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SHORT COMMUNICATION

Ultrasound-guided transvaginal thrombin injection of uterine arteries pseudoaneurysms

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Objective: To evaluate the utility of transvaginal ultrasound-guided thrombin injection (UGTI) to treat uterine artery pseudoaneurysms (UAPs) as an alternative to emergency arterial embolization.

Methods: Two females presenting with heavy vaginal bleeding were diagnosed with UAPs by pelvic CT scan. After UAP identification by transvaginal ultrasound, 2 cm³ of thrombin (Tissucol®; Baxter Healthcare Corporation, Munich, Germany) was slowly injected into the UAPs using a 30-cm long 22-gauge needle through a needle guide attached to the vaginal probe. The same procedure was performed in both cases, and the Doppler sign disappeared immediately and the bleeding stopped.

Results: We describe two cases of UAPs treated with transvaginal UGTI: one after intrauterine tandem and vaginal colpostat insertion for brachytherapy after diagnosis of cervical cancer (Case 1) and the other after the insertion of a levonorgestrel-releasing intrauterine device (Case 2).

Conclusion: Transvaginal UGTI could be a minimally invasive tool to treat selected cases of UAPs with severe vaginal bleeding.

Advances in knowledge: Transvaginal UGTI could avoid the need for uterine embolization and emergency hysterectomy in selected cases of UAPs diagnosed by CT scan.

INTRODUCTION

The formation of uterine artery pseudoaneurysms (UAPs) is a very rare condition and is generally associated with postpartum haemorrhage as well as surgical procedures and traumatic events. The origin of UAPs is generally iatrogenic, and they are typically related to interventions such as caesarean section, uterine curettage, vaginal delivery or cervical conisation¹ and may therefore occur after any traumatic event.

The development of UAPs induces a high risk of rupture and possible life-threatening bleeding. Indeed, UAPs cause vaginal bleeding but may also provoke internal bleeding. Emergency arterial embolization is the main therapeutic option to treat UAPs and has shown high rates of success.² However, the use of ionizing radiation and iodinated contrast is necessary when arterial embolization is performed, and in some cases, emergency hysterectomy is required.

Percutaneous ultrasound-guided thrombin injection (UGTI) has been used to treat pseudoaneurysms in other

locations, mainly those formed after artery puncture.³ UGTI treatment of femoral artery pseudoaneurysms is a safe technique with low complication rates. Currently, UGTI is one of the main treatments for superficial pseudoaneurysms in which percutaneous access is feasible.

In the field of gynaecology, UGTI was firstly described to treat two cases of late post-partum haemorrhage attributed to pelvic arterial pseudoaneurysm following caesarean section.⁴ This technique has recently been used to treat haemorrhage due to intrauterine arteriovenous malformations during post-partum⁵ and in caesarean scar pregnancies.⁶

METHODS AND MATERIALS

Transvaginal UGTI was considered in two females with severe vaginal bleeding and the presence of a UAP localized by pelvic CT scan (Figure 1). The UGTI procedure was performed following the methodology used for sentinel lymph node detection in endometrial cancer previously described by our team of oncogynaecologists.⁷ Patients

were asked to void and were placed in the lithotomy position. Transvaginal ultrasound (TVUS) was performed using an endovaginal transducer (Voluson V730 Expert; GE Healthcare, Chicago, IL). UAPs were identified as an anechoic mass with strong Doppler signals with the yin–yang Doppler sign, reflecting the turbulent flow inside the pseudoaneurysm^{1,8} (Figure 2a). A 22-gauge biopsy needle (Gallini Medical Devices, Mantova, Italy) was passed through the lateral vaginal fornix into the UAP. The 30-cm long needle was inserted through a needle guide attached to the vaginal probe. Local anaesthesia with 10 ml of 2% lidocaine was administered by infiltration in the vaginal fornix before the puncture. On confirmation of correct placement of the needle tip by fluent aspiration of the arterial blood, 2 cm³ of thrombin (Tissucol®; Baxter Healthcare Corporation, Munich, Germany) were slowly injected into the UAP. The blood flow was immediately discontinued, with the absence of colour Doppler signal (Figure 2b). Thrombin should be injected until the disappearance of the Doppler signal is observed, depending on the size of the UAP. The disappearance of the UAP was also confirmed by means of a new CT angiography (Figure 2c,d).

RESULTS

We present two cases of UAP successfully treated by transvaginal UGTI.

Case report 1

A 33-year-old female was diagnosed with a IIB bulky stage moderately differentiated invasive squamous carcinoma of the uterine cervix. Laparoscopic staging lymphadenectomy with oophoropexy was performed. After surgery, the patient underwent

Figure 1. Contrast-enhanced abdominopelvic multidetector CT in the arterial phase. Volume rendering showing the pelvic vascular anatomy. Uterine artery (black arrowhead) arises from internal iliac artery (black arrow). A pseudoaneurysm (white arrowhead) originating from the left uterine artery is observed.

chemoradiation therapy consisting of external radiotherapy (45-Gy dose) followed by brachytherapy. The insertion of the intrauterine applicator was extremely difficult due to the hardness of the cervix, a retroverted uterus and poor visualization of the cervicouterine canal due to a previous caesarean uterine scar. Finally, the tandem was placed in the uterine cavity and the colpostats into the vagina. On removal of the applicators after treatment, an unusual metrorrhage was observed. CT angiography showed the presence of a 16-mm UAP dependent on the left uterine artery. A percutaneous UGTI was proposed and successfully performed. Thereafter, the patient presented no further haemorrhagic episodes.

Case report 2

A 36-year-old female was attended to at a gynaecological primary care centre with abdominal pain and severe hypermenorrhoea. She had a history of myomectomy and a caesarean section. TVUS was performed in the primary care centre, showing a 6-cm intramural fibroid in the posterior uterine wall. The endometrial biopsy was negative for endometrial pathology. A levonorgestrel-releasing intrauterine device (IUD) type Mirena® was inserted. However, the symptoms worsened, and the patient was finally referred to our centre 1 week later. A three-dimensional TVUS (type RIC5-9, Voluson-V730 Expert, GE) was performed, confirming the fibroid and the presence of adenomyosis. Additionally, a 5-cm retrocervical haematoma was described. The IUD was not seen in the endometrial cavity, leading to suspicion of the presence of an accidental false passage during device insertion followed by migration of the IUD. On continuation of active bleeding, the patient underwent emergency surgery. The haematoma was removed, and myomectomy was performed following an uneventful post-operative course. Nonetheless, the patient consulted again 9 days later with a new heavy-bleeding episode requiring blood transfusion. An abdominal CT scan with intravenous contrast showed a left UAP measuring 11 mm. UGTI technique was proposed and carried out as in the previous case. Following the procedure, the patient remained asymptomatic. CT angiography performed 1 day later confirmed the absence of blood flow inside the UAP. Unfortunately, bleeding resumed despite the patient remaining asymptomatic for more than 1 week, and a hysterectomy was finally performed. Pathological findings after hysterectomy showed that the cause of bleeding was the myomectomy scar, probably due to the associated severe adenomyosis. Therefore, since recanalization of the UAP did not take place, the transvaginal UGTI was successful.

DISCUSSION

UAPs can be asymptomatic or cause life-threatening vaginal or intra-abdominal bleeding when ruptured. Thus, these pseudoaneurysms should be considered in the differential diagnosis of any unexplainable vaginal bleeding, especially after a recent obstetric or traumatic procedure. In the present series, severe and unpredictable vaginal bleeding was the main symptom, leading to severe analytical and haemodynamic consequences. In both cases, UAP was diagnosed after intrauterine tandem insertion for brachytherapy or the insertion of a levonorgestrel-releasing IUD.

On suspicion of UAP, both CT angiography and TVUS are strongly recommended to confirm the diagnosis. In our series, UAP was

Figure 2. (a) Longitudinal plane of the cervix obtained by transvaginal ultrasound. The pseudoaneurysm is identified as an anechoic mass with strong Doppler signals with the yin-yang Doppler sign, reflecting the turbulent flow inside the pseudoaneurysm (white arrow). (b) Longitudinal plane of the cervix obtained by transvaginal ultrasound performed after the treatment with thrombin, where the yin-yang Doppler sign (pseudoaneurysm) is no longer patent (white arrow). (c) Contrast-enhanced pelvic CT in the arterial phase. Note the hyperdense lesion in the uterus (white arrow), which was isodense in portal and delayed phases (not shown) consistent with uterine pseudoaneurysm. (d) Contrast-enhanced pelvic CT in the arterial phase performed after the treatment with thrombin, where the pseudoaneurysm is no longer patent (white arrow), showing a correct embolization.

first observed during CT scan performed to determine the cause of bleeding. After the diagnosis, the presence of the UAP was confirmed by TVUS using colour Doppler, being identified as a cystic area filled with a turbulent, multidirectional, mosaic blood flow.^{1,8}

Until recently, most females presenting with life threatening vaginal bleeding associated with a UAP were treated with hysterectomy.⁹ Thus, many fertile females underwent permanent sterility with all the subsequent physical and psychological impact that this entails. In the past years, many techniques have been developed in order to control severe bleeding and preserve fertility.^{1,2} Uterine artery embolization is a safe technique but is not exempt of complications. Indeed, transient fever, post-embolization pain, lower limb paraesthesia, transient buttock ischaemia, groin haematoma and pelvic abscess or vesicovaginal fistula formation have been reported. Some studies have concluded that these females can achieve pregnancy after embolization,¹⁰ but the actual risk of further possible complications remains unknown. On the other hand, UGTI may have some advantages compared with uterine artery embolization (Table 1).

The use of UGTI inside a femoral pseudoaneurysm was first described by Cope and Zeit¹¹ in 1986. Several studies have compared

UGTI with other treatments, achieving rates of success as high as 93–100%.¹² Several complications such as thrombosis or allergic responses (extremely uncommon) have been described in the literature.¹³ These complications are thought to be related to the volume and rate of thrombin administration, as well as to the size of the neck of the pseudoaneurysm (around 1 mm in our two case reports). On the other hand, the short- and long-term immunological effect of thrombin injection is still unclear. These complications should be taken into account for transvaginal UGTI, in addition to the difficult access to the puncture site in the case of vaginal bleeding. Compression over the area of vaginal bleeding may be a solution. In case of rupture of the UAP with relevant bleeding, embolization is an option.

Additionally, pseudoaneurysms have been successfully treated with UGTI in other locations such as the brachial,³ epigastric, pancreaticoduodenal¹⁴ and carotid arteries.¹⁵ In gynaecology, two cases of UAP after a caesarean section were successfully treated by UGTI,⁴ one percutaneous and another transvaginally guided. Moreover, two studies have recently reported the use of UGTI to treat post-partum haemorrhage due to intrauterine arteriovenous malformations,⁵ as well as to treat caesarean scar pregnancies.⁶ The management protocol was very similar to

Table 1. Advantages and disadvantages of uterine arterial embolization (UAE) vs ultrasound-guided thrombin injection (UGTI)

	UAE	UGTI
Advantages	Tested and accepted technique	Safety tested for superficial pseudoaneurysms
	Fertility preservation	Fertility preservation (lower haemodynamic impact on the uterus)
Disadvantages	Ionizing radiation	Poorly tested transvaginally
	Iodinated contrast	No experience in UAP
	Complications reported: fever, pain, lower limb paresthesia, groin haematoma	Complications: allergic responses, thrombosis, immunological effect
		Puncture site with difficult access

UAPs, uterine artery pseudoaneurysms.

ours, injecting a human fibrin sealant (Tisseel®) allowing selective occlusion of the feeding vessels. These case reports are in concordance with our management protocol.

This preliminary study with two cases of UAP treated by UGTI does not provide enough evidence to replace the implemented option of uterine embolization. Nonetheless, we propose that this method may be an alternative in selected cases considering its simplicity and feasibility. However, this procedure must be performed by experts in imaging medicine, due to the current lack of knowledge on the scope or frequency of possible complications.⁴ Although no adverse effects were observed in the two present

cases after 1 year of follow-up, it is important to note that the resolution of possible complications after puncture of the UAPs could be more difficult than that of typical pseudoaneurysms of the more easily accessible femoral or radial artery.

CONCLUSION

Transvaginal UGTI may be used in selected patients with uterine bleeding and UAPs identified using CT angiography. The application of this biological glue is a minimally invasive and a selective treatment which could avoid uterine embolization and emergency hysterectomy. More research is needed to confirm the safety and feasibility of this procedure.

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