Temporary Arterial Balloon Occlusion of Internal Iliac Artery to Control Hemorrhage after Pelvic Trauma

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Angiography has been widely used to identify the source of hemorrhage. Hemostasis with temporary balloon occlusion is used occasionally to control hemorrhage. This technique provides an effective and safe choice rather than surgical intervention. We report a 7-year-old girl with traumatic pelvic fracture. Massive vaginal bleeding developed on the 6th day of hospitalization. Hypovolemic shock was noted in spite of aggressive fluid challenge and blood transfusion. We were consulted to help stop the hemorrhage. The source of hemorrhage was confirmed by angiography under fluoroscopy. A balloon catheter was placed and inflated in the proximal portion of the anterior division of the left internal iliac artery. The hemorrhage was stopped successfully. The balloon catheter was removed the next day. There was no complication after this procedure. Therefore, temporary balloon occlusion should be considered as an alternative in emergent situation or when surgical intervention is technically not feasible.

Key Words: Balloon occlusion • Hemorrhage • Iliac artery • Pelvic fracture

INTRODUCTION

Pelvic fractures with retroperitoneal bleeding are associated with high morbidity and mortality rates. Surgical intervention to control hemorrhage is the traditional management.[1,2] However, the injured vessels are usually difficult to expose.[2] Therefore, angiography provides a better choice rather than surgery, with advantage of direct identification and easy embolization in these cases.[2] Previous literature had reported that temporary balloon occlusion was used in many situations, such as retroperitoneal hemorrhage, obstetric hemorrhage, traumatic liver hemorrhage, and pulmonary hemorrhage.[1,3-5] In this case report, we present a girl with severe vaginal hemorrhage after trauma that was treated successfully with temporary arterial balloon occlusion of the anterior division of the left internal iliac artery. This technique should be considered as an alternative to control hemorrhage in emergent situations.

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CASE REPORT

This 7-year-old, 20-kilogram little girl was run over by a bus when crossing the street. Her vital signs were stable when she was sent to our emergency department. A whole-body computed tomography (CT) scan was performed. Bilateral hemothorax, left kidney and spleen laceration, and fracture of the left superior pubic ramus were noted on CT image. Pigtail insertion for hemothorax and fixation of the pelvis with cloth were performed. The patient was admitted to our intensive care unit. Although her vital signs were stable, a persistent small amount of vaginal bleeding (about 10 ml per day) was noted during the first 5 days of hospitalization. She

was transfused blood to correct the anemia.

However, massive vaginal bleeding (590 ml) developed on the 6th day of hospitalization. Hypovolemic shock was noted in spite of aggressive fluid challenge and blood transfusion. The patient's blood pressure dropped to 80/44 mmHg, heart rate increased to 142/min, and respiratory rate was 30/min. The total amount of vaginal bleeding was about 1100 ml that day. The girl was sent to the catheterization laboratory. Left-side bleeding was suspected because of left pelvic facture. Therefore, right femoral artery approach was chosen. Extravasation of contrast medium from the anterior division of the left internal iliac artery was noted (Figure 1). A 6 Fr right Judkins-4 guiding catheter (Cordis, Miami, FL) was engaged to the left internal iliac artery. A Whisper guide wire (Abbott Vascular, Santa Clara, CA) was then delivered into the anterior division of the left internal iliac artery. A 1.5-mm × 2.0-mm Voyager balloon catheter (Abbott Vascular, Santa Clara, CA) was placed and inflated in the proximal portion of the anterior division of the left internal iliac artery (Figure 2). There was no more extravasation of contrast medium after balloon occlusion. The balloon was kept inflated in this position. The patient was sent back to ward for observation. Pulsations of bilateral legs and skin color were checked closely. Her vital signs were stabilized after this procedure. There was no more vaginal bleeding noted after balloon occlusion. The balloon catheter was deflated after 21 hours. Hysteroscopy was performed and confirmed there was no more bleeding. Therefore, the balloon catheter was removed the next day. One month later after her condition was stable, the patient was discharged. There was no complication noted since then.

DISCUSSION

Angiography was first described in the 1960s to identify the site of hemorrhage.[2] Transcatheter arterial embolization to control hemorrhage was first used in the 1970s.[2] In fact, hemostasis with balloon occlusion has been widely used for the treatment of bleeding secondary to vascular perforation in coronary intervention in recent years. Previous literature reported that balloon

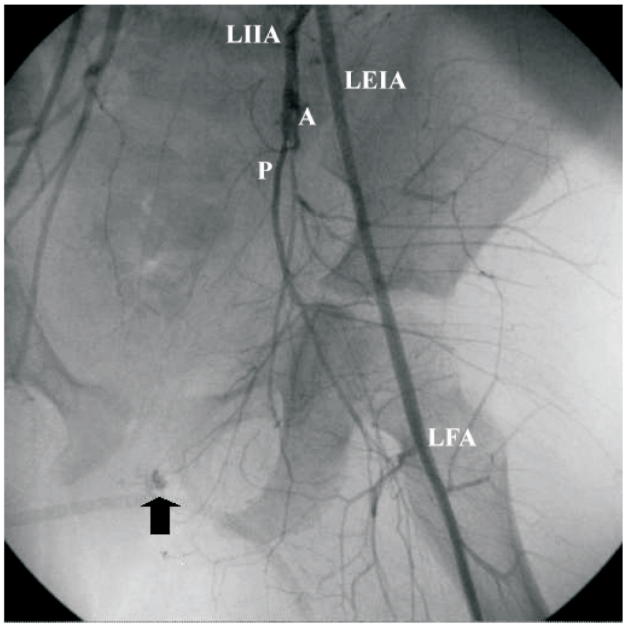

Figure 1. *The arrow represents the extravasation of contrast medium from the anterior division of the left internal iliac artery. In this picture, fracture of the left superior pubic ramus is also noted. LEIA: left external iliac artery; LIIA: left internal iliac artery; A: anterior division of internal iliac artery; P: posterior division of internal iliac artery; LFA: left femoral artery.*

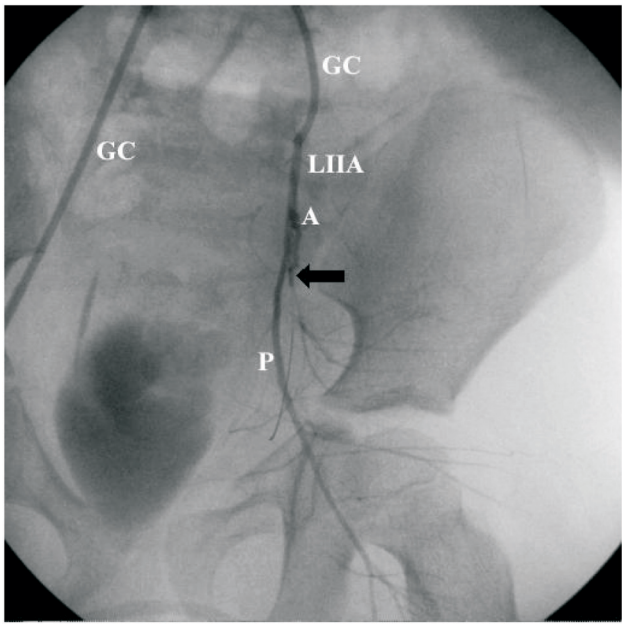

Figure 2. *The arrow represents the inflated balloon. The balloon catheter is inflated and placed in the proximal portion of anterior division of the left internal iliac artery. There was no extravasation of contrast medium after injecting contrast medium through the guiding catheter. GC: guiding catheter; LIIA: left internal iliac artery; A: anterior division of internal iliac artery; P: posterior division of internal iliac artery.*

occlusion was used in many situations, such as retroperitoneal hemorrhage, obstetric hemorrhage, traumatic liver hemorrhage, and pulmonary hemorrhage.[1,3-5] Some studies also reported that arterial balloon occlusion was used perioperatively to reduce intraoperative blood loss and transfusion requirement.[1,3,6,7] Microcoils, gelfoam, polyvinyl alcohol, and thrombin are sometimes used concomitantly with balloon occlusion to induce arterial thrombosis and control hemorrhage.[1]

Gelfoam is classified as a short-acting occluding agent. This agent was reported for embolization in abdominal, retroperitoneal, and pelvic hemorrhage.[8] The advantages of gelfoam are its availability, low cost, the ease and speed of delivery. However, delayed recanalization is one of its disadvantages.[8] Most cases require 20 to 30 days of recanalization after embolization.[8] Permanent occlusion by gelfoam may occur. Surgical intervention is indicated if there is evidence of organ ischemia or infarction. Another disadvantage of gelfoam is less selectivity because it may reflux into non-target arteries.[8] Microcoil is a superselective material. Because microcoil can be readily seen, it allows precise deployment. In one study, immediate hemostasis was achieved in 97% of patients of colonic hemorrhage after microcoil embolization.[9] However, although rare, ischemic complication was still a major concern.[9]

Traumatic pelvic fractures are associated with high morbidity and mortality rates. The major reason for mortality is hemorrhage from retroperitoneal vessels. Surgical intervention is the traditional management to control the hemorrhage.[1,2] However, those injured vessels are difficult to expose because of hemorrhagic surgical field.[2] Therefore, with its advantage of direct identification of the source of hemorrhage and easy embolization, angiography provides a better choice to help in controlling hemorrhage.[2]

Despite its benefits, balloon occlusion has risks. Any endovascular treatment may cause endothelial damage and result in thrombus formation and subsequent embolus. Prolonged balloon occlusion can cause tissue ischemia. Therefore, intermittent deflation of the occluded balloon is sometimes needed to reduce the risk of tissue ischemia. Other complications, such as catheter dislocation, vessel dissection or rupture, have been reported.[6]

In our case, the balloon was inflated in the anterior division of the internal iliac artery. Extensive anastomoses and collateral vessels are rich is this area. Therefore, tissue ischemia is less possible. However, these collaterals vessels may decrease the efficacy of balloon occlusion of the internal iliac artery. It is unclear that balloon occlusion in the anterior division of the internal iliac artery will influence the patient's fertility. One study using gelfoam embolization to control post-partum hemorrhage in adults showed no influence on subsequent fertility.[10] Long-term observation is needed in our case.

Here, we have reported a little girl with traumatic pelvic fracture. Conservative treatments including fluid resuscitation and blood transfusion failed to control hemorrhage. Surgical intervention was difficult because the source of hemorrhage was not localized. Hysterectomy was not considered because her fertility should be preserved. Because the episode of hemorrhagic shock happened on a Saturday night, the fastest management we could choose was balloon occlusion. Gelfoam and microcoil were not chosen because no interventional radiologist was on duty in the hospital at that time. Using angiography to identify the source of hemorrhage, hemorrhage was treated with temporary balloon occlusion successfully.

In summary, temporary arterial balloon occlusion is an effective and safe alternative for controlling hemorrhage. This technique should be considered in emergent situations and when surgical intervention is technically not feasible. Further study on the long-term safety of this technique is necessary.

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