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Особенности ангиоархитектоники матки при лейомиоме матки: серия клинических наблюдений

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АННОТАЦИЯ

Введение. Одной из наиболее актуальных проблем в гинекологической практике является выбор метода лечения лейомиомы матки. В Республике Татарстан (г. Казань) эмболизация маточных артерий практикуется с 2004 г. Индивидуальные особенности кровоснабжения матки и яичников в 20–25% случаев становятся причиной неудач эндоваскулярного лечения больных миомой матки и вынуждают возвращаться к традиционным хирургическим методам. В работе представлена серия клинических наблюдений, демонстрирующая варианты ангиоархитектоники матки, и зарегистрированные при анализе результаты эмболизации маточных артерий (ЭМА, n = 1743), выполненной в отделении рентгенхирургических методов диагностики и лечения Медико-санитарной части Казанского (Приволжского) федерального университета.

Заключение. Эндоваскулярная окклюзия маточных артерий у больных с миомой матки является достаточно эффективным методом лечения данного заболевания и адекватная оценка особенностей ангиоархитектоники матки при миоме матки позволяет существенно повысить результативность лечения и уменьшить частоту осложнений. Представленная серия клинических наблюдений демонстрирует варианты ангиоархитектоники матки из клинического архива авторского коллектива.

Ключевые слова: лейомиома матки; эмболизация маточных артерий; ангиоархитектоника матки

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Features of Angioarchitectonics of Uterus in Uterine Leiomyoma: a Series of Clinical Observations

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ABSTRACT

INTRODUCTION: One of most important problems in the gynecological practice is the choice of the treatment method of uterine leiomyoma. Uterine artery embolization has been practiced in the Republic of Tatarstan (Kazan), since 2004. Individual peculiarities of blood supply to the uterus and ovaries become the cause of failure of the endovascular treatment of patients with uterine leiomyoma in 20%–25% of cases forcing the doctors to resort to traditional surgical methods. The article presents a series of clinical cases demonstrating variants of angioarchitectonics of uterus and the results of the analysis of uterine artery embolization (UAE, n = 1743) performed at the department of X-ray surgical methods of diagnostics and treatment in the Primary healthcare unit of Kazan (Privolzhsk) Federal University.

CONCLUSION: Endovascular occlusion of uterine arteries in patients with uterine myoma is a fairly effective method of treatment of this disease, and an adequate assessment of the peculiarities of the angioarchitectonics of uterus in uterine myoma permits to considerably increase the effectiveness of treatment and reduce the frequency of complications. The presented series of clinical observations from the clinical archive of the authors' team demonstrates the variants of angioarchitectonics of uterus.

Keywords: *uterine leiomyoma; uterine artery embolization; angioarchitectonics of uterus*

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LIST OF ABBREVIATIONS

UAE — uterine artery embolization

UL — uterine leiomyoma

INTRODUCTION

Uterine leiomyoma (UL) is a benign tumor of uterus which can endanger the reproductive function of a woman. One of the most important problem in the gynecological practice is the choice of a method of UL treatment. Of attention is a tendency towards an increase in the number of women of reproductive age suffering from UL (the mean age is 32 years), as well as in the number of primigravidae who decided to realize their reproductive function after 35 years [1]. Of no less importance is the role of this gynecological pathology in the structure of female infertility which is found in 23.5% of cases [2].

The uterine artery embolization (UAE) is actively used in obstetric and gynecological practice as a minimally invasive method of treating UL, bleeding during interstitial pregnancy, arteriovenous transformation, uterine and ovarian artery aneurysms, cervical pregnancy, trophoblastic disease, postpartum bleeding as a result of improper placentation, uterine atony, deep ruptures of the vagina and cervix, disseminated intravascular coagulation syndrome, and also in malignant neoplasms of the uterus, including bleedings after radiation therapy of tumors. In the Republic of Tatarstan (Kazan), this technique has been used since 2004 [3].

It should be noted that one of the conditions for the successful and safe implementation of UAE is the correct assessment of the angioarchitectonics of the uterus and adjacent organs in order to determine the necessary amount of an intervention and an embolic agent [4].

The anatomical features of the origin of the uterine artery are the main problem that must be taken into account by a specialist when performing X-ray endovascular intervention. For example, rough manipulations with a catheter and a conductor lead to a severe and persistent spasm of the uterine artery and significantly increase the risk of dissection and perforation of the artery. The choice of arterial access is also important, since it plays a large role in the postoperative management of patients and affects the number of complications at the access site.

Our data in comparison with transfemoral access showed that the use of transradial access led to a 1.6-fold reduction in the time of roentgenoscopy and surgery in general, which permitted to reduce the level

of radiation load (4-fold) [5, 6]. That is why, since 2015, on the base of the Medical and Sanitary Part of Kazan (Privolzhsk) Federal University, similar procedures are performed using *transradial access*, without conversion to transfemoral one.

Individual peculiarities of the blood supply to the uterus and ovaries in 20%–25% of cases become the cause of failures of endovascular treatment of patients with UL and force the doctors to return to traditional surgical methods [7].

The **aim** this study was to present a series of clinical observations from the clinical archive of the author's team, demonstrating variants of uterine angioarchitectonics.

CLINICAL OBSERVATIONS

Our accumulated experience (2004–2022) of performing this procedure permits to present the features of the angioarchitectonics of the uterus in UL. The work is based on the analysis of the results of UAE performed in 1,743 patients with UL who underwent treatment in the Department of X-ray surgical methods of diagnosis and treatment of the Medical and Sanitary Unit of Kazan (Privolzhski) Federal University. The age of the patients ranged from 21 to 56 (41 ± 2) years. The average duration of the disease since the first diagnosed uterine fibroids was 5.8 ± 2.1 years.

The UAE was performed in an operating room equipped with an angiographic digital installation with a Siemens Artis Q flat detector (Siemens Medical System, Germany), by selective catheterization of the uterine arteries with a Berenstein 5F catheter (Merit Medical, USA) with a hydrophilic coating for radiation access on a controlled conductor with the curved tip. In all cases, the embolic agent was microspheres 500 μm –700 μm in diameter manufactured by Merit Medical (USA). The particle size permits a complete occlusion of the lumen of even the smallest arteries, surrounding and supplying the myomatous nodules. To prevent spasm and thrombosis of the radial artery, nitroglycerin 200 μg and heparin 5000 units were sequentially injected through an introducer.

Peculiarities of the blood supply to the pelvic organs are present in 22.2% of patients with uterine fibroids and can be identified by ultrasound, color

Doppler mapping and angiography. The effectiveness and safety of uterine artery embolization in patients with uterine fibroids is determined by the type of the blood supply to the pelvic organs.

During the UAE in patients of the older age group, alterations of vessels in the form of pronounced tortuosity of the iliac and uterine arteries were recorded in 100% of cases (Figure 1). More often, these anatomical vascular alterations are associated with pregnancies, when the pelvic arteries lengthen, and then significantly decrease in size after childbirth. Difficulties in superselective catheterization of the uterine artery were also encountered in patients over 50 suffering from arterial hypertension. The

resulting tortuosity of the iliac arteries, especially in combination with a high position of the aortic bifurcation and the sharp angle of its division, significantly hampered manipulation on the contralateral side. These features of vascular anatomy were a cause of failure of selective catheterization of the uterine arteries on one of the sides in 17 (1.6%) patients with use of transfemoral access.

In the endovascular intervention in UL, special attention is paid to the segment of the uterine artery that ascends towards the uterine-tubal angle and gives off numerous tortuous branches directly to the uterine body and cervix (the zone of direct branching of the uterine artery into the terminal branches) (Figure 2).

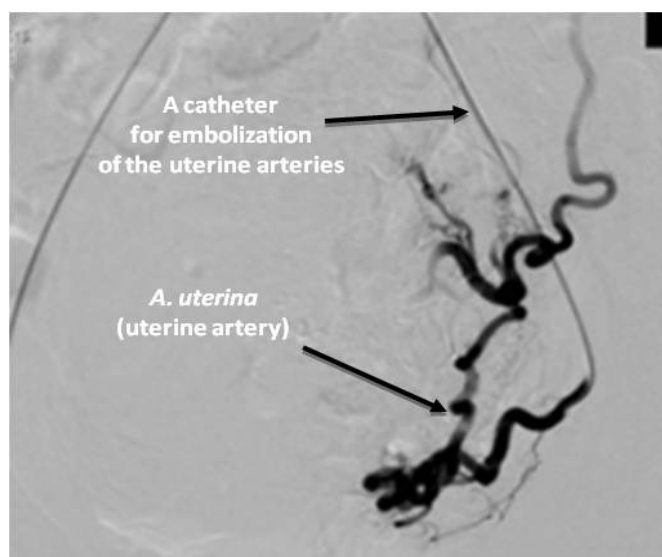


Fig. 1. A selective angiogram of the left uterine artery of a female patient G., 51 years old.

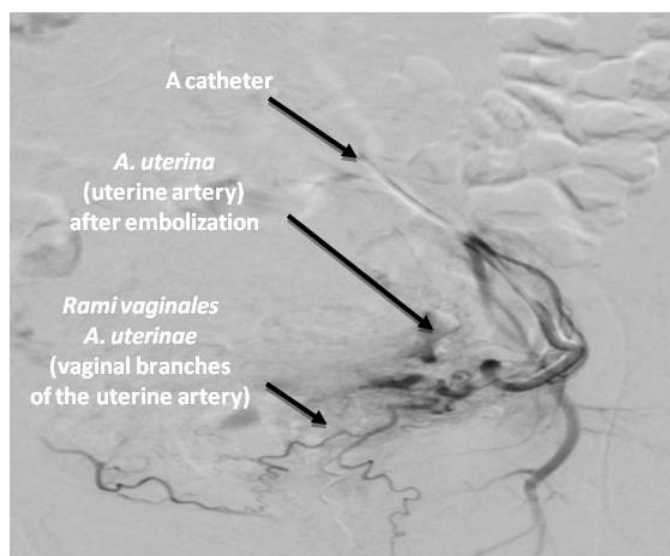


Fig. 2. A selective angiogram of the left uterine artery of a female patient Z., 40 years, after embolization with preservation of the isthmic and vaginal branches.

The uterine artery is usually a tortuous artery that is well visualized throughout its entire length (both the trunk and its small branches) (Figure 3). The degree of blood supply to the nodules depends on their arrangement in the myometrium. In the presence of large subserous nodules, the branches of the uterine artery in the area of formation lose their characteristic tortuosity, are expanded and strained, and are located around the myomatous nodule. The inner part of the formation is poorly vascularized,

the accumulation of contrast agent in the parenchymal phase is sharply weakened. With the intramural and submucous nodules, there is a more pronounced perifibroid accumulation of vessels in the layer on the periphery of the structure and intense contrast of the parenchyma in this zone (Figures 4, 5). The tubal part of the uterine artery often actively anastomoses with ovarian vessels. Wide anastomoses in this area can become the cause of restoration of blood supply to myomatous nodules (Figure 6).

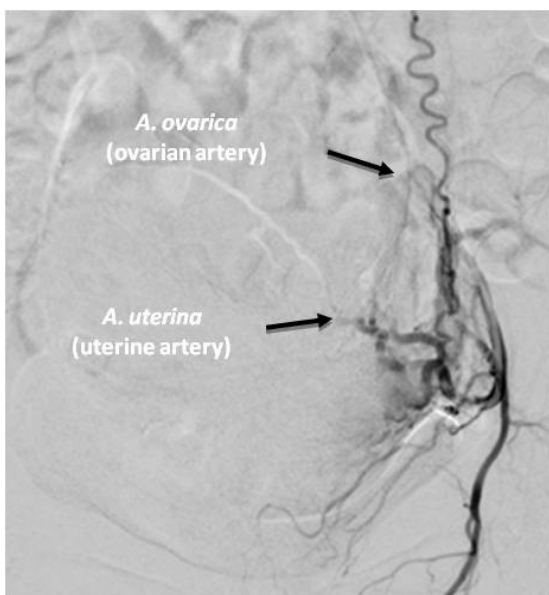


Fig. 3. A selective angiogram of the left uterine artery after embolization of the uterine arteries: uterine-ovarian anastomosis.

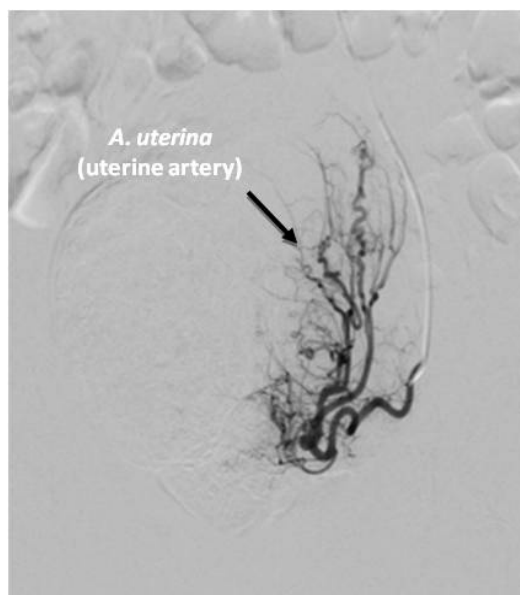


Fig. 4. A selective angiogram of the left uterine artery: perifibroid blood flow — intramural location of the nodule.

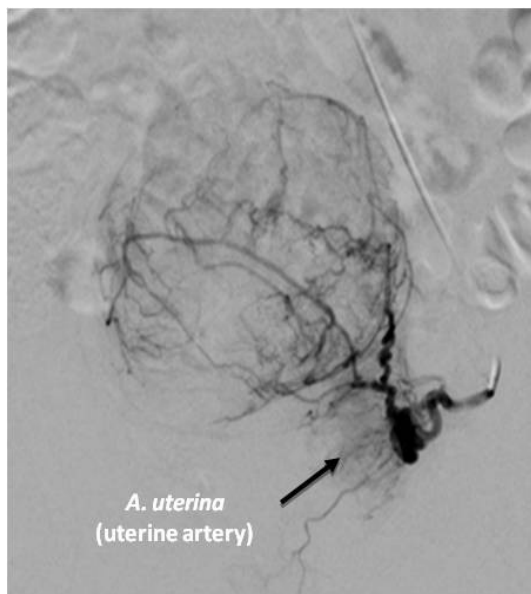


Fig. 5. A selective angiogram of the left uterine artery: submucous location of the nodule.

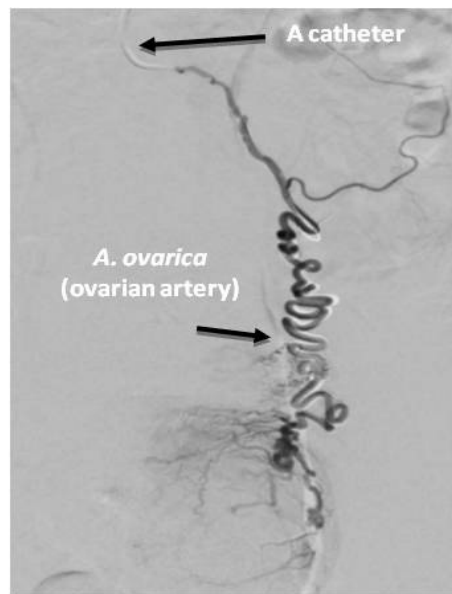


Fig. 6. A selective angiogram of the left ovarian artery supplying an interstitial-subserous uterine leiomyoma (an additional source of blood supply to uterine leiomyoma).

There are several types of communication between the uterine and ovarian arteries (Figures 7, 8); according to the literature, in patients with type 1 and type 3 anastomosis, a low clinical effect was recorded in 22% of cases, and in 5.2% it was completely absent [6]. Unfortunately, reliable identification of collateral vessels between the uterine and ovarian systems is very laborious angiographically and is not always possible before their expansion following embolization

of the uterine arteries (Figure 9). For this reason, most authors recommend that the ovarian arteries be studied in the absence or insufficient clinical effect of the performed uterine artery embolization followed by their additional embolization in the long term [13]. Other collateral vessels from the cystic and internal pudendal arteries are not able to fully restore blood supply to myomatous nodules after embolization of the uterine arteries and have no clinical significance.

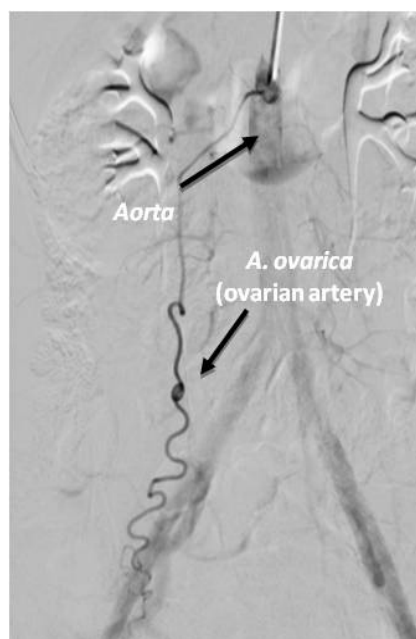


Fig. 7. A selective angiogram of the ovarian artery: utero-ovarian anastomosis type 1.

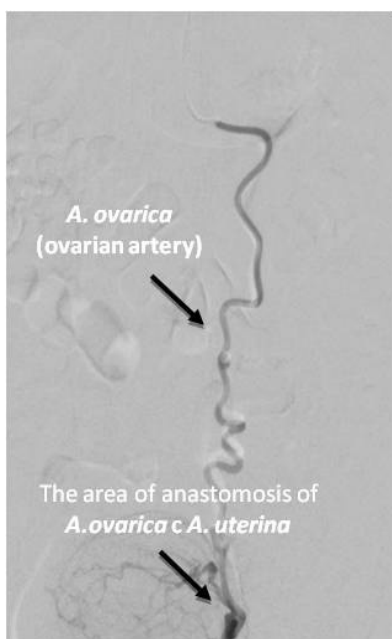


Fig. 8. A selective angiogram of the ovarian artery: utero-ovarian anastomosis type 2.

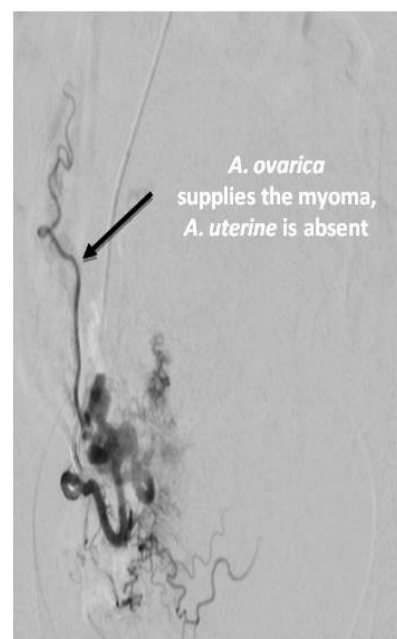


Fig. 9. A selective ovarian artery angiogram: blood supply to myoma through the left ovarian artery.

A many-year experience in the management of patients with UL after UAE has shown that the main cause of technical failures is pronounced pathological tortuosity of the iliac arteries in 27% and angulation in the area of the orifice of the uterine artery and its proximal part in 16% of patients, and underestimation of vessels supplying uterine fibroids and the development of various anastomoses in 9% of patients, which become the cause of restoration of blood supply to myomatous nodules, which agrees with the clinical practice of other X-ray endovascular centers.

Isolated blood supply to uterine fibroids from the ovarian artery leads to the inefficiency of UAE in 3.2% of cases, it can be leveled out by endovascular intervention through the radial access and embolization of myoma through the ovarian artery.

DISCUSSION

In recent years, the contingent of female patients wishing to preserve the uterus has changed towards late reproductive, perimenopausal and menopausal age. The features of the normal blood supply to the uterus in various age groups with uterine fibroids are presented in a number of publications highlighting the number of arteries supplying the organ, the peculiarities of branching and collateral connections.

Anatomical features of the uterine blood supply are important for making a decision before the UAE about the access and the type of embolic agent. The uterine artery is a branch of *A. hypogastrica* (*A. iliaca interna*), it can also be a branch of the inferior gluteal artery, have an initial common trunk with the superior gluteal artery, or be a branch of the inferior

cystic artery. Thus, there are 5 types of origination of the uterine artery: the first branch of *A. pudenda interna*; a branch of *A. glutea inferior*; origination of the uterine artery between *A. glutea inferior* and *A. glutea superior* — trifurcation; a branch of *A. obturatoria*; a branch of *A. Iliaca interna* [8]. The lack of clinical effect of the procedure stimulated studying the variants of collateral blood supply to the uterus [6, 9–12].

CONCLUSION

Endovascular occlusion of the uterine arteries in patients with uterine leiomyoma is a fairly effective method of treating this disease, and an adequate assessment of the features of uterine angioarchitectonics in uterine leiomyoma can significantly improve the effectiveness of treatment and reduce the incidence of complications. The presented series of clinical observations from the clinical archive of the authors' team demonstrates variants of uterine angioarchitectonics.

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