

**Hemostatic sandwich to control percutaneous nephrolithotomy tract bleeding**

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**Background and Purpose:** Significant bleeding necessitating use of a tamponade balloon, embolization, or renal exploration is a rare but catastrophic complication after percutaneous nephrolithotomy (PCNL). The purpose of this study is to review the success of a novel, minimally invasive technique for controlling percutaneous tract bleeding that is refractory to conventional measures.

**Materials and Methods:** A retrospective review was performed on four patients with refractory tract hemorrhage that was managed with a novel gelatin matrix hemostatic sandwich technique. In this technique, a 5F angiographic reentry catheter was placed through the kidney into the bladder and a 22F Councill-tip catheter balloon was passed over this catheter and positioned so that the inflated balloon would occlude the inner surface of the nephrostomy tract. Next, a 16F Councill-tip catheter was placed over a second wire so that the uninflated balloon was just underneath the skin surface. Gelatin matrix hemostatic sealant was then injected to fill the tract. Inflation of the outer balloon completely sealed the tract, completing the hemostatic sandwich.

**Results:** This technique was successfully applied to four patients with tract bleeding that would not stop with pressure or a conventional nephrostomy tube alone. The average estimated blood loss was 562 mL, and three of four patients avoided transfusion. All postoperative hemoglobin values stabilized within 2 days of surgery. There were no major or minor complications after use of this technique. No patients needed angioembolization or renal exploration.

**Conclusions:** This novel hemostatic sandwich technique should be considered as an option for the control of refractory tract hemorrhage after PCNL.

**Editorial Comment**

The authors describe a novel technique for acute control of post-PCNL hemorrhage. One of the potential challenges for this technique would be the ability to maintain sufficient tension/traction on the inner balloon to avoid inadvertent seepage of the hemostatic agent into the collecting system. One might propose that the sandwich balloon technique might be sufficient to tamponade the bleeding without the need for hemostatic adjuncts instilled into the tract. However, the authors hypothesize that in addition to activating the final step of the clotting cascade, the gelatin matrix hemostatic sealant (GMHS) swells up to 20% after application, thereby augmenting the tamponade pressure within the tract. One might question whether 5 cc of GMHS is the optimal volume. Amplatz sheaths range in length from 16-30 cm, so the volume of the parenchyma displaced by a 30F sheath would range from 12-24 cc.

The authors note that superselective angioembolization can lead to loss of up to 15% of the renal parenchyma, thus novel techniques such as these are important adjuncts to the PCNL armamentarium. The authors emphasize the need for close hemodynamic monitoring for any signs of persistent bleeding in the perioperative period.

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