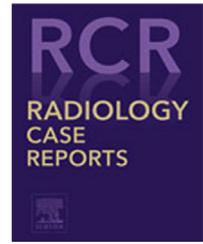


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Case Report

A case report of staged testicular infarction

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ABSTRACT

Segmental testicular infarction is a rare clinical condition most often seen as acute unilateral scrotal pain. Segmental testicular infarction should be suspected in patients with scrotal pain; when an ultrasound shows hypoechoic or mixed echogenic lesions within the testicular parenchyma; contrast-enhanced ultrasound shows a little or no contrast filling, along with negative multiple tumor markers. This report presents a 60-year-old male who presented with sudden onset of left testicular pain with no apparent cause. Emergency Doppler ultrasound, contrast-enhanced ultrasound, and laboratory tests showed findings characteristic of Segmental testicular infarction. The patient the final diagnosis was based on a combination of clinical findings (regression or cessation of symptoms, no tumor marker abnormalities, no palpable testicular mass) and ultrasound evidence of improvement (size reduction or shape change from oval to wedge) during a follow-up period of at least 3 months.

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Introduction

Segmental testicular infarction (STI) refers to the infarction of a part of the testis, which is an infarction of a small artery in the testis, resulting in ischemia and necrosis in a local area; the extent of distribution depends on the distribution of ischemia and the location and degree of venous thrombosis. STI is a rare condition, and there are few case reports of STI in the national and international literature. It occurs mainly in

young to middle-aged men between 30 and 40 and is most often characterized by unilateral acute scrotal swelling and pain as the first symptom [1]. It is idiopathic mainly, with some reports suggesting that its etiology may be related to acute epididymitis, hematological, and systemic disorders such as sickle cell disease [2], erythrocytosis, and vasculitis [3,4]. STI may be suspected when color Doppler ultrasound shows a hypoechoic lesion without blood flow signal in the testis and when contrast-enhanced ultrasound (CEUS) shows areas of hypoechoic lesions showing no areas of enhancement in the

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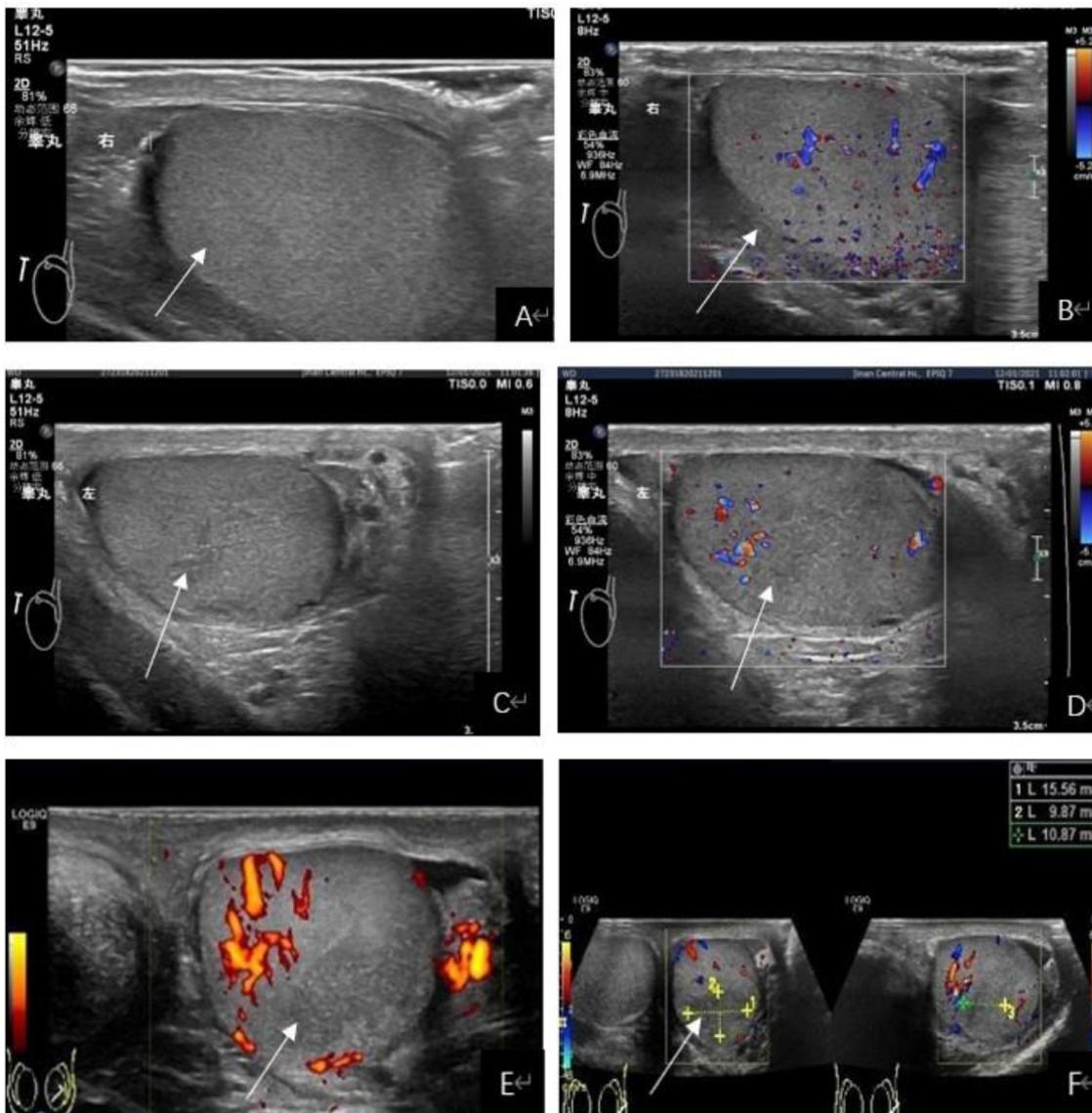


Fig. 1 – Two-dimensional ultrasound image. (A and B) 2D ultrasonography Transverse scan 2D gray scale shows normal size and shape of the right testis with no significant abnormalities in the parenchymal echogenicity, and color Doppler flow imaging (CDFI) shows scattered dotted and striped blood flow signals in the right testis. (C–F) Cross-sectional scan in two-dimensional grayscale showed parenchymal echogenicity in the left testis, with an area of approximately 16 x 11 x 10 mm of inhomogeneous hypoechoic areas detected within the left testis. CDFI showed no significant blood flow signal within the inhomogeneous hypoechoic lesion in the left testis, with a slightly abundant blood flow signal in the surrounding parenchyma. CDE showed no significant energy signal within the hypoechoic lesion.

arterial, venous, or delayed phases [5]. Some experts believe that despite negative testicular tumor markers, the differential diagnosis of testicular tumors combined with intratumoral necrosis cannot be excluded from the imaging presentation alone. Therefore, surgical excision of the specimen for histological examination is required [6]. Currently, as clinical and imaging techniques continue to improve, the diagnostic accuracy of STI is also increasing, and conservative treatment is becoming more and more critical [1]. Bak-Ipsen CB et al proposed that magnetic resonance and multimodality ultrasound techniques could diagnose segmental testicular infarction, with ultrasonography being the imaging technique of

choice for segmental testicular infarction. Once the diagnosis is made, conservative treatment is also used to avoid surgical excisional treatment and reduce patient suffering [1,7].

Case report

An elderly male, 60 years old, with a history of atrial fibrillation and cerebral infarction, presented to our emergency department 38 hours ago with no apparent cause of increasing

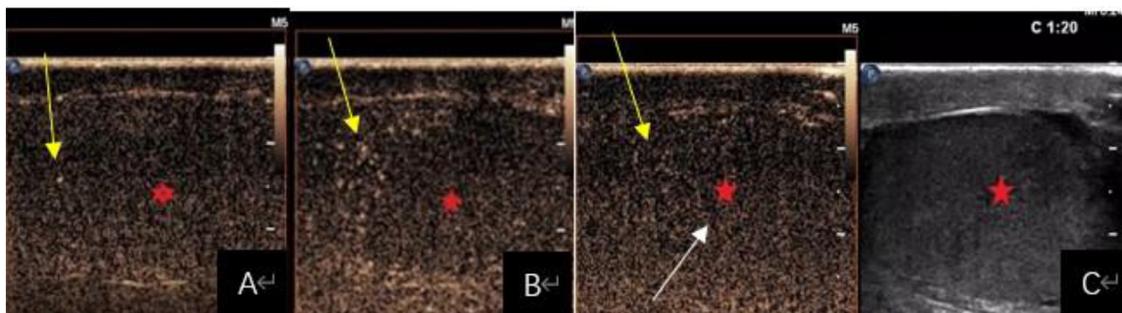


Fig. 2 – Left testis 45 s, 60 s, and 80 s CEUS plots. (A–C) CEUS: The ultrasound contrast agent was SonoVue (sulfur hexafluoride microbubble) from Bracco, Italy. 2.5 mL of sulfur hexafluoride microbubble suspension + 5 mL of sodium chloride injection was pushed through the patient left median elbow vein. In the arterial, venous, and delayed phases of the left testicular parenchyma, a 20 × 15 mm patch of the unenhanced area is seen (red star position in [Figure 2](#)), with contrast filling of the tissue around the unenhanced area starting at 45 s, peaking at 60 s and fading at 80 s (yellow arrow in [Figure 2](#)). (Color version of figure is available online.)

left testicular pain. To further clarify the diagnosis, an emergency scrotal ultrasound was performed. 2D gray-scale (12–4 MHz line array probe, Philips epiq 7) image showed a well-defined and heterogeneous hypoechoic area in the left testis, color Doppler flow imaging (CDFI) and color Doppler energy (CDE) showed that there was no apparent blood flow and energy signal in it, the echo of the surrounding parenchyma was homogeneous, and no obvious abnormality was found in CDFI and CDE ([Figs. 1A–F](#)). Contrast-enhanced ultrasound evaluation showed a 20 × 15 mm patchy area of no enhancement in the arterial, venous, and delayed phases of the left testicular parenchyma, with contrast filling in the surrounding tissue starting in 45s, peaking in the 60 seconds, and fading in the 80 seconds ([Fig. 2D](#)). Access the Sonoliver workstation, retrieve the patient's contrast-enhanced ultrasound motion picture and select the reference and analysis areas. The reference area is the normal testicular tissue surrounding the area of interest; the analysis area is the target area of interest and is no smaller than 2 cm². The system fits the contrast perfusion curve (TIC fit curve) according to a built-in function ([Fig. 3A](#)). The TIC fitting curve can more realistically reflect tissue perfusion information. Collect the quantitative analysis parameters IMAX(Maximum Intensity-IMAX), RT (Rise Time-RT), TTP (Time To Peak-TTP), and obtain the mean value of IMAX, RT, and TTP. The peak time of the contrast agent in the contrast region was 18.42 seconds ([Fig. 3B](#)), the rise time was 11.67 seconds ([Fig. 3D](#)), and the maximum peak concentration was 100% ([Fig. 3C](#)), the peak time of the contrast agent in the region of interest was 29.32 seconds. The rise time was 5.67 seconds, and the maximum peak concentration was 61.9%, which indicated that the region of interest was an ischemic hypoperfusion area. In combination with the patient's history of cerebral infarction and atrial fibrillation ([Fig. 3E](#)), as well as laboratory tests showing slightly elevated c-reactive protein and leukocytes and negative tumor markers, the patient was reviewed 3 months after taking conservative treatment, the clinical symptoms of the patient's left testicle disappeared, and the left testicle was reduced in size in two-dimensional gray-scale bilateral comparison ([Figs. 4A and B](#)); CDFI and CDE

showed good blood flow and energy signals in the right testicle, and no significant blood flow and energy signals were seen in the hypoechoic zone of the left testicle ([Figs. 4C and D](#)); The hypoechoic area of the left testis measured by elastography was harder than the surrounding normal tissue ([Fig. 4E](#)); Contrast-enhanced ultrasound evaluation showed no enhancement in the arterial, venous and delayed phases in the left testis ([Fig. 4F](#)). It was concluded that the patient's disease was most likely caused by focal ischemic changes in the testicular tissue due to re-dislodgement of the atrial fibrillation embolus and embolization of the testicular artery.

Discussion

STI is a rare condition, with only a hundred or so cases reported in the national and international medical literature. Its etiology is usually idiopathic, and studies have found it associated with underlying systemic diseases. Such as thalassemia and erythrocytosis, vasculitis, inflammatory conditions (orchitis, epididymitis), testicular torsion and traumatic arterial embolism, and venous thrombosis secondary to blood flow disorders are associated [8]. Clinical presentation to the emergency department is mainly characterized by acute unilateral scrotal pain, usually without other concomitant symptoms, making it more challenging to differentiate from other causes of acute scrotal pain disorders [2,3]. Depending on the clinical situation, the differential diagnosis usually includes testicular tumor, testicular torsion, testicular epididymitis, etc. Color Doppler ultrasound is the imaging technique of choice for evaluating scrotal pain. According to Bilagi et al [9]. A typical STI is a separate solid wedge or circular area within the testis formed by ischemic testicular lobules. However, there is a time lag between the onset of 2D gray scale sonographic changes and the onset of symptoms. Studies have shown that within the first 24 hours, the 2D gray scale does not immediately detect the lesioned area, which may be essentially the same as the normal testicular parenchymal echo, but with

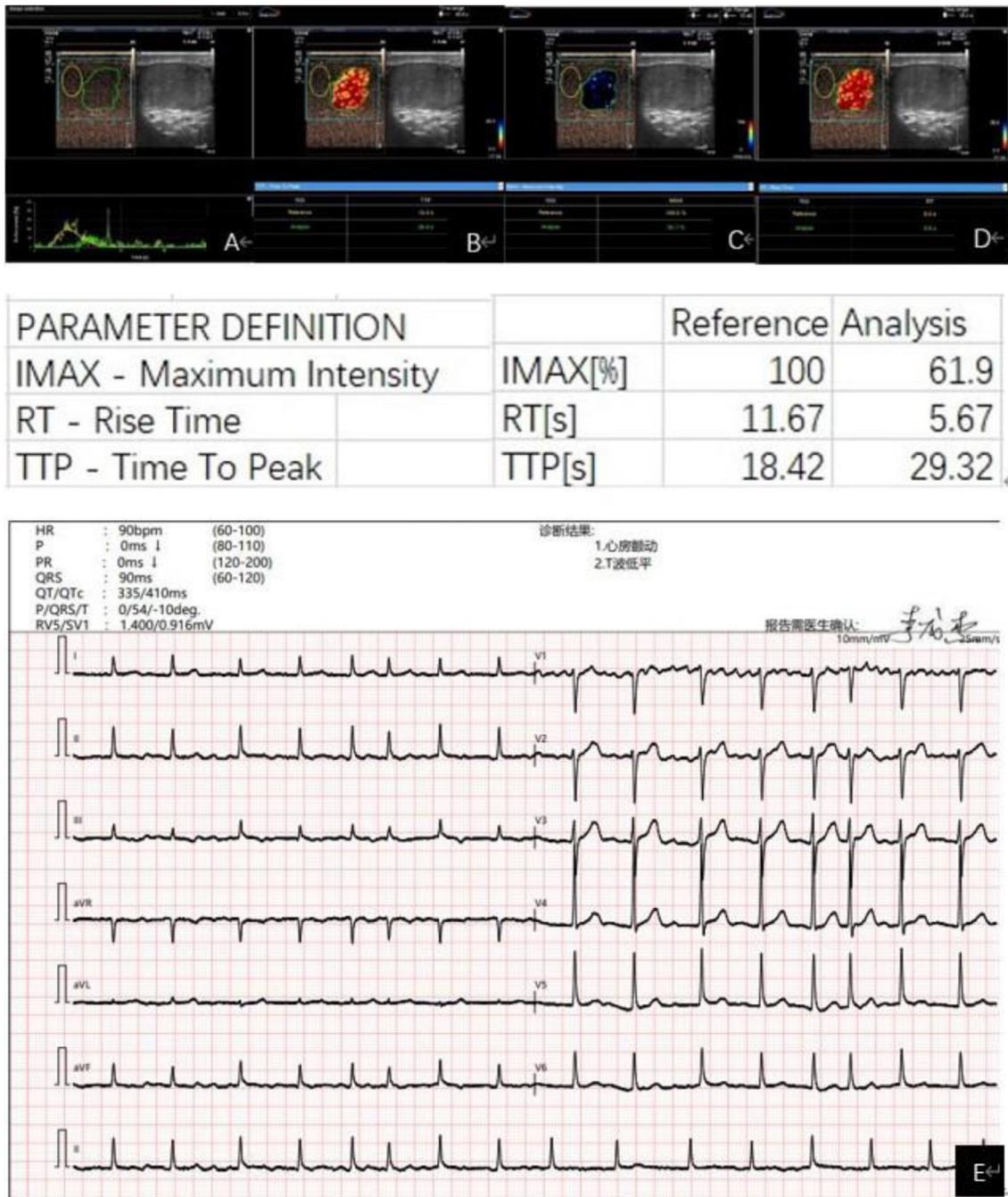


Fig. 3 – Graph of ultrasonographic data analysis results. (A) Plot of fitted curve (TIC); (B) plot of time to peak (TTP) data analysis; (C) plot of maximum intensity (IMAX) analysis; (D) plot of rise time (RT) analysis. (E) Electrocardiogram. Quantitative ultrasonographic analysis: Access the SonoLiver workstation, retrieve the patient’s CEUS motion picture and select the reference area and the analysis area. The reference area is the normal testicular tissue surrounding the area of interest; the analysis area is the target area of interest and is no smaller than 2 cm². The system fits the contrast perfusion curve (TIC fit curve) according to a built-in function (Figure 3A). The TIC fitted curve gives a more realistic picture of the tissue perfusion information. The mean values of the quantitative parameters IMAX, RT, and TTP are obtained. The contrast peak time was 18.42 s (Figure 3B), the rise time was 11.67 s (Figure 3D), and the maximum peak concentration was 100% (Figure 3C), while the contrast peak time in the region of interest was 29.32 s, the rise time was 5.67 s, and the maximum peak concentration was 61.9%, which indicates that the region of interest is an ischaemic hypoperfusion zone. Atrial fibrillation with a heart rate of about 90 beats/min (Figure 3E).

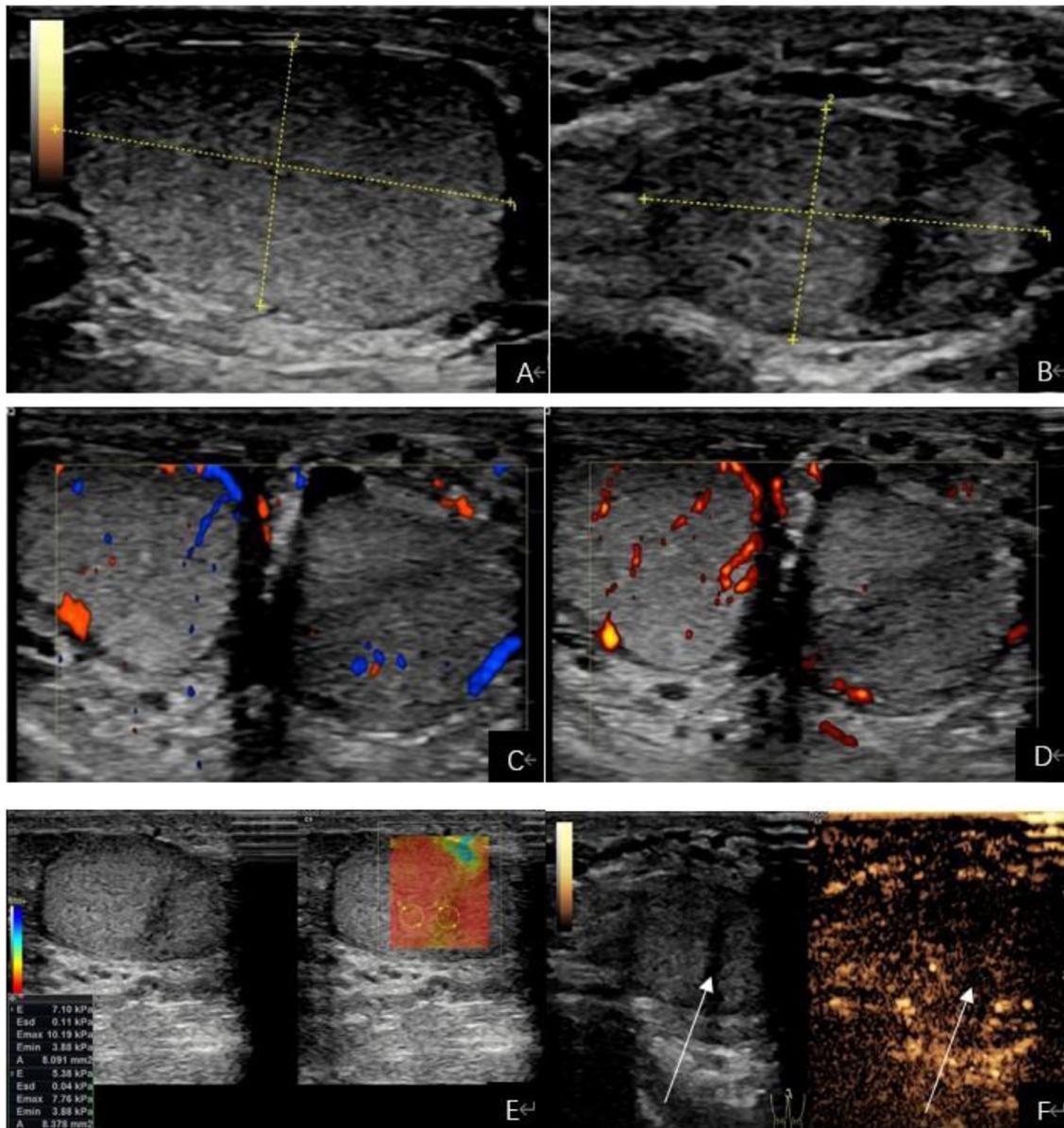


Fig. 4 – Scrotal ultrasound findings at three months postoperatively. (A, B) 2D gray scale showed bilateral contrast of the testes and a reduction in the size of the left testis; (C, D) CDFI and energy Doppler showed good blood flow and energy signal in the right testis, and no significant blood flow and energy signal in the hypoechoic zone of the left testis; (E) elastography measured that the hypoechoic zone of the left testis was harder than the surrounding normal tissue; (F) CEUS showed a three-stage area of no enhancement in the left testis. The left testis was found to be reduced in size and hypoechoic in the left testis (considered to be a post-treatment change of segmental testicular infarction), while the right testis was of acceptable size and shape with no significant abnormalities in parenchymal echogenicity.

both active and inactive parenchyma present in the lesioned area, and color Doppler examination reveals a marked reduction or loss of blood flow signal in the lesioned area and a surrounding normal testicular the parenchymal blood flow signal was slightly increased [5]. As the disease progressed after 24 hours, gray-scale ultrasound showed heterogeneous echogenicity and hypoechogenicity in the lesioned area, and color Doppler ultrasound revealed a surrounding hyperemic rim, which may correspond to inflammatory changes, granulation tissue, and compressed parenchymal vessels [5,10].

Currently, with the development of contrast-enhanced ultrasound technology, its characteristic presentation of testicular lesions is also instrumental [5]. Ultrasound contrast agents (sulfur hexafluoride microbubbles) injected by vein are inert bubbles encapsulated by a protein, lipid shell, which are stable and can be present in the vasculature for a relatively short period of time, facilitating continuous assessment of the lesion [8]. Contrast-enhanced ultrasound provides a more sensitive visualization of the parenchyma of the living testis than color multispectral ultrasound and provides earlier and more

visualization of the vascular changes throughout the testis. In focal ischemic necrotic foci in the acute phase, the avascular portion of the lesion shows diffuse hypo- or no enhancement surrounded by a discrete hyperenhancing rim, corresponding to the previously described hypoperfused tissue. In addition, Contrast-enhanced ultrasound is particularly useful in the evaluation of small testicular tumors, which may appear avascular at color Doppler examination [5]. If Contrast-enhanced ultrasound is not available, enhanced testicular MRI may be a good option. However, if prior Contrast-enhanced ultrasound has been performed, MRI usually adds little to the diagnostic workup as the presentation on dynamic-enhanced MRI mainly overlaps with the findings on contrast-enhanced ultrasound [11]. On MRI, testicular infarction appears as a low signal on T1- and T2-weighted images, showing diffuse hyperenhancement with hypervascular margins, similar to contrast-enhanced ultrasound images [11,12]. However, because MRI is expensive and time-consuming, contrast-enhanced ultrasound is inexpensive and convenient, and it can be used as the imaging method of choice for STI. The most important differential diagnosis for testicular infarction is malignancy. In general, testicular tumors present as painless and palpable masses in a hypervascular or multivessel state, with frequently elevated tumor markers, although the presence of tumors with normal tumor markers, such as testicular seminoma, cannot be excluded [13].

In conclusion, STI is a relatively uncommon benign finding. Although surgical treatment was once recommended, advances in imaging techniques, of which multimodality ultrasound including CEUS and MRI and follow-up imaging are indispensable diagnostic tools to rule out testicular malignancy, have made the diagnosis of segmental testicular infarction increasingly confident as well. If segmental testicular infarction is identified on the basis of imaging features and negative results for tumor markers, follow-up is recommended [1,7]. If symptoms subside and the lesion remains stable or shrinks, surgical resection may be dispensed with.

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Patient consent statement

The patient hereby gives me permission to publish the case information in the radiology case report "A case report of staged testicular infarction".

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.radcr.2022.06.067.

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