ОРИГИНАЛЬНАЯ СТАТЬЯ

METHODOLOGICAL ASPECTS OF ULTRASOUND DIFFERENTIAL DIAGNOSIS OF UNCOMPLICATED FAT-CONTAINING HERNIAS OF THE ANTERIOR ABDOMINAL WALL

Zorin Ya.P., Boitsova M.G., Karlova N.A, Rumyantseva I.V.

Scientific and clinical educational center "Diagnostic imaging and nuclear medicine",
Saint-Petersburg State University. Saint-Petersburg, Russia.

Abdominal wall hernias are the common pathology in the surgical practice. Clinical data do not always indicate a correct diagnosis, and the ultrasound image might be doubtable. This requires the choice of methodological aspects of the examination for the successful search for specific ultrasound symptoms for differential diagnosis.

Purpose. The choice of methodological techniques and clarification of ultrasound signs for differential diagnosis of fat-containing hernias of the anterior abdominal wall.

Materials and methods. Over a three-year period, the ultrasound examinations were performed for 52 patients with various anterior abdominal wall hernias, using a standard ultrasound procedure and specific tests to analyze the hernial contents. There were used the B-mode ultrasound scanning and the color Doppler Imaging mode. Most of the patients were subsequently subjected to routine surgical operations followed by dynamic ultrasound follow-up.

Results and discussion. The ultrasound method made it possible to detect hernias in most of patients at standard examination and in all patients during the Valsalva maneuver. The fat content was identified by revealing the typical echogenicity and structure. Visualization of the parietal peritoneum and the typical respiratory motion of abdominal structures are recognized as the main ultrasound signs that allow differentiating various types of fat-containing hernias.

The successful ultrasound imaging of hernias is possible in most of patients. Standardization of the methodological approach and morphometry are the important conditions for successful diagnosis and differential diagnosis of fat-containing abdominal wall hernias.

Conclusion. The ultrasound method is highly informative for the search, diagnosis and differential diagnosis of abdominal wall hernias. A purposeful search for specific ultrasound symptoms allows making the correct diagnosis, which is of great importance for the timely beginning of adequate treatment.

Keywords: ultrasound, differential diagnosis, hernia, abdominal wall.

Corresponding author: Zorin Y.P., e-mail yzorin@mail.ru.

For citation: Zorin Ya.P., Boitsova M.G., Karlova N.A, Rumyantseva I.V. Methodological aspects of ultrasound differential diagnosis of uncomplicated fat-containing hernias of the anterior abdominal wall. REJR 2022; 12(2):148-154. DOI: 10.21569/2222-7415-2022-12-2-148-154.

.

Received: **17.01.22** **Accepted:** **17.03.22**

МЕТОДИЧЕСКИЕ АСПЕКТЫ УЛЬТРАЗВУКОВОЙ ДИФФЕРЕНЦИАЛЬНОЙ ДИАГНОСТИКИ НЕОСЛОЖНЕННЫХ ЖИРОСОДЕРЖАЩИХ ГРЫЖ ПЕРЕДНЕЙ БРЮШНОЙ СТЕНКИ

Зорин Я.П., Бойцова М.Г., Карлова Н.А., Румянцева И.В.

Санкт-Петербургский Государственный Университет, медицинский факультет, Научно-клинический и образовательный центр «Лучевая диагностика и ядерная медицина».
г. Санкт-Петербург, Россия.

Грыжи брюшной стенки являются частой патологией в хирургической практике. Клинические данные не всегда позволяют поставить верный диагноз, а ультразвуковая картина может быть сомнительной. Это требует выбора методических приемов обследования для целенаправленного поиска специфической симптоматики и дифференциальной диагностики.

Цель исследования. Выбор методических приемов и уточнение ультразвуковых признаков для дифференциальной диагностики жиросодержащих грыж передней брюшной стенки.

Материалы и методы. В течение трехлетнего периода было проведено ультразвуковое исследование 52 пациентов с различными грыжами передней брюшной стенки, с использованием стандартной процедуры УЗИ и специфических проб для анализа состояния грыжевого содержимого. Использован В-режим ультразвукового сканирования и режим цветного допплеровского картирования. Большинство пациентов в дальнейшем подверглись плановому оперативному лечению с последующим ультразвуковым динамическим наблюдением.

Результаты и обсуждение. Ультразвуковой метод позволил выявить грыжевые образования у большинства пациентов при стандартном исследовании и у всех при выполнении пробы Вальсальвы. Жировое содержимое идентифицировано по выявлению характерной эхогенности и структуры. Визуализация париетальной брюшины и характерного дыхательного смещения абдоминальных структур признаны основными ультразвуковыми признаками, позволяющими дифференцировать различные типы жиросодержащих грыж. Успешная ультразвуковая визуализация грыжевых образований возможна у большинства пациентов. Стандартизация методического подхода и морфометрии являются условиями успешной диагностики и дифференциальной диагностики жиросодержащих грыж брюшной стенки.

Заключение. Ультразвуковой метод является высокоинформативным для поиска, диагностики и дифференциальной диагностики грыж брюшной стенки. Целенаправленный поиск специфической ультразвуковой симптоматики позволяет верно поставить диагноз, что имеет большое значение для своевременности начала адекватного лечения.

Ключевые слова: УЗИ, дифференциальная диагностика, грыжа, брюшная стенка.

Контактный автор: Зорин Я.П. E-mail yzorin@mail.ru.

Для цитирования: Зорин Я.П., Бойцова М.Г., Карлова Н.А., Румянцева И.В. Методические аспекты ультразвуковой дифференциальной диагностики неосложненных жиросодержащих грыж передней брюшной стенки. REJR 2022; 12(2):148-154. DOI: 10.21569/2222-7415-2022-12-2-148-154.

Статья получена: **17.01.22** **Статья принята:** **17.03.22**

Introduction.

Hernias of the anterior abdominal wall are detected in 4-7 % of patients seeking outpatient medical care in all age groups. [1, 2, 3]. Modern methods of surgical treatment made it possible to treat successfully all the types of hernias [3]. The common non-specificity of the clinical pattern, the lack of convincing physical data for hernias of small sizes, and the potential risk of complications require an early and precise diagnosis and differential diagnosis of hernia formations. [4].

For the diagnosis of abdominal wall hernias in previous years there was created a special X-ray examination – the herniography, nowadays are widely used ultrasound examination, computed tomography, and magnetic resonance imaging [6, 7, 8, 9]. X-ray herniography is an invasive procedure designed mostly for the detection of inguinal and femoral hernias, but it is not informative for the detection of hernia formations in the anterior abdominal wall and especially those containing extraperitoneal fat [11]. Computed tomography and magnetic resonance imaging allow to study the structure of the abdominal wall, but do not provide convincing information for the differential diagnosis of hernial protrusions containing fat tissue [10]. In comparison with other methods of diagnostic imaging, the ultrasound method allows to study the entire structure of the abdominal wall, to identify hernia formations of almost any size in most of localities, to perform the functional tests and confidently diagnose some complications, particularly, the strangulation of the hernial contents [5, 11].

Purpose.

To clarify the possibilities of ultrasound examination and development of optimal tactics for the differential diagnosis of fat-containing hernias of the abdominal wall.

Objectives of the study.

The optimization of the ultrasound technique for revealing the hernias of the abdominal wall of various localization; clarification of the ultrasound semiotics of fat-containing hernial protrusions; the development of criteria for differential diagnosis of various types of hernias, depending on their contents.

Materials and methods.

There were examined 52 patients aged 20 to 80 years (men – 47, women – 5) who underwent outpatient and inpatient treatment in the multidisciplinary clinic Scandinavia from 2015 to 2020. The distribution of patients by the pathology is presented in Table 1.

The method of ultrasound examination consisted of a several of stages. Each patient, regardless of the location of the hernia, underwent a complete ultrasound examination of the abdominal cavity and retroperitoneal space in B-mode and with the application of color Doppler imaging. The study was performed on GE expert class equipment Logiq E9 and Voluson E8, by a convex probe with a frequency of 3.5 to 5 MHz ultrasound. At the next stage, the soft tissues of the anterior abdominal wall were examined at the area of the suspected hernia in the longitudinal and transverse plane using a linear high-frequency probe of 11-15 MHz.

When a hernial protrusion detected, there was evaluated the nature of its contents and primary measurements of the size of the protrusion and the size of the hernial gate were performed.

Subsequently, a deep breath test was performed to determine the relationship of the hernial contents with the abdominal organs and to identify specific differential diagnostic signs that allowed to distinguish different types of hernias with fat content.

During the Valsalva maneuver, there were revealed the maximal dimensions of the hernial protrusion and the width of the hernial gate at the maximal straining, the displacement of the hernial contents, and the motion of the hernial sac contents back into the ab-

Table №1. Distribution of patients by location and type of fat-containing hernias.

Location	Extraperitoneal fat containing hernias (number of patients)	Omentum containing hernias (number of patients)
Linea alba	5	6
Umbilicus	8	30
Linea semilunaris	2	1
Summary	15	37

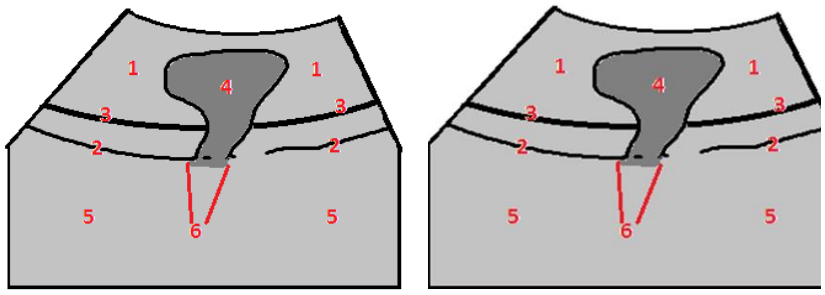

Fig. 1 a (Рис. 1 а)

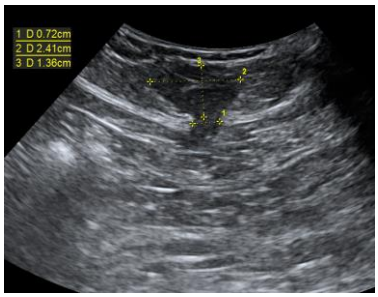

Fig. 1 b (Рис. 1 б)

Fig. 1. A – the chart, B – Ultrasound image. Patient T., 54 y.o. Fat containing hernia at linea alba.

1 – subcutaneous fat; 2 – peritoneum; 3 – aponeurosis; 4 – fat tissue in a hernia sac; 5 – abdominal structures; 6 – hernia gate

Рис. 1. А – схема, Б – ультразвуковое изображение. Пациент Т., 54 лет. Грыжа белой линии, содержащая жировую ткань.

1 – подкожная клетчатка; 2 – брюшина; 3 – апоневроз; 4 – Жировая ткань в составе грыжевого выпячивания; 5 – абдоминальные структуры; 6 – грыжевые ворота

dominal cavity in the relaxation phase, accompanied by forced compression with an ultrasound probe.

At the final stage, the blood flow in the hernial sac contents was analyzed by color Doppler. And the study was completed by examination of the surrounding soft tissues of the abdominal wall.

All the examined patients underwent surgical intervention with the verification of the hernial contents and subsequent plastic surgery of the abdominal wall. In the postoperative period, within 1-3 months, all the patients underwent a control ultrasound examination.

Results and discussion.

At the ultrasound examination of the abdominal wall, the hernia formations were clearly detected in 40 of the 52 patients, and in the remaining 12 – only at the Valsalva maneuver, which showed the appearance of protrusion at the maximal straining, followed by spontaneous reduction into the abdominal cavity.

Therefore, the determination of the maximum size of the hernial formation and the width of the hernial gate was performed only at the Valsalva maneuver.

Differentiation of the contents of the hernial sac, as a rule, was not difficult, due to the obvious difference in the ultrasound image of the intestinal wall and fat tissue. Fat containing hernias of the abdominal wall are usually not very clearly visualized.

We noted that the echogenicity of the fat tissue in the the hernial contents, in most of cases was moderately lower, in comparison with the surrounding subcutaneous fat tissue. (Fig. 1). Perhaps this is due to a slightly lesser amount of interlobular connective tissue in the extraperitoneal fat and in the omentum.

It should be noted that the distinction between hernias containing a fragment of the omentum and hernias containing extraperitoneal fat (so-called “preperitoneal lipoma”) in some cases, it is a certain complexity, but it is of great importance for the planning of surgical treatment.

The only obvious criterion that allows the differentiation of such hernias is the ultrasound visualization of the parietal peritoneum, which, in the presence of an omentum in the hernial sac, is not traced at the level of the hernial gate, since it is involved in the hernial contents. In the case of extraperitoneal fat hernias, the parietal peritoneum is visualized as a thin hyperechoic "line of demarcation" between the layer of extraperitoneal fat and abdominal structures, which is especially clearly seen in deep-breathing maneuver.

According to our experience, in 15 patients out of 52 with fat containing hernias, the visualization of the peritoneum in the area of the hernial gate was clear, which confirmed the type of these formations as "preperitoneal lipomas" (Fig. 2).

In the remaining 37 patients, there was impossible to visualize the "demarcation line", and the respiratory shift of the abdominal structures was limited, which allowed us to conclude that there was a fragment of omentum in the hernia sac (Fig. 3).

The Valsalva maneuver also showed dif-

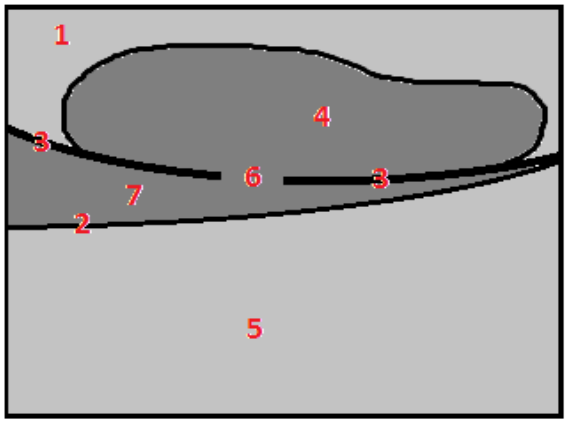

Fig. 2 a (Рис. 2 а)

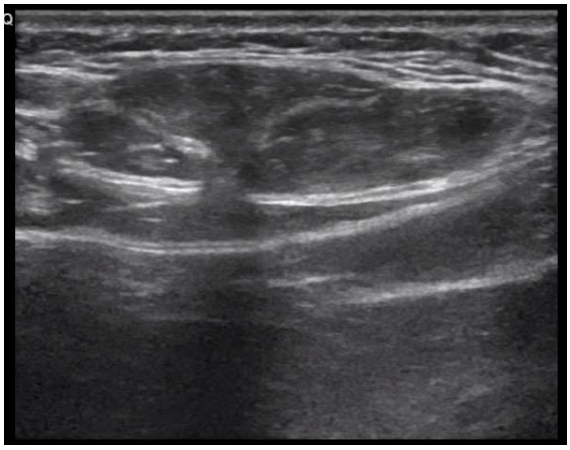

Fig.2 b (Рис. 2 б)

Fig. 2. **A – the chart, B – ultrasound image. Patient B., 40 y.o. Extraperitoneal fat containing hernia.**

1 – subcutaneous fat; 2 – peritoneum; 3 – aponeurosis; 4 – fat tissue in a hernia sac; 5 – abdominal structures; 6 – hernia gate; 7 – extraperitoneal fat layer

Рис. 2. **А – схема, Б – ультразвуковое изображение. Пациент В., 40 лет. Грыжа белой линии, содержащая предбрюшинный жир.**

1 – подкожная клетчатка; 2 – брюшина; 3 – апоневроз; 4 – жировая ткань в составе грыжевого выпячивания; 5 – абдоминальные структуры; 6 – грыжевые ворота; 7 – предбрюшинный жир

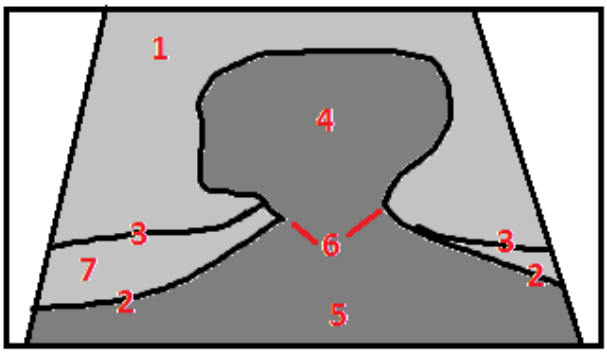

Fig. 3 a (Рис. 3 а)

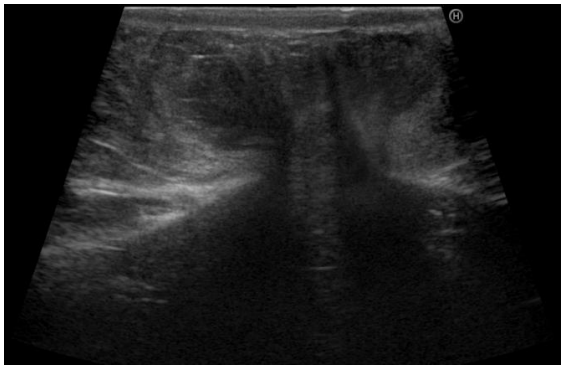

Fig.3 b (Рис. 3 б)

Fig. 3. **A – the chart, B – Ultrasound image. Patient D., 47 y.o. Omentum fat containing hernia.**

1 – subcutaneous fat; 2 – peritoneum; 3 – aponeurosis; 4 – fat tissue in a hernia sac; 5 – abdominal structures; 6 – hernia gate ; 7 – extraperitoneal fat layer

Рис. 3. **А – схема, Б – ультразвуковое изображение. Пациент Д., 47 лет. Грыжа белой линии, содержащая фрагмент сальника.**

1 – подкожная клетчатка; 2 – брюшина; 3 – апоневроз; 4 – жировая ткань в составе грыжевого выпячивания; 5 – абдоминальные структуры; 6 – грыжевые ворота; 7 – предбрюшинный жир

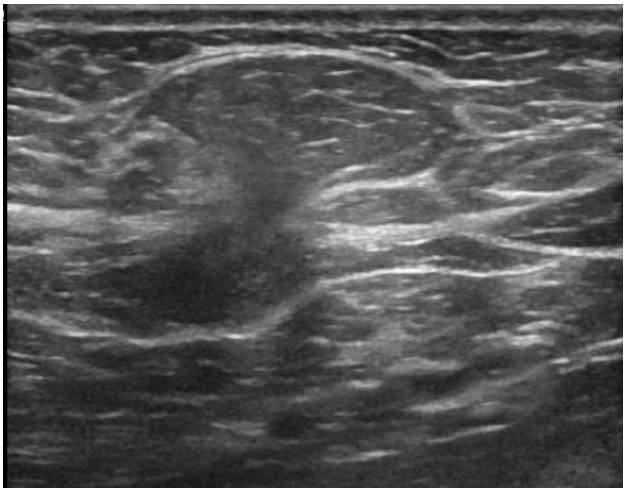

Fig. 4 a (Рис. 4 а)

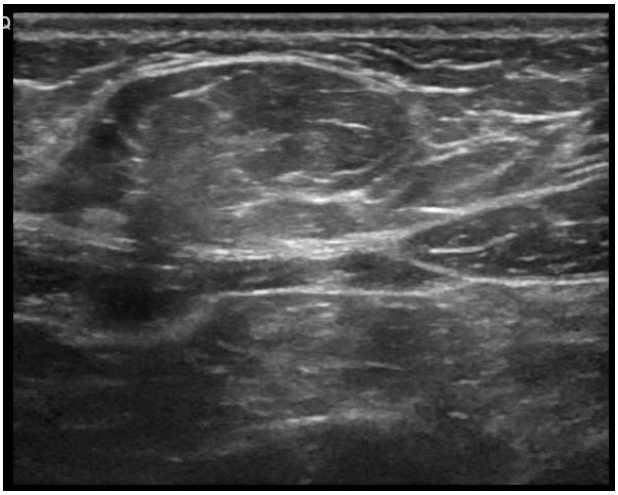

Fig. 4 b (Рис. 4 б)

Fig. 4. US.

Patient K., 60 y.o. extraperitoneal fat containing hernia of linea alba. Hernia sac size at relaxing phase (A) and at Valsalva maneuver (B).

Рис. 4. УЗИ.

Пациент К., 60 лет. Грыжа белой линии, содержащая предбрюшинный жир. Размер грыжи при спокойном состоянии (А) и при выполнении пробы Вальсальвы (Б).

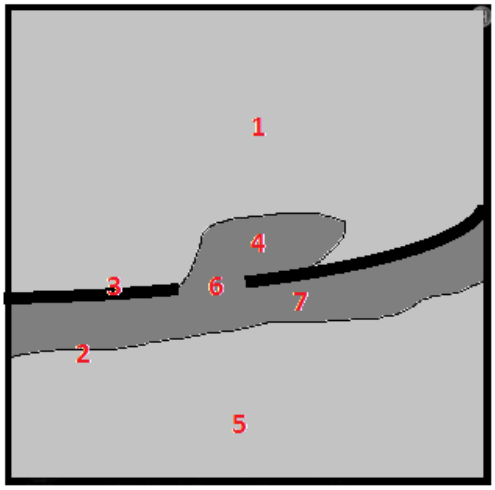

Fig. 5 a (Рис. 5 а)

Fig. 5 b (Рис. 5 б)

Fig. 5. A – the chart, B – Ultrasound image. Patient G., 70 y.o. Small size non-palpable extraperitoneal fat containing hernia.

1 – subcutaneous fat; 2 – peritoneum; 3 – aponeurosis; 4 – fat tissue in a hernia sac; 5 – abdominal structures; 6 – hernia gate ; 7 – extraperitoneal fat layer

Рис. 5. А – схема, Б – ультразвуковое изображение. Пациент Г., 70 лет. Мелкая грыжа белой линии, содержащая предбрюшиннный жир.

1 – подкожная клетчатка; 2 – брюшина; 3 – апоневроз; 4 – Жировая ткань в составе грыжевого выпячивания; 5 – абдоминальные структуры; 6 – грыжевые ворота; 7 – предбрюшинный жир.

ferences in the visualization of hernias containing the omentum and extraperitoneal lipomas. When straining and relaxing, the size of the hernial protrusion changed most significantly in the presence of an omentum in the hernial sac, and, in some cases, there was a complete reduction of the protrusion through the hernial gate into the abdominal cavity, while the size of the extraperitoneal fat lipomas changed minimally (Fig. 4).

The interpretation of this symptom should be treated with some caution, since such a small change in the size of the hernia, might also be detected in the case of a stranlated hernia.

Non-palpable hernias are very difficult to determine physically. Most often, this category includes small hernias of the linea alba and semilunar line. The only way to identify this pathology is an ultrasound examination with a targeted search for a hernia ptotrusion. Among the patients we examined, there were only two cases of visualization of such hernias (Fig. 5), and in both cases, the contents of the hernial sac was extraperitoneal fat.

Conclusion.

The ultrasound method is highly informative for the search, diagnosis and differential diagnosis of anterior abdominal wall hernias. A purposeful search for specific ultrasound signs in most of cases allows providing the correct diagnosis, which is of great importance for the choice of treatment tactics.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding Statement

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References:

1. Voskresensky N.B., Gorelik S.L. ¬Surgery of the abdominal wall hernias.¬¬ M., Medicine, 1965, 217 p. (in Russian).

2. Grubnik ¬V.V., Losev A.A., Bayazitov N.R.¬Modern methods of abdominal hernias treatment. Kiev., Zdorovie, 2001. 280 p. (in Russian).

3. Poulose B.K. Epidemiology and cost of ventral hernia repair: making the case for hernia research. Hernia. 2012; 19: 1-24.

4. Krivoschekov E.P. ¬Surgery of ventral hernias¬. Samara. ¬SamLuxPrint, 2014. 152p. (in Russian).

5. Kuntsevich G.I., Adamyan A.A., Chebysheva E.N., Gogiya B.S. The application of complex ultrasound imaging for inguinal hernias in surgical practice. Ultrasound and functional diagnostics. 2004; 3: 30-34 (in Russian).

6. Mariev A.I., Fetyukov A.I. X-ray herniography. Petrozavodsk, 1993. 31 p. (in Russian).

7. Mariev A.I., Tsarev N.I., Fetyukov A.I. Buzuhair G. Preoperational herniography for diagnosis of inguinal and femoral hernias. Actual aspects of martial and practical medicine. Vladivostok. 1996; 71-73 (in Russian).

8. Nagibin V.A., Tchizhikov V.V. Diagnostics and treatment of complicated forms of inguinal hernias. Surgery. 1992; 2: 133-134 (in Russian).

9. Severin V.I., Takuev K.S., Zhorina O.M., Hazime B.M. X-ray diagnosis and treatment of femoral hernias. Saint-Petersburg. 1998. 12 p. (in Russian).

10. Tanaka E. Y. et all. A computerized tomography scan method for calculating the hernia sac and abdominal cavity volume in complex large incisional hernia with loss of domain. Hernia. 2010; 14 (1): 63-69.

11. Akin E.A., Khati N.J., Hill M.C. Ultrasound of the scrotum. Ultrasound Q. 2004; 20 (4): 181-200.

.