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EMBOLIZATION OF THE INTERNAL ILIAC ARTERY USING LIQUID EMBOLYZING SYSTEMS

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Abstract

Among the complications of endovascular abdominal aortic aneurysm repair the most common are the so-called endoleaks - the preservation of blood flow inside an isolated aneurysmal sac. This complication occurs in almost every fourth patient and is the main cause of reinterventions, which makes the late development of this complication one of the urgent problems under discussions. The report presents a clinical case of treatment of a patient with an aneurysm of the infrarenal abdominal aorta with its spread to the common iliac artery using the technique of preventive embolization of the internal iliac artery with application of a liquid tantalum-containing ethylene vinyl alcohol copolymer. All stages of the operation were performed in the catheterization laboratory using a stationary angiographic system. The embolizing material was introduced after implantation of the stent-graft into the target position, through a microcatheter pre-installed at the ostium of the embolizing internal iliac artery. The introduction of a tantalum-containing ethylene vinyl alcohol copolymer after the installation of the stent-graft, under conditions of significant reduction of arterial antegrade blood flow in the lumen of the internal iliac artery, allowed to create a reliable occlusion of the ostium segment of the artery, reduced the risk of migration of embolizing substance into the distal arterial bed.

Сұйық эмболизация жүйелерін қолдану арқылы ішкі мықын артериясын эмболизациялау

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Тұжырым

Іштің қолқасын эндоваскулярлық протездеудің асқынуларының ішінде эндолик деп аталатындар жиі кездеседі-оқшауланған аневризмалық қапшықта қан ағымының сақталуы. Бұл асқыну әрбір төртінші науқаста кездеседі және қайталанған интервенциялардың негізгі себебі болып табылады, бұл осы асқынудың кеш дамуын іштің қолқасын эндоваскулярлық протездеу үшін өзекті және талқыланытын мәселелердің біріне айналдырады. Баяндамада сұйық тантал бар этилен винил спирті кополимерін қолдану арқылы ішкі мықын артериясын профилактикалық эмболизациялау әдістемесін қолдана отырып, жалпы

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мықын артериясына таралуы бар инфраренальды құрсақ қолқасының аневризмасы бар науқасты емдеудің клиникалық жағдайы ұсынылған. Операцияның барлық кезеңдері стационарлық ангиографиялық жүйені қолдана отырып, рентгеноперациялық бөлме жүргізілді. Эмболизациялаушы материалды енгізу эндопротезді мақсатты позицияға имплантациялағаннан кейін, эмболизацияланатын ішкі мықын артериясының аузына алдын ала орнатылған микрокатетер арқылы жүзеге асырылды. Эндопротезді орнатқаннан кейін құрамында тантал бар кополимер этиленвинил спиртін енгізу артериялық антеградтық қан ағымының айтарлықтай төмендеуіне мүмкіндік берді, артерияның ауыз қуысы сегментінің сенімді окклюзиясын жасауға мүмкіндік берді, эмболизациялаушы заттың дистальды артериялық арнасына көшу қаупін азайтты.

Түйінді сөздер:
аорта аневризмасы,
эндоваскулярлық протездеу,
эндолик, эмболизация.

Эмболизация внутренней подвздошной артерии с применением жидких эмболизирующих систем

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Аннотация

Среди осложнений эндоваскулярного протезирования брюшной аорты наиболее часто встречаются так называемые эндоподтекания – сохранение кровотока внутри изолированного аневризматического мешка. Данное осложнение встречается почти у каждого четвертого пациента и является основной причиной повторных интервенций, что делает позднее развитие данного осложнения одной из актуальных и обсуждаемых проблем в эндоваскулярном лечении аневризм. В сообщении представлен клинический случай лечения пациента с аневризмой инфраренального отдела брюшной аорты с распространением на общую подвздошную артерию с применением методики превентивной эмболизации внутренней подвздошной артерии с использованием жидкого танталсодержащего кополимера этиленвинилалкоголя. Все этапы операции выполнялись в рентгеноперационной с использованием стационарной ангиографической системы. Введение эмболизирующего материала осуществлялось после имплантации эндопротеза в целевую позицию, через предварительно установленный в устье эмболизируемой внутренней подвздошной артерии микрокатетер. Введение танталсодержащего кополимера этиленвинилового спирта после установки эндопротеза, в условиях значительной редукции артериального антеградного кровотока в просвете внутренней подвздошной артерии, позволило создать надежную окклюзию приустьевого сегмента, снизило риск миграции эмболизирующего вещества в дистальное артериальное русло.

Конфликт интересов:
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конфликта интересов

Ключевые слова:
аневризма аорты,
эндоваскулярное
протезирование,
эндоподтекание,
эмболизация

Introduction

Among the complications of endovascular aneurysm repair (EVAR), the most common are the so-called endoleaks - the preservation of blood flow inside an isolated aneurysmal sac. This complication is the most frequent and occurs in almost every fourth patient after EVAR [1]. The main reason for reinterventions is type II endoleak, which makes the late development of this complication one of the current and discussed problems of EVAR. Preservation of blood flow into an isolated

aneurysmal sac from the inferior mesenteric artery (IMA), lumbar, internal iliac or sacral arteries occurs in up to 30% of cases. In 50% of cases, type II endoleaks close on their own within a few months, in 10-15% of cases they can cause an increase in the diameter of the aneurysmal sac and in 5-10% of cases they can appear in the long-term period after surgery [2, 3, 4].

Today the interventional radiologist has several options in his arsenal for performing pre-occlusion of the arteries in order to prevent the development of type II retrograde endoleak from the lumen of the

internal iliac artery (IIA). For this purpose, as a rule, occlusion with metal coils of the Gianturco type, endovascular occluders of the Amplatzer type, or a simple covering of the ostium of the IIA with a graft is used [5]. As mentioned above, more often it is the IIA covered with a graft during implantation that is the main source of the development of a long-term persistent retrograde leak, which provokes endotension and growth of the aneurysmal sac in the long-term follow-up period. This fact is primarily due to the significant level of collateralization in the IIA basin and its large diameter [6].

Case study

Patient K., born in 1954, was hospitalized in the Department of Interventional Radiology of the Corporate Fund "University Medical Center" with a diagnosis of infrarenal abdominal aortic aneurysm involving the right common iliac artery. Arterial hypertension III stage, risk four. Benign prostatic hyperplasia II stage. The diagnosis was confirmed by multispiral computed tomography (CT) of the abdominal segment.

After obtaining the informed consent of the patient for inclusion in the experimental study, approved by the Local Ethical Commission of NJSC "Astana Medical University", on 5 June, 2021, the operation was performed: implantation of a stent graft in the infrarenal abdominal aorta with embolization of the right IIA.

The course of the operation: under combined spinal-epidural anesthesia, in the conditions of a catheterization laboratory, the patient was positioned on the operating table on his back, after appropriate processing of the surgical field, access was made according to Pirogov to the common femoral arteries (CFA) on both sides. 6F sheaths were introduced in the lumen of the CFAs on both sides according to the Seldinger technique. Next, a preliminary installation of a 2.4F microcatheter, 140 cm, was performed into

the lumen of the right IIA from a separate puncture access to the CFA on the left across the aortic bifurcation (Figure 1). After placing the microcatheter in the lumen of the right IIA, the aneurysmal sac was isolated by implanting an endovascular prosthesis - a stent graft, according to the generally accepted method. Next, a liquid tantalum-containing ethylene-vinyl alcohol copolymer was introduced in a volume of 1.5 ml, with a viscosity of 34cP, into the ostium section of the right IIA at a rate of not more than 0.3 ml per minute (Figure 2). After microcatheter removal under the installed endoprosthesis, the final angiographic control was performed (Figure 3). On the obtained digital subtraction angiograms, the lumen of the IIA on the right is occluded, the material for embolization is located maximally proximally in the lumen of the IIA, there are no signs of retrograde endoleak into the lumen of the aneurysmal sac.

Control CT examination was performed 6 and 12 months after the operation. On the obtained tomograms, the lumen of the right IIA was reliably occluded, there were no signs of retrograde endoleak from the lumen of the right IIA (Figure 4). The embolization agent was localized in the ostium part of the right IIA, while the distal blood flow in the lumen of the anterior and posterior branches of the right IIA was preserved. The described method of embolization of the IIA (patent for the invention No. 35941, issued by the Republican State Enterprise "National Institute of Intellectual Property"), in contrast to the methods of preliminary embolization routinely used at the moment using metal coils and endovascular occluders, made it possible to ensure the secure placement of the embolizing substance in the lumen of the IIA with the preservation of distal blood flow, reliable occlusion of the ostium segment of the IIA due to the use of a polymer that accurately fulfills the lumen of the IIA in the occlusion zone after polymerization.

Figure 1.
Aortography: 1 - microcatheter,
2 - internal iliac artery
on the right side

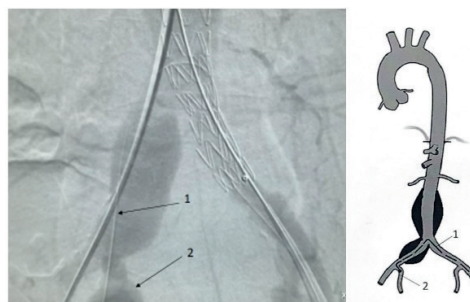
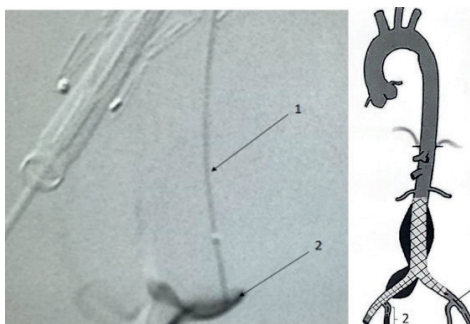


Figure 2.
Selective arteriography:
1-microcatheter, 2-injection of the
embolizing agent in the lumen
of the internal iliac artery on the
right side



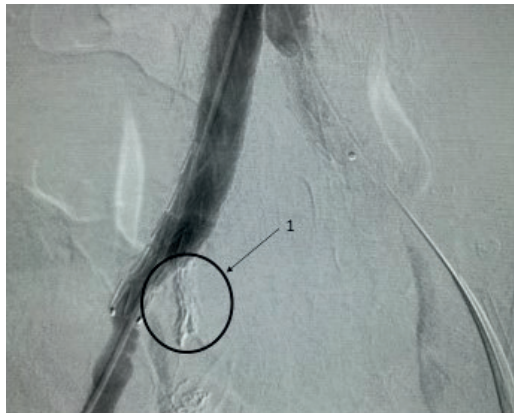


Figure 4.
Final angiographic control:
1 - embolized ostium of the
internal iliac artery on the right,
there are no signs of early
retrograde endoleak

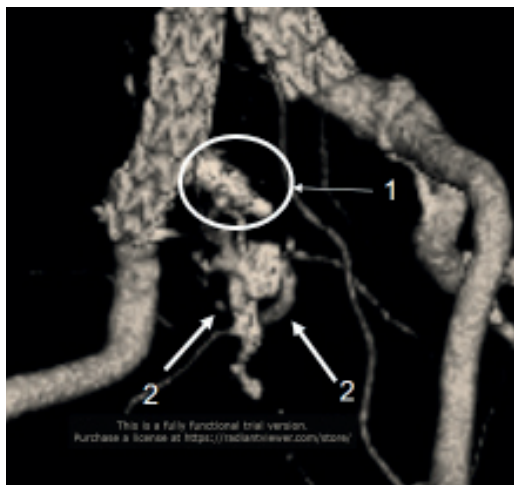


Figure 4.
CT Control: 1 - embolized
segment of the internal iliac artery
on the right, 2 - preserved distal
blood flow in the lumen of the
internal iliac artery on the right

Discussion

Studies by Bosanquet D.C. and co-authors show that a third of patients who underwent preliminary occlusion of the IIA report the development of high intermittent claudication, which resolves within two years in half of them. In cases where the occlusion of the IIA was bilateral, the recovery process took much longer time. Meanwhile, the incidence of high intermittent claudication was significantly higher in those patients who underwent embolization with metal coils, with simultaneous bilateral occlusion, and with distal placement of embolization material in the lumen of the IIA. Type II endoleaks most often developed when the IIA was covered with a stent graft without prior occlusion – up to 5.53% of cases [7].

The described ischemic complications directly depend on the collateralization of blood flow in the IIA basin, the presence of direct anastomoses with the contralateral IIA, deep femoral artery, external iliac artery, lumbar and mesenteric arteries. The presence of such arterial anastomoses can significantly reduce the degree of ischemia of the pelvic organs. A higher incidence of ischemic complications in cases with the use of metal coils is associated with the migration of the coils into the distal branches of

the IIA, followed by separation of the blood flow along the anterior and posterior branches of the IIA [8, 9]. The use of endovascular occluders makes it possible to place them maximally proximally and preserve blood flow in the distal bed of the IIA [10].

Thus, currently used preventive embolization techniques using metal coils and endovascular occluders show a high incidence of type II retrograde endoleaks and high intermittent claudication (5.53% and 29.2%, respectively) [7]. This fact determines the relevance and necessity of improving the methods of preventive embolization of the internal iliac arteries in order to prevent retrograde endoleaks after endovascular repair of abdominal aortic aneurysms.

An analysis of the anatomical characteristics of the ostia of previously embolized IIAs showed that the main source of endoleaks is the first-order branches (anterior or posterior trunk), while metal coils of the Gianturco type were used as the material for embolization. In these cases, the embolization material was placed predominantly distally, in the area of the IIA bifurcation. When using vascular occluders installed in the ostium of the IIA, the endoleak was of a “parietal” nature and was due to a discrepancy between the geometric shape of the occluder and the deformed, atherosclerotically altered ostium of the IIA. The

developed method using an ethylene vinyl alcohol copolymer and introducing it into the lumen of the IIA after "covering" its ostium with a graft makes it possible to perform reliable occlusion of the IIA as proximally as possible, which makes it possible to maintain distal blood flow in the IIA and minimizes the risks of ischemic events. In addition, the copolymer, during the polymerization process, takes the form of the internal lumen of the embolized IIA with tight filling, which makes it possible to eliminate the risks of developing "parietal" endoleaks.

Conclusion

The proposed original method of intraoperative

embolization of the internal iliac arteries to prevent retrograde endoleak after endovascular repair of abdominal aortic aneurysms showed good early and delayed results. There were no signs of development of retrograde endoleaks, high intermittent claudication during dynamic observation, and staged interventions to eliminate endoleaks or ischemic events in the right IIA were not required. With an increase in the observation period, we will have to evaluate the effect of the proposed method on improving the results, quality of life, and prognosis of the disease in patients who underwent endovascular aneurysm repair for abdominal aortic aneurysm.

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