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CASE REPORT

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Conservative treatment of bladder flap hematoma complicated with uterine artery pseudoaneurysm after cesarean section via internal iliac artery embolization: a case report

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Abstract

Background Bladder flap hematoma (BFH) is a rare complication associated with cesarean section (CS). Its pathogenesis is linked to insufficient hemostasis and bleeding at the incision site, leading to the formation of a hematoma between the bladder and the lower uterine segment (LUS). To the best of the authors' knowledge, no specific protocols have been formulated to guide the treatment of BFH.

Case presentation A 29-year-old woman underwent an emergency CS due to relative cephalopelvic disproportion. Twenty-two hours after the CS, she developed pale red hematuria accompanied with a significant decrease in hemoglobin. The patient experienced two fainting episodes after standing and engaging in activity, along with vaginal bleeding. A bedside ultrasound revealed a 50 mm fluid-filled sonolucent area between the lower uterine segment (LUS) and bladder. Subsequently, the patient received conservative treatment with internal iliac artery embolization, antibiotics and blood transfusion, to avoid secondary laparotomy. The angiography and computer tomography examinations revealed the existence of uterine artery pseudoaneurysm and a large BFH. Her vital signs remained stable after the intervention and repeat ultrasonography demonstrated a significant reduction in the hematoma size.

Conclusions Selective pelvic artery embolization as a conservative treatment can be a safe and effective option for large BFH, provided the patient remains clinically stable. This interventional therapy presents an innovative, non-surgical approach to a condition that is typically treated surgically and may carry the risk of irreparable complications.

Keywords Bladder flap hematoma, Pseudoaneurysm, Cesarean section, Artery embolization, Conservative treatment, Case report, Interventional radiology

Introduction

Cesarean section (CS) can be a life-saving surgical intervention but can also introduce complications to the mother and the newborn. The commonly reported acute complications include infections such as endometritis or wound infections, hematomas or abscesses [1]. Bladder flap hematoma (BFH) is a rare complication associated with lower transverse cesarean, caused by uterine

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bleeding following closure [2]. The clinical manifestations of BFP are atypical due to their special formation site, and it is often accompanied with wound pain and uterine contractions pain after CS, and cannot be identified early. The condition is diagnosed by the presence of hypovolemic shock and a significant decrease in hemoglobin (Hb), which delays the initiation of treatment.

In the present case, we describe a patient with large BFH complicated with uterine artery pseudoaneurysm (UAP) post CS that was successfully treated by conservative medical management via internal iliac artery embolization. The patient provided written informed consent for the publication of this case.

Case presentation

A 29-year-old woman (gravida 1, para 0) was admitted to our hospital at 40^{+4} weeks of pregnancy due to paroxysmal irregular abdominal pain, on Day1 at 22:05 (we considered the day of admission as Day1). No other abnormalities were found in prenatal examinations, except for positive vaginal culture of Group B Streptococcus. She was administered 2.0 g of intravenous cefazolin to prevent intrauterine infection of Group B Streptococcus since the penicillin skin test was positive, showing local redness and swelling at the skin test site [3, 4]. The labor process had stopped for 3 h at cervical dilation of 8 cm. On Day 2 at 11:25, an emergency CS was performed under combined spinal-epidural anesthesia due to relative cephalopelvic disproportion.

During the CS operation, a transverse incision was conducted, and significant edema of lower uterine segment (LUS) was observed. A female baby weighing 3250 g was delivered with an Apgar score of 10–10 and intact placenta delivery. Uterine contraction was poor even after uterine injection of Oxytocin 20 IU. Consequently, 250 μg Hemabate was injected intrauterine to promote contraction. A further examination of the uterine incision revealed that the upper part of the incision on the right side was extended and torn to the right broad ligament. Thus, the incision was sutured to stop the bleeding and the ascending branch of the right uterine artery was also ligated to prevent postpartum hemorrhage. Finally, the three layers of the uterus were sutured and the peritoneum was closed. The total bleeding during the entire procedure was about 400 mL, which lasted 1 h and 5 min. After the operation, cefazolin 1.0 g was administered to prevent infection, uterine contraction was stimulated by intravenous administration of oxytocin, urinary drainage was maintained until urine volume was normal.

Twenty-two hours after surgery, the patient developed pale red hematuria, and blood tests revealed a significant drop in Hb from 13.4 g/dL at admission to 6.2 g/dL. The patient's hemodynamic status was stable, with blood pressure (BP) of 117/69 mmHg, heart rate (HR) of 105 beats per minute (bpm), body temperature (T) of 37.2 ℃, and respiration (R) of 18 times per minute. The shock index (SI) of the patient was about 0.90. No dizziness, palpitations, or chest tightness were observed, but developed a pale complexion. The fundus uteri was flat consistent with the navel. Palpation of the fundus elicited pain and vaginal bleeding. The catheter was patent, with light red urine and normal urine output. Emergency reexamination showed a Hb concentration of 5.6 g/dL. Analysis of the patient's coagulation function indicated that the concentration of D-Dimer (D-D) and fibrin degradation product (FDP) were 3.46 g/L and 14.2 mg/L, respectively. The result of plasma protamine paracoagulation (3P) test was negative. The first bedside ultrasound showed a 59×25 mm hypoechogenicity in the uterine cavity, and no significant fluid accumulation was seen in the abdominal and pelvic cavities. The cervix was at the extreme posterior position, deviating from the normal position and could not be accessed through vaginal examination. Subsequently, Hemabate 250 μg was intramuscularly administered to promote uterine contractions, and the patient was transfused with 3 units of red blood cells (RBCs) and 400 mL of plasma to correct anemia. Blood routine showed found Hb of 7.7 g/dL, but the patients experienced two episodes of fainting when standing up and engaging in activity, accompanied with vaginal bleeding about 400 mL(with blood clots). The HR rose to 143 bpm, BP was 109/63 mmHg, and SI was about 1.31. The Hb concentration further decreased to 5.9 g/dL, while D-D and FDP increased to 15.37 g/L and 50.6 mg/L, respectively. The second bedside ultrasound showed the uterus measuring 143×98×113 mm, with a mixed hypoechoic area of 127×78 mm. Additionally, a 50 mm fluid-filled sonolucent area was observed outside the anterior uterine wall muscle layer. The patient's examination results and shock symptoms didn't match the amount of vaginal bleeding, and we suspected the possibility of pelvic hematoma formation. The Vascular Interventional Department was immediately contacted to perform transcatheter arterial embolization (TAE).

At 23:09 on Day3, bilateral internal iliac artery angiography showed that bilateral uterine artery stenosis, with contrast agent accumulation in the branches of the right uterine artery. The surrounding tissue wrapped up this blood accumulation and the space still had continuity with the parent artery, which suggesting the formation of pseudoaneurysm. Due to the inability to locate the uterine artery, embolization with fine particles of gelatin sponge was performed via injection into the bilateral internal iliac arteries. The interventional treatment was administered by two experienced interventional radiologists, which lasted for 50 min. Given the significant loss

Table 1 Changes in hemoglobin and coagulation function

Day		Time for blood draw	HB (11–15 g/dL)	Plt (100 ~ 300 x 10^9/L)	PT (9.4–12.5 s)	APTT (25.1–36.5 s)	FIB (2.38–4.98 g/L)	D-D (0–0.243 mg/L)	FDP (0–5 mg/L)	3P-test
D1	Admission	22:15	13.4	205	9.8	28.1	3.42	1.78	/	/
D3	After CS	10:00	6.2	174	/	/	/	/	/	/
		14:10	5.6	175	10.3	24.6	4.92	3.46	14.2	negative
		18:38	7.7	152	/	/	/	/	/	/
		21:38	5.9	173	11.1	25.1	4.05	15.37	50.6	/
D4	After TAE	0:55	8.0	98	/	/	/	/	/	/
	ICU	2:21	7.0	80	11.0	29	3.71	9.8	58.7	negative
		9:23	6.0	80	11.1	25.8	3.70	3.60	/	negative
		13:51	6.7	75	10.9	26.1	3.63	/	/	/
D5		9:55	7.1	78	10.9	27.3	3.66	2.01	/	/
D6		9:44	9.1	131	11.0	28.3	3.62	5.05	/	/
D7	General ward	11:07	9.6	177	11.9	29.8	3.91	5.75	/	/
D11		5:22	11.0	303	10.8	28.2	3.96	9.57	21.28	/
D13		9:32	11.9	296	/	/	/	2.48	/	/

CS Cesarean section, *Hb* Hemoglobin, *Plt* Platelet, *PT* Prothrombin time, *APTT* Prolonged activated partial thromboplastin time, *FIB* Fibrinogen, *D-D* D-Dimer, *FDP* Fibrin degradation product, *3P-test* Plasma protamine paracoagulation test, *TAE* transcatheter arterial embolization, *ICU* intensive care unit

of Hb, elevated levels of D-D and FDP, we suspected that there was significant depletion of coagulation factors. To prevent DIC and maintain circulatory stability during interventional surgery, 3.5 units of RBCs, 400 ml of plasma, 400 units of prothrombin complex concentrate, and 2 g of fibrinogen were infused during TAE. At 01:15 on Day4, the patient was transferred into ICU after TAE, and infused with antibiotic comprising ceftazidime and tinidazole. At that time, the patient's HR was 80 bpm, BP was 131/81 mmHg, and SI was 0.61. The concentration of Hb increased to 7.0 g/dL. D-D and FDP were 9.8 g/L and 58.7 mg/L, respectively, and the result of 3P-tset was remained negative. The changes in hemoglobin and coagulation function of the patient can be found in the Table 1.

Results of computed tomography (CT) of BFH after TAE are shown in Fig. 1. On the 5th day after CS, the patient's condition remained stable and was transferred from the ICU to the general ward. On the 7th day after CS, the transabdominal ultrasound revealed a uterus of 94×67×92 mm, with heterogeneous echoes of 56×16 mm in the uterine cavity, and mixed echoes of 110×53 mm close to the cervix (Fig. 2). On the 9th day after surgery, antibiotics were stopped and conservative treatment was continued. Her body temperature remained normal and blood pressure remained stable. The patient had no further complaints and was subsequently discharged 13 days after surgery, and regular followed-up ultrasound examinations confirmed continuous reduction of the hematoma. One month after CS, transabdominal ultrasound results showed a 58×42 mm fluid sonolucent area between the LUS and the bladder (Fig. 3). Six months after CS, the patient resumed her normal menstrual and the residual BFH also shrank to around 15.4×7.5 mm (Fig. 4).

The patient's diagnosis and treatment processes are illustrated in Fig. 5.

Discussion

BFH is a rare complication associated with CS through a LUS transverse incision in which the uterovesical peritoneal reflection is incised. It occurs due to insufficient hemostasis and bleeding at the incisions site between LUS and bladder [5]. The bleeding is caused by injury to the arterial wall during childbirth. A pseudaneurysm may form if the blood is covered by the surrounding tissue

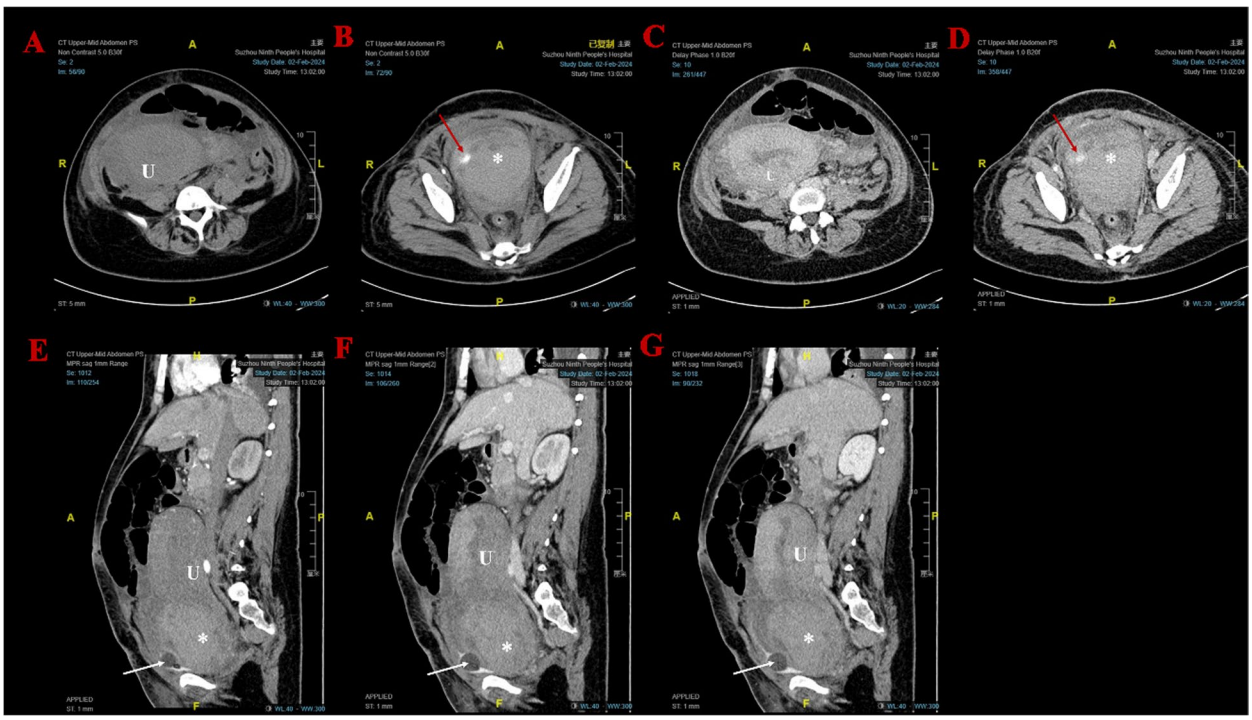

Fig. 1 CT images of bladder flap hematoma after internal iliac artery embolization. **A**, **B** Axial non-contrast CT images of the uterus (U), showing a high-density shadow (*) in the pelvic. Significant high-density accumulation of iodine agents was seen in the soft tissues (red arrow). **C**, **D** Axial contrast-enhanced CT images showed that compared to the uterine wall(U), the enhancement of the mass (*) was not significant, suggesting a diagnosis of hematoma. **E**, **F**, **G** Arterial, venous and delayed phase of sagittal reformatted contrast-enhanced CT images indicating a high-density shadow measuring approximately 12×7.5 cm between the lower segment of the uterus (U) and the bladder (white arrow reflecting the catheter balloon) without significant enhancement, suggesting a hematoma

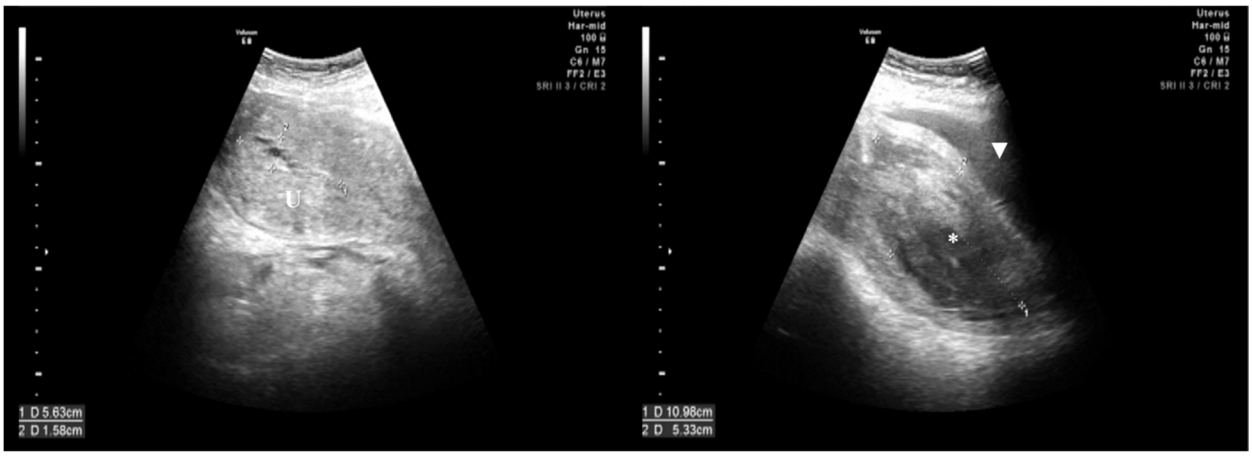

Fig. 2 Transabdominal ultrasonography images of bladder flap hematoma on the seventh day after cesarean section. The uterus(U) measuring 94×67×92 mm was observed and the mixed echoes of 110×53 mm (*) were seen between lower uterine segment and bladder (▼)

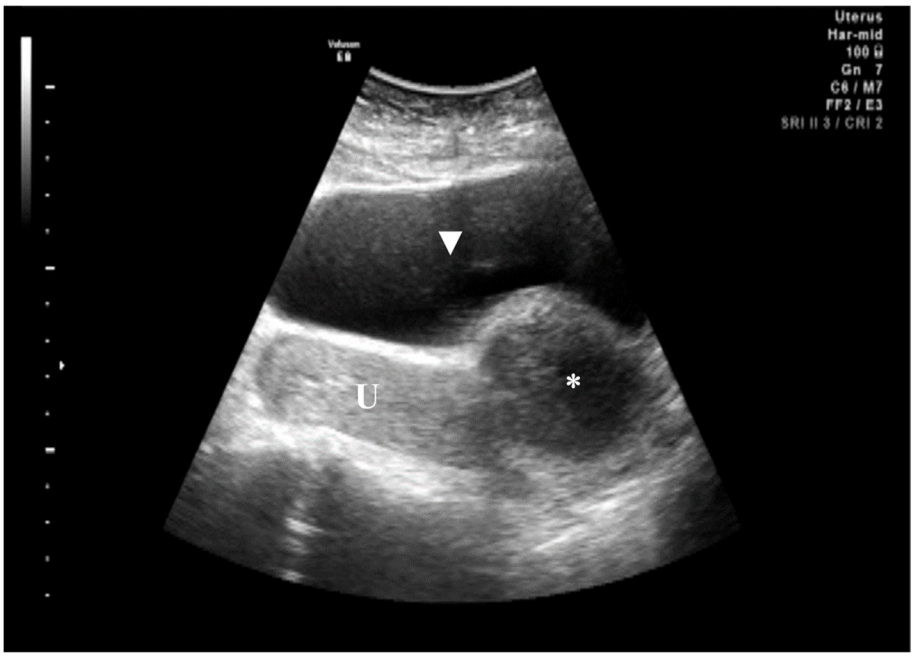

Fig. 3 Transabdominal ultrasonography images of bladder flap hematoma one month post-cesarean section. Residual bladder flap hematoma (*) was a 58×42 mm fluid sonolucent area between the lower segment of the uterus (U) and the bladder (▼)

and if the space is continuous with the parent artery [6, 7]. Another rare complication of CS is UAP, which causes delayed postpartum hemorrhage and can be life-threatening if rupture occurs. An unruptured UAP may be asymptomatic. A study by Yosuke Baba on patients with delivery/abortion-related UAP reported that the lag time between manifestation/detection and delivery/abortion (preceding events) was a median of 28 days, with the shortest being 0 day and the longest being 140 days [7]. On imaging, the margin of the pseudoaneurysm was irregular and was surrounded by a hematoma [8]. It is postulated that the UAP may contribute to the occurrence of BFH.

The diagnosis of BFH after CS is complicated owing to the non-specific clinical manifestations. In some cases, it presents as lower abdominal pain, hypovolemia which increases tachycardia, decrease in Hb and oliguria, infection or hematuria, all of which are non-specific [9]. In the

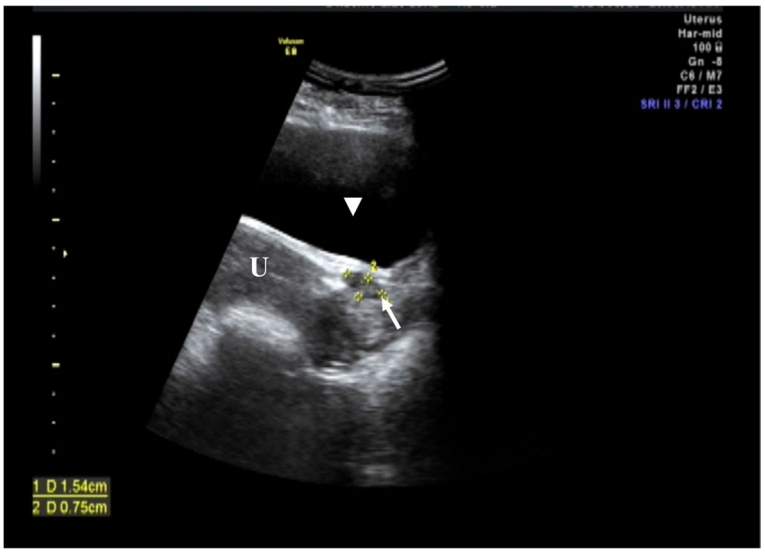

Fig. 4 Transabdominal ultrasonography images of bladder flap hematoma six month post-cesarean section. Residual bladder flap hematoma (white arrow) was a 15.4 × 7.5 mm fluid hypoechoic area between the lower segment of the uterus (U) and the bladder (▼)

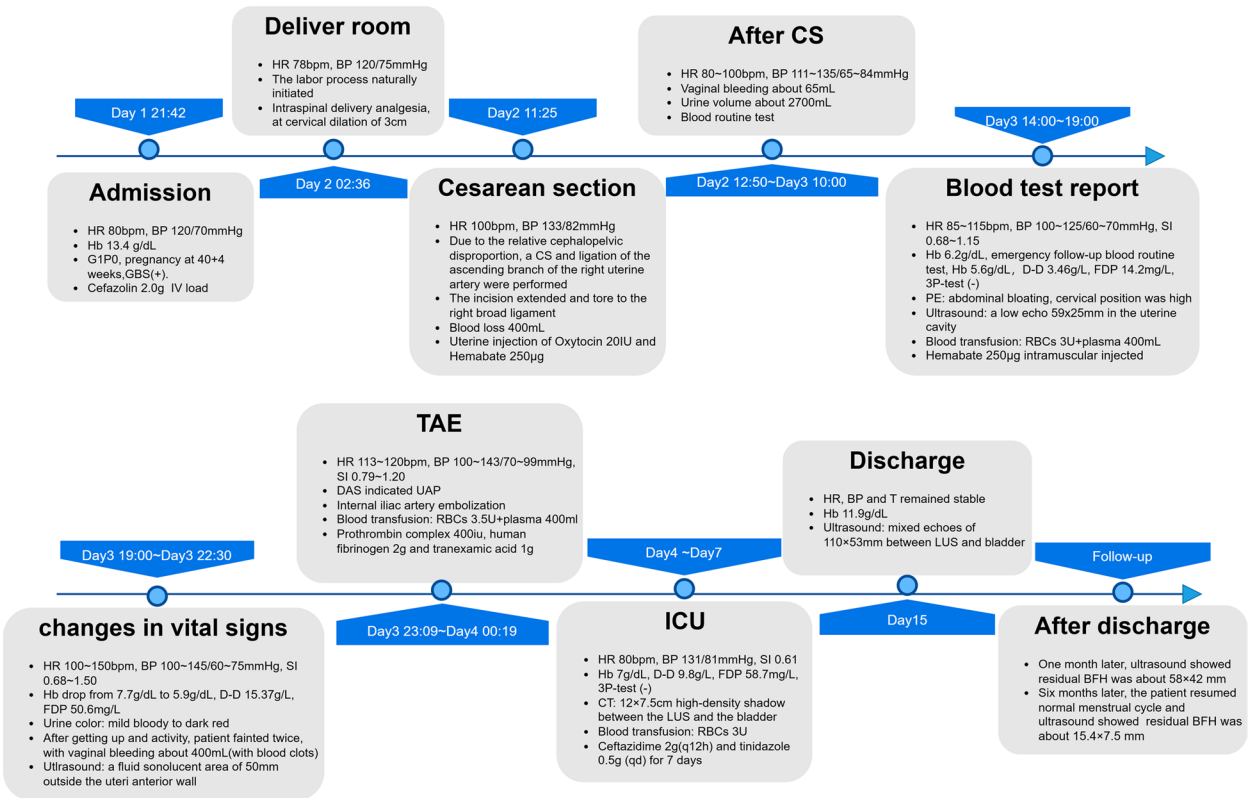

Fig. 5 The patient's diagnosis and treatment process. HR, heart rate. bpm, beats per minute. BP, blood pressure. Hb, hemoglobin. GBS, group B streptococcus. CS, cesarean section. IV, intravenous. SI, shock index. D-D, D-Dimer. FDP, fibrin degradation product. PE, physical examination. 3P-test, plasma protamine paracoagulation test. TAE, transcatheter arterial embolization. LUS, lower uterine segment. CT, computer tomography. ICU, intensive care unit. T, body temperature. RBCs, red blood cells. BFH, bladder flap hematoma. UAP, uterine artery pseudoaneurysm

Table 2 Published cases reports on different treatment methods for BFH

Author	Cases	Age (years)	Gestational weeks	Indication for CS	Time for BFH symptoms after CS	Symptoms	Conservative treatment	Surgical treatment	Duration of hospital stay after re-surgical treatment	Complications
Tinelli [14]	1	38	/	Scarred uterus	3 days	lower abdominal pain and anaemia, TAUE showed the a BFH of 11 × 8 × 6 cm, fever, dysuria	ceftriaxone (4 g/daily) and tobramicine (160 mg/daily) for 10 days	Laparoscopic surgery	2 days	Infection (The final histological examination of the BFH and its borders showed purulent material with an abscess pseudo-capsule)
	2	31	/	Dystocia	4 days	lower abdominal pain and anaemia, TAUE showed the a BFH of 9 × 7 × 5 cm, fever	/	Laparoscopic surgery	2 days	Infection (The final histological examination of the BFH and its borders showed purulent material with an abscess pseudo-capsule)
Tinelli [13]	10	Average 33.5	Average 39 + 2	PROM > 36 h (2) Dystocia (3) CS on request (2) Failed induction (1) Non reassurance NST (2)	Average 7 days	Lower abdominal pain, diarrhea, and fever	ceftri axone (4 g/daily) and tobramicine (160 mg/daily) for 7 days	Laparoscopic surgery	Average 1.3 days	Infection (The final histological examination of the BFH and its borders showed purulent material with an abscess pseudo-capsule)
Thanasa [2]	1	19	40	Non reassurance NST	3 days	Fever, atpical abdominal pain and continuous severe pain localized in the right renal region	tigecycline (100 mg/12 h) and tazobactam-piperacillin (4 g/8 h) for 7 days	Re-laparotomy	5 days	Right hydrouretero-nephrosis
Singh [15]	1	28	39 + 4	Dystocia	2 h	Hematuria, the uterine size increased to 26 weeks gestation, ultrasound revealed a BFH of 100 cc	broad-spectrum antibiotics for 1 day	Re-laparotomy	/	/

BFH Bladder flap hematoma, *CS* Cesarean section, *TAUE* Transabdominal ultrasonographic evaluation, *PROM* Premature rupture of membrane, *NST* non-stress test

present case, the patient had no symptoms such as palpitations, chest tightness, nausea, vomiting, etc. after CS, which may have been masked by the good postoperative analgesic effect, but she reported mild abdominal pain. Twenty-two hours after surgery, the patient developed pale hematuria accompanied with a decrease of Hb from 13.4 g/dL before surgery to 6.2 g/dL, necessitating the search for the reason underlying the loss of Hb.

Imaging examination can facilitate to confirm the diagnosis of BFH. Pelvic ultrasonography is often applied as a preliminary imaging technique for postpartum pathology [10]. On ultrasound images, BFH appear as mixed-echogenicity avascular mass anterior to the LUS and posterior to the bladder wall [10, 11]. On CT images, the hematoma is somewhat attenuated and may be detected in the same location, with or without mass effect [5]. In this case, the initial bedside transabdominal ultrasound did not reveal any obvious pelvic mass or effusion, likely due to the presence of intestinal gas. However, changes in cervical position during the vaginal examination, along with notable tenderness above the bladder, suggested the formation of hematoma. Hematoma was suspected on the second bedside transabdominal ultrasound. For patients with significant decrease in Hb, imaging methods such as CT and magnetic resonance should be performed if ultrasonography is not sensitive enough.

To the best of our knowledge, no well-defined protocols have been proposed for the treatment of BFH. Various treatment methods such as conservative use of antibiotics, percutaneous or transvaginal drainage, laparoscopy or laparotomy exploration, etc. are often used. Notably, BFH measuring less than 4 cm is generally considered not clinically significant, while that measuring 5 cm may indicate the possibility of uterine dehiscence [5]. For patients who are haemodynamically stable, conservative treatment and broad-spectrum antibiotics may be administered as the first choice. However, in patients with severe hemorrhage or with hematoma accompanied by clinical signs of intra-abdominal infection, surgical treatment is recommended [2, 12, 13]. As is shown in Table 2, Tinelli and Thanasa's reported that patients with BFH developed fever and abdominal pain during conservative treatment. However, the patients' clinical condition did not improve, necessitating laparoscopic surgery or re-laparotomy [8, 13, 14]. Another study observed that continuous vaginal bleeding and hematoma enlargement symptoms occurred during conservative treatment, requiring exploratory laparotomy [15]. In this case, the patient experienced syncope, tachycardia upon mobilization, along with a further decline in hemoglobin and persistent bleeding. Our team promptly performed pelvic arterial embolization and identified a pseudoaneurysm in the right uterine artery during angiography. The common causes of pseudoaneurysm formation during CS include difficult fetal extraction, formation of a hemostatic point near the uterine artery or of the uterine incision [16, 17]. In this case, prolonged compression of the fetal head on the LUS led to tissue ischemia and edema, increased the difficulty of delivering the fetal head, and unexpected extension of the uterine incision towards the right broad ligament altering the anatomical structure and the puncture point for ligation of the ascending uterine artery adjacent to the parauterine vascular plexus. These factors made it difficult to perform surgical hemostasis. Following treatment, the patient in this case report didn't show any symptoms of fever or infection.

It has been reported that UAP can lead to severe postpartum hemorrhage following cesarean or vaginal delivery, which can be potentially life-threatening, and some of its effects may persist up to 10 years [8]. It is usually treated by laparotomy and hemostatic sutures or by uterine artery embolization [18]. Selective arterial embolization is a minimally invasive approach to precisely locate bleeding, identify pseudoaneurysms, and target their feeding arteries, effectively preventing the need for secondary laparotomy. Non-permanent embolic agents can achieve temporary interruption (with arterial recanalization within 3–6 weeks) and without affecting the patient's fertility in the long-term [19]. Following the internal iliac artery embolization, CT imaging showed that the patient's BFH measured about 12×7.5 cm, and the bleeding as well as vital signs were well-controlled. During the follow-up, ultrasound revealed gradual shrinkage of the hematoma, and menstruation normalized after six months. The conservative treatment proved successful, eliminating the need for the secondary laparotomy.

Conclusion

Conservative management through interventional radiology may be a viable alternative to conventional surgery when the patient remains hemodynamically stable. Due to the lack of sufficient evidence in the current literature, further studies or case reports are needed to validate the advantages of interventional radiology in the treatment of BFH.

Abbreviations

CS	Cesarean section
BFH	Bladder flap hematoma
UAP	Uterine artery pseudoaneurysm
Hb	Hemoglobin
bpm	Beats per minute
CT	Computer tomography
TAE	Transcatheter arterial embolization
LUS	Lower uterine segment
D-D	D-Dimer
FDP	Fibrin degradation product
SI	Shock index
3P-test	Plasma protamine paracoagulation test
RBCs	Red blood cells

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Not Applicable.

Authors' contributions
All authors contributed to the study conception and design. JYZ, CYW and YTL contributed to data collection, collation and analysis. JJY, GLJ and JYZ searched the literature. The first draft of the manuscript was written by JYZ and ZGQ. JJY and ZGQ were responsible for supervision, writing, reviewing and editing.

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Data availability
All data contained in this study can be obtained from the corresponding authors under reasonable request.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
The patient provided written informed consent for publication of identifying images or other personal or clinical details in open access journal.

Competing interests
The authors declare no competing interests.

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