).

Nonetheless, consensus regarding the effectiveness of NBCA in TAE has not been reached because the literature regarding treatment of PPH using NBCA has been limited to a few case reports (4,7,8) and one original article that described its effectiveness for ruptured pseudoaneurysm (5). We know of no single-institution study that has compared the effectiveness of gelatin sponge with NBCA. We retrospectively evaluated the safety and effectiveness of NBCA in TAE for treatment of PPH with active bleeding and compared the efficacy of NBCA with gelatin sponge.

## MATERIALS AND METHODS

### Patient Selection

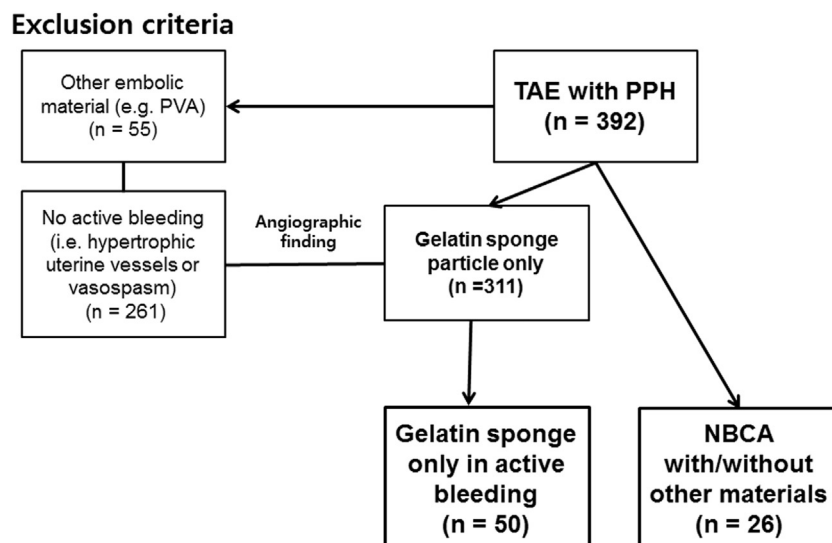
Our institutional review board approved this retrospective study, and informed consent was waived. All patients who underwent TAE for PPH from January 2004 to September 2013 were retrospectively analyzed. We identified from our medical review system 392 patients who underwent TAE for treatment of PPH. Of the 392 patients, 26 (mean age, 31.9 y; range, 27–40 y) underwent TAE using NBCA (Histoacryl; B. Braun AG, Melsungen, Germany) as a primary embolic material. We also retrospectively reviewed 50 patients with active bleeding on angiography who underwent TAE using gelatin sponge only to compare the effectiveness of gelatin sponge. The study patient accrual process is summarized in [Figure 1](#). NBCA was selected as a primary embolic material when (a) active bleeding (ie, extravasation, pseudoaneurysm, or both) did not appear to be easily controlled via gelatin sponge or (b)

the patient's hemodynamic status was too unstable and emergent and required rapid intervention. The decision to use NBCA was based predominantly on the interventional radiologist's judgment.

### Analysis and Definitions

The obstetric medical records were reviewed to collect data regarding patient characteristics, the cause of bleeding, mode of delivery, treatments performed before and after embolization, bleeding tendency, number of red blood cell transfusions before and after embolization, details regarding the TAE procedure, the immediate and long-term complications, and TAE-related outcomes. Primary PPH was defined as the onset of hemorrhage within 24 hours after delivery, whereas secondary PPH occurred between 24 hours and 12 weeks after delivery. Various causes of PPH were determined based on obstetric and angiographic findings, including uterine atony, genital tract laceration, retained placental tissue, traumatic pseudoaneurysm, and uterine rupture. Traumatic pseudoaneurysm was defined as persistent bleeding with no identifiable cause according to the obstetrician's opinion (including firm uterine fundus, no genital tract laceration, and no abnormal placenta findings) but with a visible pseudoaneurysm on angiography. Coagulopathy was defined as an international normalized ratio > 1.5 or platelet count of < 80,000/mm<sup>3</sup>.

Technical success was defined as complete occlusion of the bleeding vessel or pseudoaneurysm as seen on angiography performed immediately after embolization. Clinical success was achieved with cessation of bleeding after TAE with no need for repeat embolization or additional surgery during the patient's hospital stay and resolution of the patient's clinical symptoms. Immediate and delayed complications at completion of embolization, at discharge, and at follow-up visits were assessed through medical chart review. Major complications were



**Figure 1.** Patient accrual process. PVA = polyvinyl alcohol.

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