SCHOLASTIC:
Journal of Natural and Medical Education
Volume 3, Issue 1, Year 2024 ISSN: 2835-303X
https://univerpubl.com/index.php/scholastic

# Possibilities of Ultrasound in Diagnosing Soft Tissue Sarcomas

**Abdumalikov Ikboljon Rustamjon ugli**
Tashkent State Dental Institute Department of Oncology and Medical Radiology

**Article Information**

**Received:** Nov 28, 2023
**Accepted:** Dec 22, 2023
**Published:** Jan 27, 2024

**Keywords**
*Ultrasound examination, Doppler, sonoelastography, soft tissue sarcoma*

**ABSTRACT**

*Literature data on the possibilities of using ultrasound examination in the diagnosis of soft tissue sarcomas are analyzed. Information on the use of B-mode in the assessment of spread, dopplerography to study tumor vascularity, and sonoelastography, a new method for differential diagnosis of benign and malignant soft tissue tumors, is presented. Analyzing the analytical value of ultrasound for the detection of soft tissue formations.*

Soft tissue sarcoma (STS) is a relatively rare disease, and the frequency of tumors in this localization is about 1% of all malignant tumors in adults [9, 27]. STS occurs with equal frequency in people of both sexes, most often in their 20s and 30s. 1/3 of patients are under 30 years old. According to the American Joint Committee on Cancer (AJCC), STS most often occurs in the limbs - 59% of cases, less in the body - 19%, retroperitoneal - 15%, in the head and neck - occurs in 9% of cases [43]. In terms of growth characteristics, clinical course and prognosis, STS are among the most dangerous human tumors [17, 42, 54]. Most STS are characterized by a tendency for local recurrence of the process. In 70-80% of cases, metastasis occurs by hematogenous route [4, 44, 16, 47, 59].

Difficulties in diagnosis are associated with a large number of nosological forms and their variants, as a result of which their differentiation, clinical course and prognosis are variable [31, 32, 35]. At the stages of ambulatory examination, the errors in determining STS reach 60-90% [6]. All this often leads to frequent medical errors in diagnosis and treatment in the early and late stages of the disease, the need for extensive operations, and a negative prognosis of the disease [2, 10].

The main tasks of X-ray diagnosis of tumors in soft tissues are to determine the nature of the tumor, to assess the degree of local spread of the process (the size of the tumor, its connection with bone structures and neurovascular bundle, etc.). Modern diagnostic arsenal includes various radiological diagnostic methods. The use of most of them is associated with significant radiation exposure to patients, which limits their repeated use, especially during dynamic monitoring [3, 16, 27, 40, 46].

Modern equipment and accumulated experience of specialists in ultrasound diagnostics allow to increase the level and quality of ultrasound examination. This allows not only to determine the derivative, but also to show the nosological relationship of some soft tissue tumors. Recently, the method of ultrasound diagnostics has attracted more and more attention because it is non-invasive, accessible, harmless, combined with high information content.

The B-mode scanning method allows for a comprehensive analysis of various features of ultrasound (contour, echogenicity, exostructure, connection with surrounding tissues, the size of the studied product, etc.). This allows to describe the state of various types of tumors in a general sense [18, 27, 56, 58, 59].

In recent years, according to many researchers, the use of linear high-frequency sensors (from 5 or more MHz), preferably in devices with Doppler software and elastography, should be considered mandatory [1, 41].

Increasing the efficiency of sonography is possible with the use of linear high-frequency sensors. Thus, according to a number of authors, their additional use made it possible to improve the details of the structure of surface formations. Echography is capable of visualizing the structure of soft tissues of any location, solid and liquid formations up to 5 mm in diameter and dense scar changes can be clearly distinguished [6,26].

Compression of tissues with the help of a sensor allows to estimate their density to a certain extent, which can be determined more accurately with the help of elastography [26].

In most cases, it is possible to determine the vascularization of the tumor, nutrition and the state of the large vessels [26]. Depending on the condition of the contours, echogenicity, the degree of homogeneity of the structure and vascularization, the nature of the tumor can be assessed. At the same time, a standard ultrasound allows to assess the condition of the surrounding tissues, including adjacent bone structures. After the removal of STS, during X-ray examination, small repeated nodes, which are almost invisible against the background of muscle and postoperative changes, are clearly detected by ultrasound. For small tumors, in most cases, ultrasound data (taking into account the morphological conclusion) is sufficient to plan treatment tactics, including surgical intervention [1, 23, 26, 41]. It is convenient to carry out a targeted puncture biopsy of the tumor under ultrasound examination and, especially with the help of elastography, it is possible to select the densest area outside the zones of fragmentation and necrosis. As a result, the diagnostic value of the puncture increases to 90% [6, 50].

When analyzing the data of echography, many note the high efficiency of the method of differential diagnosis with infiltrating tumors, because it was possible to clearly determine the borders of the tumor with the help of ultrasound [7, 8]. At the same time, the diagnostic capabilities of B-mode ultrasound in assessing the spread of benign tumors against an inflammatory background are often limited, and this ultrasound image may correspond to a malignant tumor.

In the literature on the issue of malignancy of neoplasms, in 92.5% of cases, the data of echography and clinical examination correspond to each other [5]. At the same time, the diagnostic accuracy of ultrasound, according to different authors, is from 75 to 95% and depends on the size and location of the tumor [3].

The main echographic sign that can predict the presence of STS is the appearance of a nodular hypoechoic heterogeneous nodular formation in the muscle layer [1, 7, 23, 41]. L.A. According to Kostyakova, malignant tumors often have an irregular shape, an uneven contour and a heterogeneous structure [20]. They usually appear as solid formations with reduced intensity of reflections from the tumor. In the same study, the author notes that the sign of clear and blurred contours of malignant neoplasms does not have significant differences, since it occurs in 56% and 44%, respectively, in almost the same cases [20].

This is consistent with the data obtained by E.Yu. Trofimova, D.L. Weise, N.V. Kochergina, A.N. According to Zaitsev, a malignant tumor can have clearly smooth or uneven contours, its structure is often solid or mixed, the pattern of the structure is heterogeneous in most cases, but can be homogeneous and fine-grained. In most cases, the exogenity of malignant tumors is low or mixed, in rare cases it is high, and in very rare cases it is isogenous. A moderate change in the echo signal behind the tumor is a low-informative feature of the sonographic image of a malignant tumor, because this sign changes all possible combinations [15, 23, 29].

According to the researchers, blurriness and heterogeneous ecostructure in certain areas of the contour, as well as a decrease in the echogenicity of malignant neoplasms, are a reflection of the hypervascularization of the formation. S.I. According to Filimonov, clear demarcation of the surrounding tissues, involvement of fascia, violation of the clarity of the intermuscular fat layers and muscle contours, and the violation of the cortical layer are the result of the infiltrative nature of the growth [33, 34].

The heterogeneity of the structure of soft tissue sarcomas may be associated with necrosis, hemorrhage, myxomatosis and/or the multinodular structure of individual tumors. These researchers consider the uneven expansion of the dorsal or acoustic shadow to be additional signs of malignancy of the neoplasm. The shape of sarcomas is usually irregular, rounded, and the contour shape is tubercular [29, 30].

However, it is not possible to distinguish between benign and malignant neoplasms based only on the data obtained using the B-mode. This forces us to pay attention to the quantitative and qualitative methods of Doppler and sonoelastography of blood flow in formations.

There are works dedicated to evaluating the possibilities of using color Doppler mapping in the differential diagnosis of benign and malignant soft tissue tumors [11, 12, 13, 19, 21, 22, 36, 38].

Thus, A.N. Zaitsev said that the Doppler image of the vascular network of soft tissue neoplasms depends on the histological characteristics of the tumor in some cases, but these signs are not pathognomonic and have no independent diagnostic value [11, 12].

In the study, they were asked to count the number of vessels visualized in 1 cm2 echographic section in three structural zones: central, intermediate and peripheral zones. It is known that malignant neoplasms, regardless of origin, in 96.2% of cases contain vessels large enough to study spectral properties and often differ significantly in diameter, length and spectral properties. The number of vessels per unit cross-sectional area of malignant tumors is significantly higher than that of benign tumors. Total blood flow saturation by Doppler ultrasound was higher in sarcomas than in benign neoplasms [12].

L.A. Kostyakova suggests dividing tumor nodes into the following types depending on the degree of vascularization: avascular (type I), hypovascular with one vascular signal (type II), hypervascular with many peripherally located signals (type III) and hypervascular with intratumoral signal (type. IV). The author reported that 9% of malignant nodules were type I, 50% were type II, and 41% were type IV, while the majority (86%) of benign nodules were type I and only 14% were type II [20].

R. Lagalla, A. Lovane stated that the presence of three or more tortuous and unstable bundles of vessels within the tumor can be considered as a sign of a malignant tumor [48]. The conducted studies give reason to believe that it is possible to determine the malignancy (or benignity) of a tumor nodule with the help of color Doppler mapping [45, 51]. Comparing spectral and color Doppler studies, the sensitivity and specificity of the latter were found to be higher (85 and 92% versus 77 and 50%, respectively) [22].

Blood flow in and around the soft tissue space-occupying lesion was analyzed to determine the possibilities of color Doppler mapping in differential diagnosis. A study conducted by H.R.

Latifi and M.J. Siegel identified a specific pattern of blood flow only for abscesses and showed that the use of color Doppler mapping alone is not sufficient for diagnosis [49]. This is consistent with other data showing the specificity of the resistance index (RI) for the diagnosis of inflammatory space-occupying formations and a similar lack of specificity for other formations [53].

L.A. According to Kostyakova, a clear distribution of absolute hemodynamic indicators was observed for all histological types of tumors, but all malignant neoplasms are characterized by a high number of peripheral resistance indicators, which is explained by the structural characteristics of tumor vessels [20]. Based on research, it is difficult to determine the histological identity of soft tissue sarcomas, because specific signs of a certain histotype of soft tissue sarcomas have not yet been found [14, 33]. Only liposarcomas are characterized by increased reflection from the formation structure in 60% of cases [20].

According to different authors, the sensitivity and specificity of ultrasound with color rotation is from 71 to 100% [16].

Sonographic information about the relationship of the tumor with the adjacent large vessels is an important factor in planning surgical intervention [24].

The most valuable, if the neoplasm is located in their projection, may be ultrasound data to assess the condition of large vessels. In this case, the agreement between the results of ultrasound examination and the conclusions based on the information obtained during surgery reaches 98.1% [28].

Echographic data are also of great value in the follow-up of patients with soft tissue sarcoma who have undergone surgery or radiation therapy [28]. This is because soft tissue sarcomas have a strong tendency to recur repeatedly and continuously. According to the results of echography, it is possible to make a correct conclusion about the presence of relapse in almost all cases [28,55]. Some sources provide information that diagnostic monitoring after surgical treatment allows to determine the recurrence of the tumor in the area of the postoperative scar with a diameter of 0.5-1.5 cm [36]. For comparison, we note that in the same patients, according to radiography of soft tissues, relapses are detected in only 53% of cases, 22.5% are suspicious and 11.4% are false negative results. Concordance of ultrasound data with the final diagnosis was noted in 86% of cases. X-ray computed tomography allowed to make a correct diagnosis only in 61.5% of cases and for relapses with a diameter of more than 5 cm [36, 55].

Elastography is one of the modern methods designed to solve the problem of differential diagnosis of space-occupying soft tissue formation. [15, 25].

Ultrasound elastography is a new diagnostic method that is widely used in the detection of tumors of superficial organs and tissues, based on the assessment of their elasticity. To date, the normal echographic anatomy of soft tissues, the ultrasound image of their traumatic and inflammatory changes have been determined in detail, the possible ecosymptoms of benign and malignant neoplasms and their possible combinations, partly depending on their histological type, have been determined. pathological process. One of the modern methods designed to solve the problem of differential diagnosis of volume formation of soft tissues is elastography. [15, 25]. Ultrasonic elastography is a new diagnostic method widely used in the detection of tumors of organs and tissues located on the surface, based on the assessment of their elasticity.

Currently, the normal echographic anatomy of soft tissues, the ultrasound image of their traumatic and inflammatory changes have been determined in detail, the possible echoes of benign and malignant neoplasms and their partially possible combinations have been determined depending on the histological type of the pathological process. Currently, the most popular technique is compression elastography, described by J. Ophir and others in the early 90s of the

20th century [52]. However, it has a number of limitations: it allows you to examine only superficial structures; not standardized and therefore subjective in assessment. The main disadvantage is the impossibility of quantitative determination of tissue elasticity (or stiffness).

Another method is shear wave elastography (SWE), in foreign literature - "Shear Wave Elastography", which is based on objective determination of the speed of movement of shear waves in tissues and determination of tissue elasticity (or stiffness) in kilopascals. (kPa) [25, 39, 57]. A prerequisite for the study of organs and structures located on the surface in the SWE mode is the absence of compression [25].

Thus, N.A. Postnova stated that in the study, all tumors were more than 1 cm in size, and the ultrasound image during B-mode ultrasound did not raise any doubts; however, it is interesting that the zone of high hardness was wider than the expected tumor boundaries imaged in B-mode. Currently, this phenomenon can be explained by the manifestation of a desmoplastic reaction with the formation of a collagen barrier along the periphery of the tumor [25].

A.N. Zaitsev [15] stated that elastography made it possible to reliably identify patients with benign tumors with a large volume of adipose tissue (stiffness coefficient, except for one observation, below 2.5) - lipoma and angioma.

Elastography could not distinguish between the group of benign fat-containing tumors, because the vascular components did not significantly affect the value of the stiffness coefficient and were poorly differentiated in the background of fat. Elastography, like gray-scale echography, misdiagnosed a hemangioma as a lipoma. Liposarcomas generally had less echogenicity than structures that were isoechoic or hyperechoic to adipose tissue. High differentiation made their exogeneity and part of the structure closer to lipomas. At the same time, the Doppler characteristics of individual areas of the tumor, including spectra with high blood flow velocity (more than 20 cm/s) and partial saturation of small flows compared to benign formations, as well as normal fatty dense inclusions drawn elastographically in the layer. the background showed the sarcomatous nature of the pathological process. Liposarcoma (highly differentiated) with a large amount of mature fat in elastograms showed contrast of its components, which are atypical for lipomas.

For diffuse lipomas, elastography made it possible to see their borders more clearly, which made it possible to show those peripheral areas of tumors that are vague or not noticeable at all on ordinary echograms, relatively tighter. The elastographic dimensions of such formations are more consistent with real (operational) than those determined by gray scale echography [15].

Elastography allows for more precise contouring of tumors with non-encapsulated or macroinfiltrative growth, which seems to be a very important addition to conventional echography. After all, in this way, elastography shows the size of the tissue to be removed during surgery more clearly and with more contrast. The introduction of this method into daily diagnostic practice increases the radicality of surgical intervention and reduces the frequency of relapses [15].

All of the above is related to the existing subjectivity of ultrasound examinations. Limitations of the use of echography also include a relatively small field of view, which makes it difficult to study large tumors. To solve this problem, modern diagnostic systems have been developed with a set of multi-frequency sensors and special software that allows taking panoramic images of the studied area up to 600 mm in length [37].

Thus, analyzing the presented literature data, ultrasound examination is a highly informative method of diagnosing soft tissue sarcomas, identifying a malignant tumor, its degree of spread, its relationship with neighboring organs and structures (vessels, bones) we can come to the conclusion that it allows to evaluate. , and systematization of echosemiotics of tumors of different histotypes. Additional use of Doppler and elastography programs allows for differential diagnosis of benign and malignant formations, planning of treatment tactics and timely detection of relapses against the background of postoperative and post-radiation changes.

**References:**

1. Абдуллаев Р.Я., Головко Т.С., Хвистюк А.Н. Ультразвуковая диагностика опухолей опорно-двигательного аппарата. Харьков: Новое слово, 2008. С. 128.
2. Алиев М.Д., Мехтиева Н.И., Бохян Б.Ю. Факторы прогноза сарком мягких тканей // Вопросы онкологии. 2005, Т. 51, № 3. С. 288–299.
3. Бебякин, В.Г., Минулин Ф.Ш. Ошибки в диагностике злокачественных опухолей мягких тканей // Вопросы онкологической помощи на этапе реформирования здравоохранения. Екатеринбург, 1996. С. 20–21
4. Буров Д.А., Бохян Б.Б., Феденко А.А., Хайленко В.А., Алиев М.Д. Ошибки диагностики сарком мягких тканей // Саркомы костей, мягких тканей и опухоли кожи. 2009. № 1. С. 48–53.
5. Вейзе Д.Л. Клинико-сонографические сопоставления при опухолях мягких тканей // Диагностика и лечение онкологических заболеваний: Тез. докл. I научно-практической конференции М., 1990. С. 8–9.
6. Веснин А.Г. Лучевая диагностика опухолей мягких тканей // Практическая онкология. 2004. Т. 5, № 4. С. 243–249.
7. Веснин А.Г., Семёнов И.И. Атлас лучевой диагностики опухолей опорно-двигательного аппарата. Ч. 2: Опухоли мягких тканей. СПб.: Невский диалект, 2003. С. 182.
8. Веснин А.Г., Семенов И.И., Зайцев А.Н. Роль лучевых методов в диагностике сарком мягких тканей на амбулаторном этапе // Вопросы онкологии. 2000. Т. 46, № 3. С. 337–340.
9. Давыдов М.И., Аксель Е.М. Статистика злокачественных новообразований в России и странах СНГ в 2012 году // Вестник РОНЦ им. Н.Н. Блохина. М., 2014. С. 51–77.
10. Жамгарян Г.С. Влияние факторов прогноза на частоту местных рецидивов сарком мягких тканей // Сибирский онкологический журнал. 2009. №1. С. 69–70.
11. Зайцев А.Н. Допплерографическая картина опухолей мягких тканей в их дифференциальной диагностике // Тез. докл. 4 съезда Российской ассоциации специалистов УЗД в медицине. М., 2003. С. 270–271.
12. Зайцев А.Н. Особенности допплерографической картины опухолей мягких тканей в зависимости от их характера // Тез. докл. Невского радиологического форума. СПб., 2003. С. 89–90.
13. Зайцев А.Н. Трудности УЗИ мягких тканей и преодоление их с помощью дополнительных приспособлений // Тез. докл. III съезда Российской ассоциации специалистов УЗД в медицине. М., 1999. С. 167–168.
14. Зайцев А.Н. Гистологически обусловленные варианты эхологической картины опухолей мягких тканей // Тез. докл. III съезда Российской ассоциации специалистов УЗД в медицине. М., 1999. С. 167.

15. Зайцев А.Н., Негусторов Ю.Ф., Атавина О.А., Бусько Е.А. Эластография в алгоритмах эхографической дифференциации опухолей мягких тканей, содержащих жировую ткань // Бюллетень сибирской медицины. 2012. № 5. Приложение. С. 47–50.
16. Замогильная Я.А., Алиев М.Д. Оценка эффективности предоперационной терапии с помощью лучевой диагностики у больных саркомами мягких тканей // Саркомы костей, мягких тканей и опухоли кожи. 2013. №2. С. 3–10.
17. Кочнева В.А. Клиника, дифференциальная диагностика и стадирование сарком мягких тканей // Практическая онкология. 2004. Т. 5, № 4. С. 237–242.
18. Каминская И.В. Ультразвуковая томография в комплексной лучевой диагностике злокачественных опухолей мягких тканей туловища и конечностей у детей: Автореф. дис. … канд. мед. наук. М., 2003. С. 22.
19. Козлов В.А., Артюшенко Н.К., Шалак О.В. Ультразвуковая допплерография в оценке состояния гемодинамики в тканях шеи, лица и полости рта в норме и при некоторых патологических состояниях / СПб., 2000. С. 25.
20. Костякова Л.А. Возможности ультразвуковой томографии в диагностике и оценке эффективности лечения опухолей опорнодвигательного аппарата: Автореф. дис. … канд. мед. наук. М., 2002. С. 21.
21. Костякова Л.А., Синюков П.А. Возможности ультразвуковой томографии и допплерографии в диагностике новообразований мягких тканей конечностей и туловища // Тез. докл. 4 съезда Российской ассоциации специалистов УЗД в медицине. М., 2003. С. 272.
22. Костякова Л.А., Шолохов В.Н., Синюков П.А. Ультразвуковая компьютерная томографии в диагностике опухолей костей и мягких тканей // Тезисы 2-го съезда онкологов Закавказских государств. Баку, 2001. С. 202.
23. Кочергина Н.В. Лучевая диагностика опухолей и опухолеподобных поражений костей и мягких тканей. М.: ООО «Фирма СТРОМ», 2005. С. 152.
24. Курилович Н.Н. Применение пластических операций при лечении больных с саркомами мягких тканей // Здравоохранение. Беларусь, 2002. № 7. С. 46–48.
25. Постнова Н.А., Васильев А.Ю., Зыкин Б.И., Павлинова Е.С., Выклюк М.В. Эластография сдвиговой волны: возможности дифференциальной диагностики очаговых и диффузных изменений различных органов и тканей // Вестник рентгенологии и радиологии. 2011. № 2. С. 29–35.
26. Семенов И.И., Зайцев А.Н., Крживицкий П.И., Пономарева А.И. Методы диагностики и оценки степени распространения процесса при саркомах мягких тканей // Практическая онкология. 2013. Т. 14, № 2. С. 87–96.
27. Тепляков В.В., Бухаров А.В., Урлова А.Н., Карпенко В.Ю., Державин В.А., Мыслевцев И.В., Яковлева В.С. Ошибки в диагностике и лечении сарком мягких тканей // Саркомы костей, мягких тканей и опухоли кожи. 2012. № 1. С. 29–35.
28. Тришкин В.А., Веснин А.Г., Столяров В.И. Сравнительный анализ современных методов амбулаторной диагностики опухолей мягких тканей // Вестник хирургии им. И. И. Грекова. 1994. Т. 152, № 1–2. С. 93–98.
29. Трофимова Е.Ю., Вейзе Д.Л., Бойко А.В. Ультразвуковая диагностика опухолей мягких тканей: Методические рекомендации. М., 1997. 14 с.

30. Трофимова Е.Ю., Вейзе Д.Л. Ультразвуковая диагностика опухолей мягких тканей // Ультразвуковая диагностика. 1999. № 2. С. 74–79.
31. Федорова И.В., Фролова И.Г. Современные возможности сонографии в дифференциальной диагностике опухолей мягких тканей // Сибирский онкологический журнал. 2004. № 1. С. 49–50.
32. Федорова И.В., Фролова И.Г., Чойнзонов Е.Л., Величко С.А. Комплексное исследование в диагностике доброкачественных внеорганных опухолей мягких тканей // Сибирский онкологический журнал. 2005. № 2. С. 8–12.
33. Филимонов С.И. УЗИ опухолей мягких тканей // Лечение повреждений и заболеваний мягких тканей. Л., 1990. С. 13–16.
34. Филимонов С.И., Веснин А.Г. Возможности эхографии в диагностике злокачественных опухолей мягких тканей // Эхография в онкологии. Л., 1990. С. 69–70.
35. Франк Г.А. Проблемы морфологической классификации и диагностики опухолей мягких тканей // Практическая онкология. 2004. Т. 5, № 4. С. 231–236.
36. Шолохов В.Н., Синюков П.А., Синюкова Г.Т., Костякова Л.А. Панорамная УЗ-томография и допплерография в диагнозе и оценке местного распространения опухолей костей и мягких тканей // Тез. докл. III съезда Российской ассоциации специалистов УЗД в медицине. М., 1999. С. 173.
37. Abeloff M.D., Armitage J.O., Niderhuber J.E. Sarcomas of the soft tissues // Clinical Oncology. 2003. Vol. 3. P. 16–86.
38. Adler R.S., Bell D.S., Bamber J.C., Moskovic E., Thomas J.M. Evaluation of soft-tissue masses using segmented colour Doppler velocity images: Preliminary observations // Amer. J. Roentgenology. 1999. Vol. 172, № 3. P. 781–788.
39. Bercoff J., Tanter M., Fink M. Supersonic shear imaging: A new technique for soft tissue elasticity mapping // IEEE Transaction on Ultrasonics, Ferroelectrics, and Frequency Control. 2004. Vol. 51, № 4. P. 67–73.
40. Brasseur J.L., Morvan G., Godoc B. Groupe des echographistes de 1’ appareil locomotor (GEL). Evolution of musculoskeletal // Bull. Acad. Natl. Med. 2005. Vol. 189. P. 675–692.
41. Chiou H.J., Chou Y.H., Chiu S.Y., Wang H.K., Chen W.M., Chen T.H., Chang C.Y. Differentiation of benign and malignant superficial soft_tissue masses using grayscale and color Doppler ultrasonography // J. Chin. Med. Assoc. 2009. Vol. 72(6). P. 307_315. doi: 10.1016/S1726- 4901(09)70377-6.
42. Coindre J.M., Terrier P., Guillou L., Le Doussal V., Collin F., Ranchère D., Sastre X., Vilain M.O., Bonichon F., N’Guyen Bui B. Predictive value of grade for metastasis development in the main histologic types of adult soft tissue sarcomas: a study of 1240 patients from the French Federation of Cancer Centers Sarcoma Group // Cancer. 2001. Vol. 91. P. 1914–1926.
43. Cormier J.N., Pollock R.E. Soft tissue sarcomas // CA Cancer. J. Clin. 2004. Vol. 54 (2). P. 94–109.
44. Estourgie S.H., Nielsen G.P., Ott M.J. Metastatic patterns of extremity myxoid liposarcoma and their outcome // J. Surg. Oncol. 2002. Vol. 80(2). P. 89–93.
45. Giovagnorio F., Andreoli C., De Cicco M.L. Colour Doppler sonography of focal lesions of the skin and subcutaneous tissue // J. Ultrasiound in Medicine. 1999. Vol. 18, № 2. P. 89–93.

46. Jamadar D.A., Robertson B.L., Jacobson J.A., Girish G., Sabb B.J., Jiang Y., Morag Y. Musculoskeletal sonography: important imaging pitfalls // J. Roentgenol. 2010. Vol. 194(1). P. 216–225. doi: 10.2214/AJR.09.2712
47. Jemal A., Siegel R., Ward E., Murray T., Xu J., Thun M.J. Cancer statistics, 2007 // CA Cancer. J. Clin. 2007. Vol. 57. P. 43–66.
48. Lagalla R., Iovane A., Caruso G., Lo Bello M., Derchi L.E. Colour Doppler ultrasonography of soft-tissue masses // Acta Radiologica. 1998. Vol. 39, № 4. P. 421–426.
49. Lai Riquan, Wang Zhuocai, Luo Zhuquan. Ultrasound diagnosis of soft-tissue tumors // Linchuang yu shiyan binglixue zazhi. 2000. № 1. P. 22–24.
50. Lin J., Jacobson J.A., Fessell D.P., Weadock W.J., Hayes C.W. An illustrated tutorial of musculoskeletal sonography: part 4, musculoskeletal masses, sonographical guided interventions // A.J.R. 2000. Vol. 175. № 6. P. 1711–1719.
51. Makaiova I., Studeny M., Kovacova S. Characteristics of bone and soft tissue sarcomas positive on 99mTc «MIBI» scintigraphy-implications for therapy monitoring // Pap. Congr. Eur. Assoc. Nucl. Med. 1999. № 9. P. 1218.
52. Ophir J., Alam S..K, Garra B., Kallel F., Konofagou E., Krouskop T., Varghese T. Elastography: a method for imaging the elasticity in biological tissues // Ultrason. Imag. 1991. Vol. 13. P. 111–134.
53. Ozbek S.S., Arkun R., Killi R., Memiş A., Dağdeviren A., Sevinç E. Image directed colour doppler ultrasonography in the evaluation of superficial solid tumors // J. Clinical Ultrasound. 1995. Vol. 23, № 4. P. 233–238.
54. Pisters P.W.T., Leung D.H.Y., Woodruff J. Analysis of prognostic factors in 1,041 patients with localized soft tissue sarcomas of the extremities // J. Clin. Oncol. 1996. Vol. 14(5). P. 1679–1689.
55. Quek S.T., Unger A., Cassar-Pullicino V.N., Roberts S.N.J. A self limiting tumor // Ann. Rheum. Diseases. 2000. Vol. 4, № 59. P. 252–256.
56. Roberts C.S., Beck D.J. Jr., Heinsen J., Seligson D. Review article: diagnostic ultrasonography: applications in orthopaedic surgery // Clin. Orthop. 2002. № 401. P. 248–264.
57. Sarvazyan A.P., Rudenko O.V., Swanson S.D. Shear wave elasticity imaging: a new ultrasonic technology of medical diagnostics – Ultrasonic imaging of tissue strain and elastic modulus in vivo // Ultrasound Med. Biol. 1998. Vol. 24. P. 1419–1435.
58. Smith J., Finnoff J.T. Diagnostic and interventional musculoskeletal ultrasound: part 2. Clinical applications // PMR. 2009. Vol. 1, № 2. P. 162–177. doi: 10.1016/j.pmrj.2008.09.002.
59. Smith S.E., Salanitri J., Lisle D. Ultrasound evaluation of soft tissue masses and fluid collections // Semin. Musculoskelet Radiol. 2007. Vol. 11, P. 174–191