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Case Report

Carbon dioxide angiography and arterial embolization could successfully control postpartum uterine hemorrhage for the patient with hypersensitivity to iodine compound

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ABSTRACT

Transcatheter arterial embolization has become a common management option for intractable postpartum uterine hemorrhage. Iodinated contrast agents are commonly used for embolotherapy but cannot be used in patients with renal dysfunction or iodine allergy. A 37-year-old woman spontaneously delivered a healthy girl but developed severe postpartum uterine hemorrhage, probably due to placenta accrete. Contrast-enhanced computed tomography revealed extravasation of the iodinated contrast agent into the uterine cavity. The patient subsequently developed allergic reaction to this agent. After recovery from the allergic reaction with appropriate treatment, we performed carbon dioxide angiography and found that the extravasation originated from the right uterine artery. Embolization of the right internal iliac artery was performed, and hemostasis was verified. Based on this experience, we suggest carbon dioxide angiography and arterial embolization can be used for treating intractable postpartum hemorrhage in patients with iodinated contrast media allergy or renal dysfunction.

Introduction

Postpartum uterine hemorrhage is an obstetric emergency and remains a major cause of maternal deaths worldwide. Primary management options for this condition include bimanual uterine massage, uterotonic agent administration, and balloon tamponade. Another reliable and safe alternative is transcatheter arterial embolization, which has also proven effective for intractable postpartum uterine hemorrhage [1], alongside other surgical approaches such as compression sutures, ligation of responsible artery, and hysterectomy. Indeed, arterial embolization is included in management guidelines for critical bleeding in obstetrics [2].

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Transcatheter arterial embolization is highly effective at achieving hemostasis and recently has helped to reduce the number of patients requiring hysterectomy. An iodinated contrast agent is typically used for angiography and arterial embolization, but caution must be taken when using such agents due to the possibility of an allergic reaction and renal toxicity. Mild allergic symptoms include urticaria, nausea, and vomiting, while serious anaphylactic reaction involving constriction of the airways, low blood pressure, and arrhythmia may be life threatening. In Japan, those serious reactions to iodinated contrast media was observed in 0.04%–0.22% [3]. In patients with a history of iodine allergy or renal dysfunction, carbon dioxide (CO_2) is occasionally used as an alternative contrast media [4].

We present here a case of a woman with severe postpartum uterine hemorrhage who developed an allergic reaction to the iodinated contrast agent during contrast-enhanced computed tomography (CT), which we were able to control successfully by using CO_2 as an alternative contrast medium for angiography and arterial embolization.

Fig. 1 – Contrast-enhanced computed tomography showed extravasation of the iodinated contrast agent into the uterine cavity (arrow).

Case

A 37-year-old nulliparous woman vaginally delivered a healthy girl weighing 3460 g at 39 weeks and 5 days of gestation in a local hospital. Without spontaneous expulsion, the placenta was manually removed and a small defect was noted. Hemorrhage from the uterine cavity persisted, with more than 700 mL of blood loss occurring within a 30-minute period after removal of the placenta. The patient showed signs of hemorrhagic shock and was urgently transported to our hospital.

On arrival, her blood pressure and heart rate were 74/40 mm Hg and 110 beats/min, respectively. Laboratory data indicated anemia (erythrocyte count 298 × 10^4/μL, hemoglobin 9.7 g/dL, hematocrit 31%) and an elevated fibrin degradation product level (22.0 μg/mL). Her obstetric disseminated intravascular coagulation score [5] was 8. Ultrasound imaging showed that part of the placenta had remained in the uterine cavity. Upon manually examining the uterine cavity, we removed a 5-cm piece of the placenta. Administration of oxytocin decreased the hemorrhagic flow with satisfactory uterine contraction. Simultaneously, we initiated transfusion of packed red blood cells and fresh frozen plasma and administered gabexate mesilate (1500 mg/d), urinastatin (100,000 IU/d), and antithrombin III (3000 IU/d) to treat disseminated intravascular coagulation. During the initial 12 hours after her arrival at our hospital, 20 units of red blood cell and 41 units of fresh frozen plasma were needed to maintain hemodynamics. Through these intensive treatments, her physical condition improved temporarily.

However, 8 hours after the full placental expulsion was completed at our hospital, uterine hemorrhage increased again and blood loss >1000 mL was observed within a 1-hour period. Contrast-enhanced CT was performed to locate the source of the hemorrhage. After administration of the iodinated contrast agent, iopamidol which was one of the low-osmolar iodinated contrast media (LOCM), the patient experienced flushing of the skin, coughing, and nausea. Wheezing could also be heard over both lungs. These symptoms disappeared after intramuscular injection of adrenaline (0.3 mg) and intravenous injection of methylprednisolone (125 mg).

We hypothesized that the patient had experienced an allergic reaction to the iodinated contrast agent. The limited images obtained by contrast-enhanced CT showed extravasation of the agent into the uterine cavity (Fig. 1). Therefore, we considered that arterial embolization or surgery was required to achieve hemostasis. Since the patient was a primipara and had a strong desire to preserve her uterus, we decided to perform angiography using CO_2 instead of an iodinated contrast agent and arterial embolization.

A 4-Fr sheath was placed in the left femoral artery, and a catheter tip was then placed in the right internal iliac artery. Contrast imaging with CO_2 confirmed contrast leakage through the right uterine artery (Fig. 2A). A microcatheter was inserted in the internal iliac artery, and embolization was performed using pieces of gelatin sponge. Subsequently, hemostasis was verified (Fig. 2B). A total of 80 mL of CO_2 was used without any complications.

Ten days after this treatment, she was discharged well. Pituitary hormone levels were within normal ranges at 1 month postpartum. Magnetic resonance imaging at 2 months postpartum showed no unusual findings in the uterus, and normal menses resumed at 6 months postpartum.

Discussion

We successfully used CO_2 in the present patient who was not known to be allergic to iodinated contrast media until such an agent was used in the management of severe postpartum uterine hemorrhage. To the best of our knowledge, this is the first case report describing the use of CO_2 angiography and arterial embolization for postpartum uterine hemorrhage.

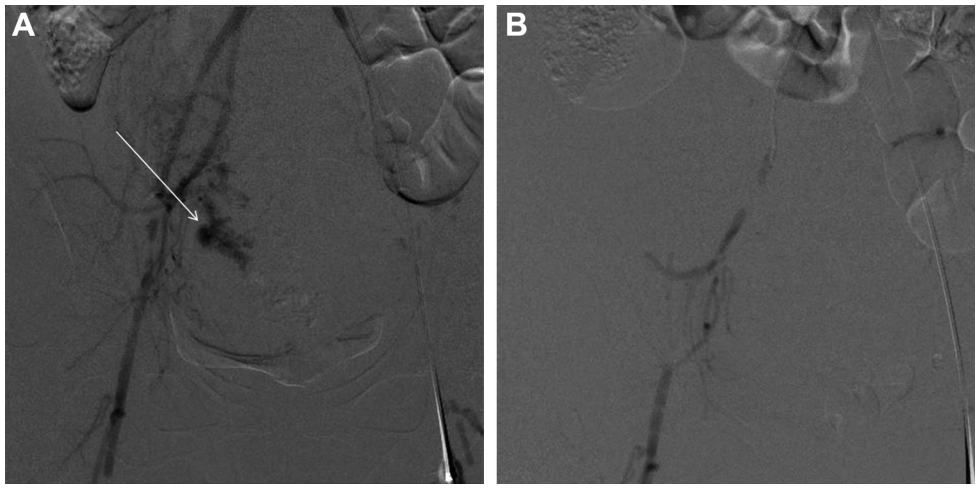

Fig. 2 – (A) Carbon dioxide angiography showed contrast agent leakage from the right uterine artery (arrow) (before transcatheter arterial embolization). (B) Carbon dioxide angiography showed complete hemostasis (after transcatheter arterial embolization).

Postpartum hemorrhage is the most significant cause of maternal death. Most cases occur soon after delivery, and uterine atony is the most common cause. Therefore, primary treatment for this status is the use of uterotonics, including oxytocin, methylergonovine, Prostaglandin F2 alpha, and so on. Then, uterine tamponade techniques, using gauze packing, Bakri tamponade balloon, and so on, should be performed in needed. If these treatment cannot control the hemorrhage, surgical approach, including artery ligation, B-Lynch uterine suture, and hysterectomy, should be considered to save maternal life. However, those surgical treatments have the risks to cause postoperative ovarian dysfunction or infertility. As the method to avoid surgical treatment, transcatheter arterial embolization is considered a safe and effective method for controlling postpartum uterine hemorrhage [1,2]. But careful observation must be taken using iodinated contrast agents for angiography to avoid serious complications, such as allergic reactions and renal toxicity. We used iopamidol, which was one of the LOCM, for contrast-enhanced CT because LOCM has been known to be less nephrotoxic and suitable for the patients under the risk of renal dysfunction due to massive hemorrhage like this case [6]. For those patients with sensitivity to these agents, CO_2 is known to be the only agent to be used safely [4]. Moreover, CO_2 is nonallergenic and nontoxic to the kidneys. Therefore, there is another advantage that CO_2 can be used for the patients with decreased renal function.

Its clinical use as an angiographic contrast agent was first proposed in the mid-20th century [7], and it is now often used in place of iodinated contrast agents. Today, CO_2 can be used for the imaging of shunt vessels in patients on hemodialysis [8], the wedged hepatic venography in the evaluation of portal hypertension [9], and angiography in patients with renal dysfunction due to chronic kidney disease [10]. Moreover, as the new technique to replace the standard splenic arterial portography, CO_2 wedged arterial splenoportography is introduced to visualize gastric varices associated with splenic vein occlusion [11]. Further investigations to widen the range of applications of CO_2 angiography are expected.

Meanwhile, CO_2 angiography has certain limitations. Since CO_2 provides poorer contrast enhancement and lower image contrast than iodinated contrast media, its usefulness for small arteries remains limited [4,12]. In the present case, it was not easy to identify the origin of the uterine artery from the umbilical artery due to weakness of the contrast offered by CO_2 angiography. Therefore, we chose to embolize the distal part of the internal iliac artery from the origin of the superior gluteal artery in this patient. It should also be noted that the specific gravity of CO_2 is less than that of blood. Therefore, CO_2 cannot be used to image arteries running dorsally. Moreover, it should not be used to image arteries above the diaphragm since several cases of organ infarction—including cerebral infarction, myocardial infarction, and spinal cord infarction—due to CO_2 embolisms in such arteries have been reported [4,13,14]. Given that neither the course of the umbilical or uterine artery nor the position of the uterus in the abdomen meets the conditions mentioned above, angiography and embolization using CO_2 appears to be clearly indicated for obstetric hemorrhage, especially for the patients with hypersensitivity to iodine compound.

In conclusion, although a deeper understanding of this procedure and its underlying mechanisms and complications is important, CO_2 angiography has the potential to expand the utility of arterial embolization for postpartum uterine hemorrhage. In particular, it could be safely used as an alternative therapy in patients complicated by iodinated contrast media allergy or renal dysfunction.

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