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ORIGINAL ARTICLE

The Incidence and Risk Factors for the Presence of Type 1B or Type 3 Utero-ovarian Anastomoses During Uterine Artery Embolization

Uterin Arter Embolizasyonu Sırasında Tip 1B veya Tip 3 Utero-ovaryan Anastomoz Varlığının Sıklığı ve Risk Faktörleri

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ABSTRACT

Background/Aims: Demonstration of possible utero-ovarian anastomoses (UOA) before or during uterine artery embolization (UAE) is important to preserve ovarian reserve. This study aimed to evaluate the incidence and risk factors for the presence of type 1b or type 3 UOA in patients undergoing UAE for the treatment of uterine myomas.
Methods: Procedural angiographies of patients who underwent UAE were evaluated in a single academic center. Patients' demographics, indication for UAE, presence and type of UOA, presence of adnexal pathology at preprocedural MRI, history of pelvic surgery, and total uterine volume at preprocedural MRI were retrospectively evaluated. Analysis of the aforementioned variables between patients with and without UOA was performed.
Results: This study included 30 patients with a mean age of 41.97±5.72 years (range 32 - 56). UOA was found in 17 (56.6%) patients, 10 (33.3%) of them were type 1b, and 7 (23.3%) of them were type 3. Five patients (17.2%) had adnexal pathology at pre-procedural MRI and 12 patients (40%) had a history of pelvic surgery. The mean total uterine volume was 607.1 cm3. In the analysis of variables between patients with and without UOA, UOA presence was significantly higher in patients with a history of pelvic surgery (p=0.005). All of the patients with a history of myomectomy were found to have type 1b or type 3 UOA. No significant relation between UOA and age, the presence of adnexal pathology, and uterine volume were detected.
Conclusion: Utero-ovarian anastomoses are commonly encountered during UAE. A history of pelvic surgery was found to be a risk factor for the presence of type 1b and type 3 UOA.

Keywords: Uterine artery embolization, Utero-ovarian anastomoses, Arterial angiography, Pelvic surgery, Ovarian reserve, Risk factors, Premature menopause

ÖZ

Giriş/Amaç: Uterin arter embolizasyonu (UAE) öncesinde veya sırasında olası utero-ovaryan anastomozların (UOA) gösterilmesi over rezervinin korunması açısından önemlidir. Bu çalışma, uterus miyomu tedavisi için UAE uygulanan hastalarda tip 1b veya tip 3 UOA varlığına ilişkin insidansı ve risk faktörlerini değerlendirmeyi amaçlamıştır.
Yöntem: UAE yapılan hastaların işlem anjiyografileri tek akademik merkezde değerlendirildi. Hastaların demografik özellikleri, UAE endikasyonu, UOA varlığı ve tipi, işlem öncesi MRG'de adneksiyal patoloji varlığı, pelvik cerrahi öyküsü ve işlem öncesi MRG' de toplam uterus hacmi retrospektif dosya incelemesi ile değerlendirildi. Yukarıda belirtilen değişkenlerin UOA'sı olan ve olmayan hastalar arasında analizi yapıldı.
Bulgular: Bu çalışmaya yaş ortalaması 41.97±5.72 yıl (32 – 56 yıl arası) olan 30 hasta dahil edildi. Hastaların 17'sinde (%56.6) UOA saptandı, bunların 10'u (%33.3) tip 1b, 7'si (%23.3) tip 3 idi. İşlem öncesi MRG'de 5 hastada (%17.2) adneksiyal patoloji vardı. On iki hastada (%40) pelvik cerrahi öyküsü vardı. Ortalama toplam uterus hacmi 607.1 cm3 idi. UOA olan ve olmayan hastalar arasındaki değişkenlerin analizinde, pelvik cerrahi öyküsü olan hastalarda UOA varlığı anlamlı derecede yüksekti (p=0.005). Miyomektomi öyküsü olan hastaların tamamında tip 1b veya tip 3 UOA mevcuttu. UOA ile yaş, adneksiyal patoloji varlığı ve uterus hacmi arasında anlamlı bir ilişki saptanmadı.
Sonuç: Utero-ovaryan anastomozlara UAE sırasında sıklıkla rastlanır. Bu çalışmada pelvik cerrahi öyküsü tip 1b ve tip 3 UOA varlığı için bir risk faktörü olarak bulunmuştur.

Anahtar Kelimeler: Uterin arter embolizasyonu, utero-ovaryan anastomozlar, arteriyel anjiyografi, pelvik cerrahi, over rezervi, risk faktörleri, erken menopoz

Introduction

The most common solid pelvic tumor in females is uterine myomas. Uterine myomas affect up to 68.6% of women, and 25-50% of patients with myomas are symptomatic (1). Uterine myomas can cause pelvic pain, abnormal uterine bleeding (AUB), reproductive dysfunction such as infertility, miscarriage, obstetric complications, and symptoms related to the mass effect such as constipation, urinary frequency, and hydronephrosis (2). Uterine artery embolization (UAE) is an effective technique in the management of symptomatic uterine myomas (3). The impact of the UAE on the ovarian reserve is still subject to debate. Although a recent meta-analysis (4) has shown that UAE does not seem to affect ovarian reserve as measured by serum concentrations of anti-mullerian hormone (AMH) and follicle-stimulating hormone (FSH), Sheikh, et al. (5) and Kim, et al. (6) reported that UAE might have an impact on ovarian reserve as measured by serum concentrations of follicle-stimulating hormone (FSH). Razavi, et al. (7) established an angiographic

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classification for utero-ovarian anastomoses (UOA) including 4 types (type 1a, type 1b, type 2, type 3). The characteristics of each type of UOA are listed in Table 1. Type 1b or type 3 have been found to be risk factors for non-target ovarian embolization during the UAE and for premature menopause after the UAE (5,7).

As type 1b or type 3 UAOs may have an effect on ovarian reserve, it is important to know the incidence and predictors of these UOA in the management of patients with myomas. Tubo-ovarian pathology, history of pelvic surgery, and large fundal myomas have been determined to be risk factors for ovarian arterial supply to uterine myomas (8). According to the classification of Ravazi et al., ovarian arterial supply to uterine myomas is consistent with type 1 and type 2 UOA, and these risk factors are valid for this type of UOA. There is no clear data in the literature for risk factors of type 1b and type 3 UOA. In patients with a high probability for type 1b or type 3 UAO, operators should look for them as they can be manageable with coil embolization or particle up-sizing (3,5). The aim of this study was to evaluate the incidence and risk factors of type 1b or type 3 UOA in a single tertiary center experience.

Materials and Methods

Institutional ethics board approval was obtained for this retrospective study. Written informed consent was obtained from all patients before the procedure. Angiographic examinations of patients who underwent UAE for symptomatic myomas ± adenomyosis were retrospectively evaluated in a single tertiary center between January 2015 and December 2022. Patients who underwent UAE for uterine arteriovenous malformation or obstetric disorders were not included in the study. Patients' age, the indication for UAE, the presence and type of UOA, the presence of adnexal pathology at preprocedural MRI, history of pelvic surgery, and total uterine volume at preprocedural MRI were evaluated. The ovarian cyst without a solid component was considered pathological if it was larger than 3 cm in size (9). Volume calculation was performed using the formula of a prolate ellipse (length × depth × width × 0.5233). Type 1b or type 3 UOA were evaluated from angiographic images that were obtained after selective catheterization of each uterine artery with a contrast injection rate of 3cc/s for 4 s. Internal iliac arteries catheterization was performed with 4 F cobra and/or SIM 1 diagnostic catheter and selective uterine artery catheterization was performed with 2.4 F microcatheter. The microcatheter was advanced inside the uterine artery until no further catheter advancement was possible due to the tortuosity of the artery. Examples of type 1b and type 3 UOA are shown in Figure 1 and 2, respectively.

For statistical analysis, SPSS 23.0 (IBM Corp, Armonk, NY, USA) was used. Categorical data were presented as percentages and continuous data were presented as mean ± Standard Deviation. Categorical variables were compared with the Chi-square test or the Fisher exact test based on the number of variables. A comparison of the mean of the continuous variable was performed with the independent t-test. Statistical significance was set to $p<0.05$.

Results

This study included 30 patients who underwent UAE with a mean age of 41.97±5.72 years (range 32 - 56). The indications for UAEs were AUB in 19 (63.3%), mass effect in 4 (13.3%), pelvic pain in 1 (3.3%), infertility in 1 (3.3%), and a combination of them in 5 (16.7%) patients. In addition to uterine myomas, 3 patients had adenomyosis. UOA was identified in 17 (56.6%) patients' angiographies, 10 (33.3%) of them were type 1b and 7 (23.3%) were type 3. In two patients UOA was bilateral, one patient for each type. Therefore, the rate of bilateral UOA was 11.7% (2 of 17 patients with UOA). All patients except one had a pre-procedural MRI examination. Five (17.2%) patients had adnexal pathology at pre-procedural MRI which were ovarian cysts larger than 3 cm in 3, endometrioma in 1, and hydrosalpinx in 1 patient. Twelve (40%) patients had a history of pelvic surgery; 7 patients had myomectomy, 3 patients had C-Section, 1 patient had cystectomy and 1 patient had surgery for ectopic pregnancy. The mean total uterine volume was 607.1 cm3. Univariate analysis of variables between patients with and without UAO are listed in Table 2. Age, the presence of adnexal pathology, and uterine volume were not significantly related to UOA. A history of pelvic surgery was significantly related to UOA (p=0.005). In this study, all of the patients with a history of myomectomy (n=7) had type 1b or type 3 UOA.

Table 1: Types of uterio-ovarian anastomoses according to Razavi, et al.'s classification (7)

Type 1a	The ovarian artery connects to the intramural uterine artery before the myoma supply through the tubo-ovarian segment. The flow in the tubal artery was toward the uterus, without evidence of retrograde reflux in the direction of the ovary on selective uterine angiograms.
Type 1b	The ovarian artery supplied the myomas in a similar manner as that of type Ia. However, reflux into the ovarian artery was seen on the pre-embolization selective uterine angiogram with washout of contrast material toward the uterus at sequential angiographic images.
Type 2	The ovarian artery supplies the myoma directly, without prior connection to the uterine artery.
Type 3	The ovarian supply is at least in part from the uterine artery, with flow in the tubo-ovarian segment toward the ovary.

Table 2: Analysis of Variable Between Patients with and without Type 1b or Type 3 UOA

Variable	Type 1b or Type 3 UOA Present (n=17)	Type 1b or Type 3 UOA Absent (n=13)	p value
Age, mean±SD	41.41±5.3	42.69±.639	0.56
Adnexal pathology at pre-procedural MRI (%)*	4 (23.5)	1 (8.3)	0.37
History of pelvic surgery (%)	11 (64.7)	1 (7.7)	0.005
Total uterine volume, cm^3, mean±SD	584.1±380.9	640.7±410.5	0.72
*in patients with pre-procedural MRI (n=29) UOA: Utero-ovarian anastomoses SD: Standard Deviation			

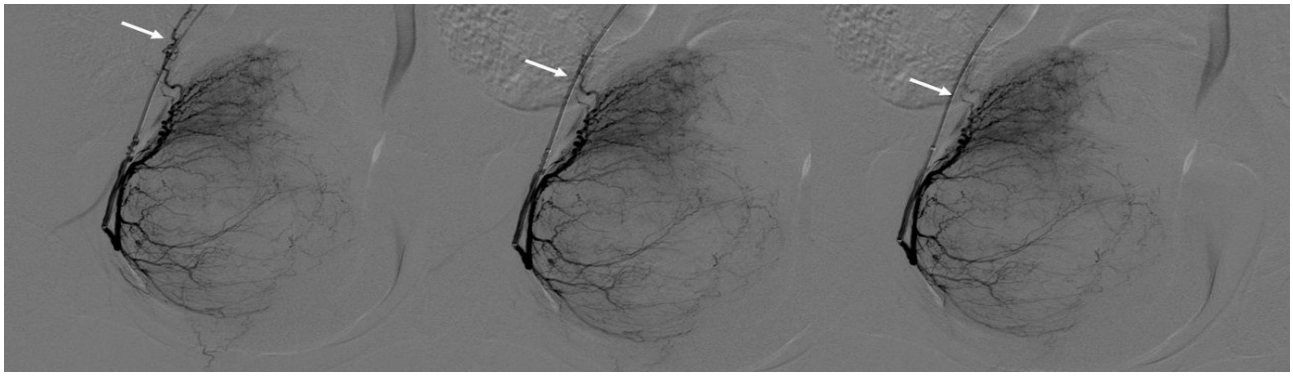

Fig. 1 Example of type 1b utero-ovarian anastomosis. Selective uterine angiography shows reflux of the contrast medium to the ovarian artery and wash-out of the contrast medium towards to the uterus during injection (left to right arrows).

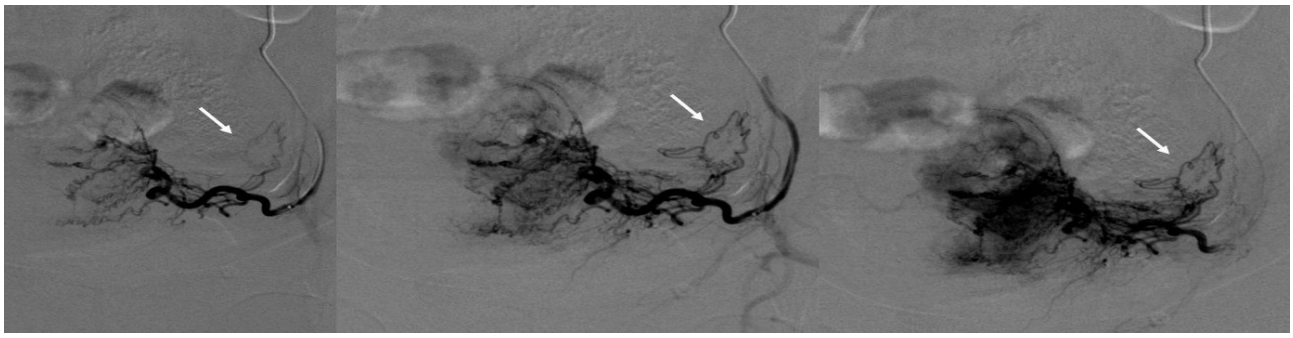

Fig. 2 Example of type 3 utero-ovarian anastomosis. Selective uterine angiography shows contrast filling of the ovarian artery from the uterine artery. Flow was towards the ovary throughout the injection (left to right arrows).

Discussion

Although the effectiveness of UAE in symptomatic myomas has been shown in multiple studies, its impact on ovarian reserve and reproduction is a matter of debate (10-12). Reported risk factors for premature menopause after UAE are >45 age and certain UOA types such as type 1b and type 3 (5,7). Type 1a and type 2 UOA were reported as risk factors for symptom recurrence and reintervention after UAE (13,14). The impact of UOA on treatment outcomes is fairly studied in the literature. However, the risk factors for the development of UOA are not well studied. This study is one of the first studies that evaluate risk factors for type 1b or type 3 UOA. It is important to define the high-risk patients for the presence of UOA before the UAE procedure, as UOA may be obscured by uterine blush, and additional images with different projections may be needed for the detection of UOA. Also, patients with risky UOA for ovarian failure may require specific precautions to prevent ovarian embolization such as use of larger particles or coil embolization of anastomosis (3,5). In this study, a history of pelvic surgery was significantly related to presence of type 1b or type 3 UAO and all of the patients with a history of myomectomy had type 1b or type 3 UAO. Therefore, when performing UAE in patients with a history of pelvic surgery, special attention should be given to detect UOA. Flow dynamic changes in the pelvic vasculature after pelvic surgery have been demonstrated in the literature (15-17). These changes may be held accountable for the increased presence of type 1b and type 3 UOA in patients with a history of pelvic surgery in this study. Razavi, et al. suggest evaluation of ovarian abnormality in patients with type 3 UOA (7); however, there was no relation between the presence of adnexal pathology at preprocedural MRI and type 3 UOA in this study.

Although UOA was found in all cases that were assessed anatomically (18,19), UOA's angiographic prevalence was reported to be in the range of 32.2 to 97% (5-7, 14, 20). The UOA rate in this study was 56.6%, which was within the range of reported UOA in the literature. Angiographic detection of UOA has its importance as it correlates with the particle reaching the ovary (21). Kim, et al. reported that in patients who underwent hystero-oophorectomy after UAE, particles were not present in the ovary of patients without utero-ovarian anastomosis at angiography (21). One of the issues with the angiographic detection of UOA is absence of a standardized protocol for angiographic image acquisition. Contrast injection rate, duration, catheter size used for contrast injection, catheter position within the uterine artery, and degree of tube rotation while obtaining angiographic images may vary between operators or institutions. This may be the reason for such a wide range of reported prevalence of angiographic UOA. Other limitations of this study were the retrospective data collection and the relatively small number of patients. As this study represents experience from a single center, its generalizability is limited.

In conclusion, utero-ovarian anastomoses are common findings during UAE. The history of pelvic surgery was a risk factor for type 1b and type 3 UOA during UAE in this study. Special attention should be given to the detection of type 1b and type 3 UOA in patients with a history of pelvic surgery. Acquiring additional images with different projections should be considered in these patients as UOA can be obscured by uterine blush.

Conflicts of interest: All authors declare that there is no conflict of interest in this study.

Informed consent: Ethics committee approval was obtained from the institution for the study and written consent was obtained from all patients before the procedures.

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Author Contributions

Conception: F.Ç., Design: F.Ç., B.Ç., B.P., Supervision: F.Ç., B.P., Data Collection and Processing: F.Ç., G.E., Analysis and Interpretation: F.Ç., G.E., B.Ç., B.P. Literature Review: F.Ç., G.E., Writer: F.Ç., B.Ç., Critical Review: F.Ç., G.E., B.Ç., B.P.

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