Scrotal acute diseases: The role of contrast-enhanced ultrasound

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Authors: M. Valentino¹, M. Bertolotto², L. Derchi³, F. Ciccarese¹, P. Pavlica¹, L. Barozzi¹, ¹Bologna/IT, ²Trieste/IT, ³Genoa/IT
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Purpose

Learning objectives

• To familiarize the radiologist with the findings of contrast-enhanced ultrasonography in scrotal acute pathology.
• To show these findings and correlate them with clinical or histopathologic diagnosis.
Methods and Materials

Background

Ultrasonography (US) with color Doppler is the mainstay for the scrotal pathology, as a number of different processes may have similar clinical presentation [1,2].

Contrast-enhanced ultrasound (CEUS) is a new technique that improves the depiction of parenchymal disorders on the base of vascularity, effective in assessing hemodynamics and tissue characteristics of many organs [3].

Potential applications in acute diseases range from distinction of acute epididymitis/epididymo-orchitis from testicular torsion, segmental testicular infarction from testicular tumor, and quantitative assessment of viable parenchyma in scrotal trauma.

This exhibit includes representative cases from a total of 46 patients studied for acute scrotal pain before and after i.v. injection of a second-generation ultrasound contrast agent (SonoVue, Bracco, Italy) at a dose of 4.8ml using gray scale harmonic imaging and very-low mechanical index (MI) level (=0.06).
Results

Imaging findings

Testicular torsion

Testicular torsion is a surgical emergency that requires corrective treatment as soon as it is diagnosed. Usually it is suspected with the clinical course of sudden onset and a physical examination called Prehn's symptom. For differentiation from acute inflammatory diseases ultrasound evaluation with color/power Doppler is carried out. The diagnosis depends on presence of parenchymal abnormalities with exclusion of normal flow in intratesticular vessels [4]. However, US with color/power Doppler method may be confusing by the limitations in the sensitivity of the Doppler signals. The absence of testicular perfusion or the presence of high resistance flow is not always a result of testicular torsion. The presence of a thickened scrotal skin or large hydrocele may also compromise the sensitivity of detecting testicular perfusion. Technical factors, vasculitis, external compression by a large fluid collection, venous thrombosis, and scrotal edema may simulate testicular torsion [5].

This difficulty can be overcome by administrating a US contrast agent [6]. Contrast-enhanced ultrasound has the potential to provide improved sensitivity in detecting testicular flow.

In an experimental study using 35 rabbits, Paltiel et al demonstrated that contrast-enhanced pulse-inversion sonography could reliably detect altered levels of testicular perfusion when compared to radiolabeled microsphere perfusion measurements [7].

In our 3 cases, color Doppler showed a slight flow with hydrocele in 2 patients and normal parenchyma in 1 patient. At CEUS all the patients were void of vascularisation with a subtle peripheral hypervascular rim (Fig. 1).

At surgery the patients underwent derotation (2) or orchidectomy (1).

Segmental testicular infarction

Acute segmental testicular infarction is a rare condition presenting with acute scrotal pain, often indistinguishable from other diseases. The possible factors for segmental testicular infarction are inflammation, trauma, sickle cell disease, polycythemia, hypersensitivity angioitis, intimal-fibrodisplasia of the testicular artery and previous surgery [8].

Us with color Doppler has variable appearance: oval or wedge-shaped, ill-defined, usually hypoechogenic, avascular at color Doppler interrogation possibly with hypervascular rim, with negative tumor markers.
In our experience, at CEUS the lesions appeared avascular, oval-shaped in 3 cases and triangular in 4 cases (Fig. 2).

**Testicular tumors**

Overall, testicular cancer accounts for about 1% of all cancers in men and is the most common malignancy in 20-34-years olds [2]. Patients with testicular tumor commonly present with a painless mass but in 25% there is an acute scrotal pain caused by haemorrhage or infarction, mimicking torsion or epididymitis.

US with color Doppler is nearly 100% sensitive for detecting testicular mass, but does not provide information about histology. Moreover, there are an overlapping in the sonographic findings of hematomas, focal orchitis, abscesses, segmental infarctions and malignant lesions.

In our study, we evaluated 23 testicular cancers. Eleven tumors showed hyperechoic enhancement during the early phase and hypoechoic enhancement during the late phase in relation to the adjacent parenchyma and have an histological diagnosis of seminomas (cFig. 3); ten tumors were hypoechoic in all the phases and had a diagnosis of Leydig cell tumors (Fig. 4); two patients had a large testicular mass with strong and inhomogeneous enhancement in the early phase and a diagnosis of lymphoma.

**Scrotal trauma**

Testicular trauma typically occurs in motor vehicle or sport accident or for a fight. It can result in contusion, hematoma, or rupture of the testis. US plays a critical role in triage by stratifying patients according to severity of injury. It accurately identifies patients with less serious injuries (hydroceles, hematoceles, scrotal hematomas), which may be managed conservatively, and patients with testicular rupture, who require urgent surgical repair.

Sonographic findings include a localized area of heterogeneous echo texture secondary to hemorrhage and infarction [9].

In the case of rupture the testicular outline may be irregular, but it is difficult to identify an interruption of the tunica vaginalis and the amount of viable parenchyma.

CEUS is able to demonstrate the extension of the fracture, the interruption of the tunica vaginalis, distinguishing exactly the contusion from the infarction (Fig. 5).
Fig. 0: Fig. 1a. Color Doppler of the testis demonstrates some vascularity in the testis.

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Fig. 0: Fig. 1b. Contrast-enhanced Ultrasonography with side-side technique shows lack of vascularisation. A subtle peripheral rim is present in the tunica vaginalis (arrows).

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**Fig. 0:** Fig.2b. Contrast-enhanced Ultrasonography demonstrated a wedge area of reduced vascularisation (arrows).

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**Fig. 0:** Fig. 3a. Longitudinal US scan of testis reveals a well-circumscribed hypoechogenic intratesticular mass (arrow).

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**Fig. 0:** Fig. 3b. Contrast-enhanced Ultrasonography shows strong enhancement during the early phase (arrow). The surgical specimen was positive for seminoma.

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Fig. 0: Fig. 4a. This patient showed an intratesticular mass similar to the previous (arrow).

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**Fig. 0:** Fig. 4b. At contrast-enhanced Ultrasonography the mass was hypoechoic in all the phases and had a diagnosis of Leydig cell tumors (arrow).

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**Fig. 0:** Fig. 5a. Testicular rupture secondary to trauma. Longitudinal scan of the testis shows heterogeneous echo texture of testis with intra and extra testicular hematoma.

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**Fig. 0:** Fig. 5b. Contrast-enhanced Ultrasonography shows a large disruption of testis with interruption of tunica vaginalis (side-side technique).

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Conclusion

Conclusions

The results of this investigation indicate that CEUS images may provide useful information regarding differential testicular perfusion in the setting of acute testicular pain. CEUS correctly determined the less-perfused testis more often than US.

CEUS improves the signal-noise ratio and delineates the characteristics of hemodynamics and flow perfusion to obtain valuable information for a more accurate diagnosis and for better choice of a therapeutic strategy for treatment. Continuous gray scale imaging allows to observe serial changes of contrast enhancement in the parenchyma adding important information to the diagnosis.

Finally, use of Contrast Agent after inconclusive US evaluation may improve management, address the correct procedure, and allow more confidence in diagnosis, reducing the global costs. It is both an accurate and cost-effective diagnostic adjunct in those patients with scrotal lesions for whom clinical and US evaluations are inconclusive.
References

Personal Information

Authors:

Massimo Valentino, Michele Bertolotto*, Lorenzo Derchi**, Libero Barozzi, Pietro Pavlica

University Hospital S.Orsola-Malpighi Department of Radiology Bologna, Italy

* University of Trieste Cattinara Hospital, Department of Radiology, Trieste, Italy

**University of Genoa, Department of Radiology, Genoa, Italy