

Signs in Imaging

Orhan Konez, MD

The Ring Sign¹

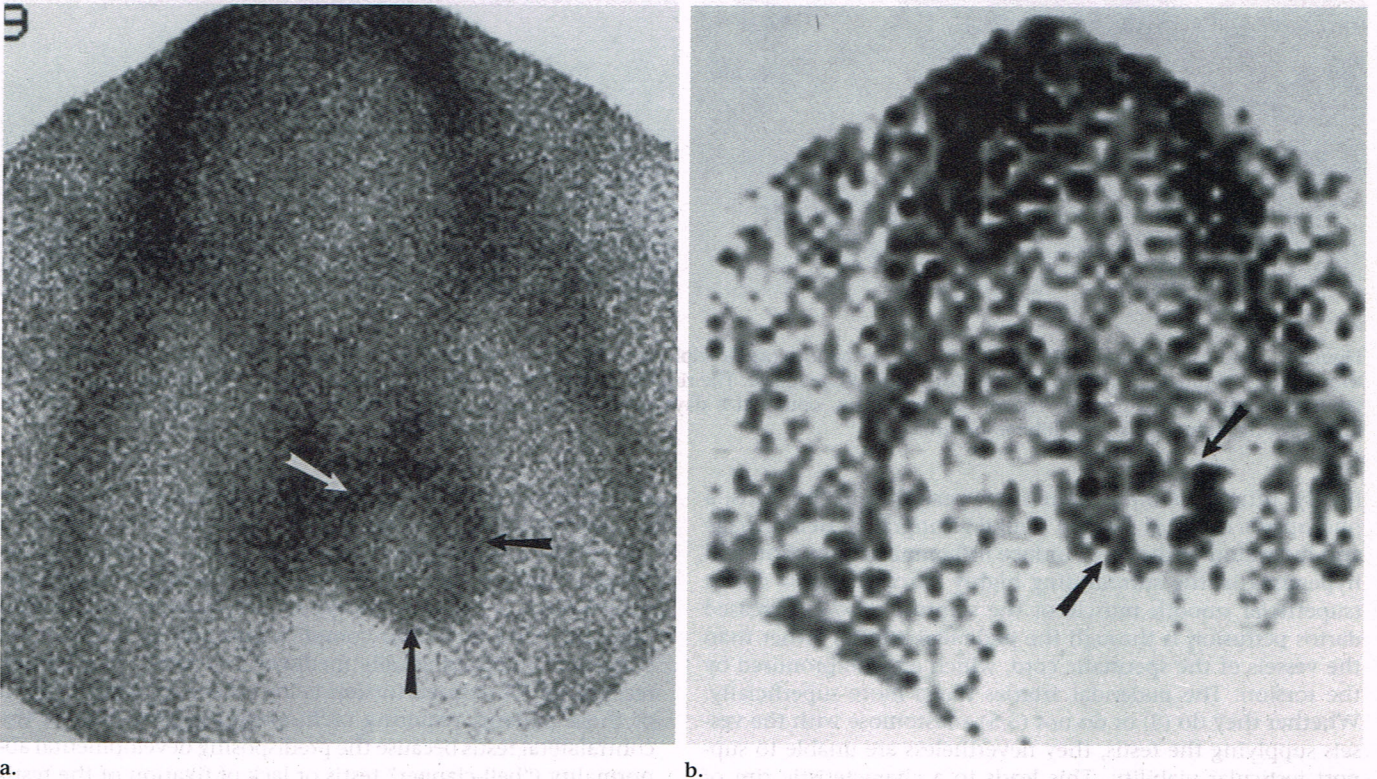


Figure 1. Delayed left testicular torsion. (a) Tissue-phase image shows a characteristic ring sign (arrows) in the left hemiscrotum. The central photopenic area represents an infarcted testis. The surrounding ringlike activity is due to increased dartos perfusion through the pudendal arteries. The normal right testis shows homogeneous and higher activity than that of the thigh. (b) Flow-phase image shows mildly increased ringlike flow activity (arrows) in the affected left hemiscrotum.

Index terms:

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¹From the Department of Radiology, Aultman Hospital, Northeastern Ohio Universities College of Medicine, 2600 6th St SW, Canton, OH 44710. Received November 19, 1997; revision requested December 12; revision received December 26; accepted January 9, 1998. Address reprint requests to the author.

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APPEARANCE

The ring sign is a finding that may be seen on scrotal scintigrams. The typical appearance is that of a rim of increased activity surrounding a central area of photopenia (Fig 1).

EXPLANATION

When the spermatic cord is twisted beyond 180° (reaching a maximum at 540°) (1), the veins in the cord are quickly obstructed, which subsequently results in sufficient pressure to stop arterial flow in the testicular, deferential, and cremasteric arteries in the spermatic cord. This leads to edema and congestion of the compromised testis, followed by hemorrhage and,

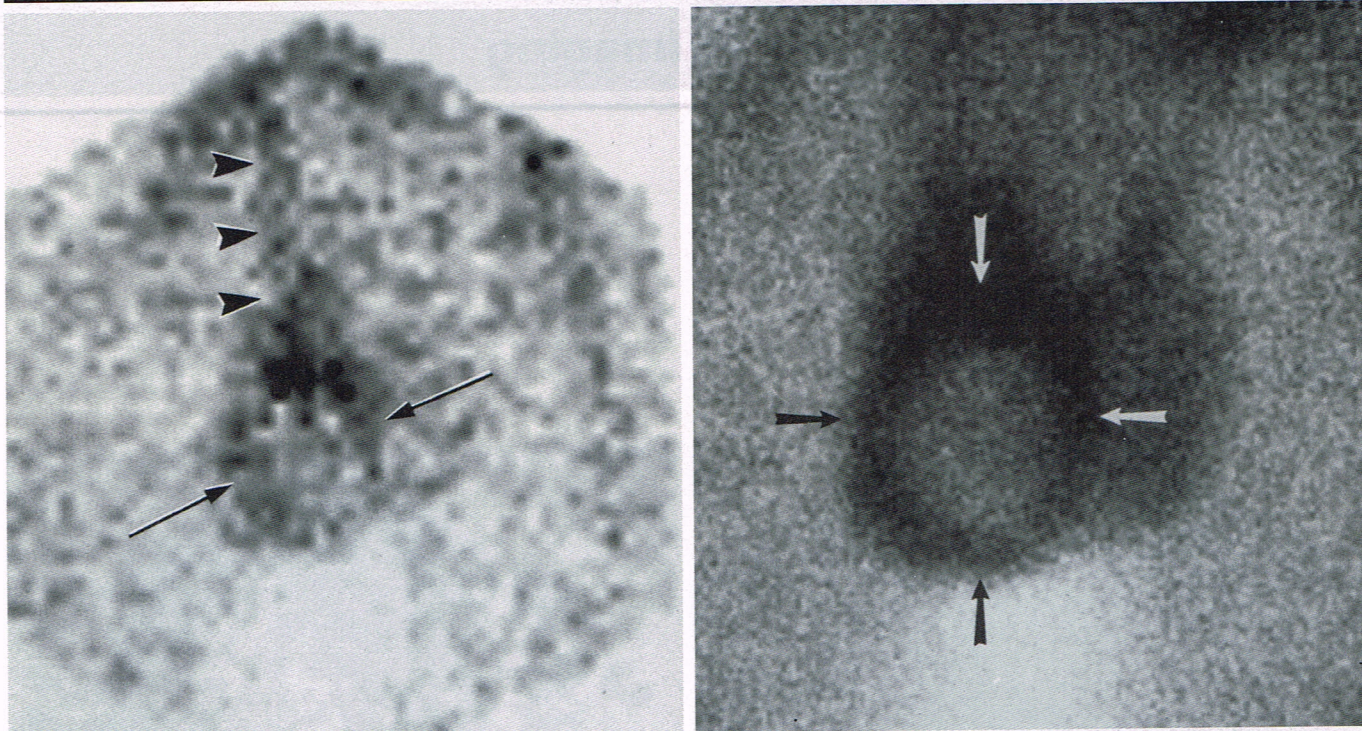


Figure 2. Right epididymo-orchitis with abscess formation. (a) Flow-phase image shows substantially increased ringlike flow activity (arrows) through the spermatic cord (arrowheads). (b) Tissue-phase image. The ringlike activity (arrows) is very similar to, but more intense than, that in the testis with delayed torsion. The initial scintigram, obtained 8 days earlier, had shown homogeneous increased activity in the affected hemiscrotum, representing epididymo-orchitis.

finally, infarction. Since there is no perfusion to the testis, a photopenic defect is seen on scrotal scintigrams. Hemorrhage and infarction of the testis induce inflammatory reaction and hyperemia in the surrounding highly vascular tunica dartos (superficial smooth muscle of the scrotum) (2-7). Increased dartos perfusion is through the pudendal arteries rather than the vessels of the spermatic cord, which are compromised by the torsion. The pudendal arteries travel more superficially. Whether they do (8) or do not (3,5) anastomose with the vessels supplying the testis, they nevertheless are unable to support testicular viability. This leads to a characteristic rim of increased activity surrounding the infarcted testis on the scintigram.

DISCUSSION

In 1973, Nadel and co-workers (9) reported a clinically useful scintigraphic method to investigate acute scrotal pain; this method uses flow- and tissue-phase imaging after injection of the radiopharmaceutical technetium-99m sodium pertechnetate. The technique has become an important tool for evaluating acute scrotal pain.

Delayed testicular torsion is defined as testicular torsion with symptoms of more than 24 hours duration (2-5). The basis for this definition is the sharp difference in the salvage rate for twisted testes operated on within 24 hours of onset of the symptoms versus the salvage rate for twisted testes for which surgery is delayed. The salvage rate drops to less than 20% if surgery is delayed for more than 24 hours (4,10). Vi-

ability of the testis depends not only on the duration of the torsion but also on the extent of the twist (degrees of rotation) and whether or not spontaneous detorsion occurs (1,5). Although it may be too late to save the infarcted testis, the involved testis is virtually always surgically removed to lessen symptoms and infectious complications and to decrease the chance of immunologically mediated infertility. In addition, recognition of delayed torsion is important for identification of those patients requiring orchiopexy for protection of the contralateral testis because the predisposing developmental abnormality ("bell-clapper" testis or lack of fixation of the testis in the scrotum by the tunica vaginalis) is usually bilateral (4,5,10).

This scintigraphic appearance (ie, photopenic center and increased rim activity) on the tissue-phase image has also been named "rim sign," "bull's-eye sign," "doughnut sign," and "halo sign" (5-7,11). This increased rim activity can be seen as early as within 7 hours of torsion but is typically seen beyond 24 hours after the onset of symptoms (3). The central photopenia usually, but not always, has less activity than that of the thigh (11). In addition, a similar "ringlike" increased activity during the flow phase has been described (2-5) (Fig 1b).

Although this sign was initially considered pathognomonic of delayed torsion, experience over the years has shown various other causes that may produce a similar scintigraphic appearance. These causes include suppurative epididymo-orchitis with abscess formation, testicular hematoma and hematocele, and testicular neoplasm with necrosis (2,3,11). Abscess complicating suppurative epididymo-orchitis is commonly confused with delayed torsion. This exhibits substantially in-

creased flow through the testicular and deferential vessels, resulting in increased rim activity on the tissue-phase image (Fig 2). The rim activity is usually very intense and asymmetric, unlike that seen with torsion (3). If the patient has a history of scrotal trauma, a ring sign may represent evidence of a hematoma or hematocele. With necrotic tumors, patchy photon-deficient areas are seen within the lesion, although the clinical history usually indicates a longer standing process than torsion (2,10). Other scrotal entities that rarely manifest a similar scintigraphic appearance include inguinal hernia, spermatocele, hydrocele, postorchietomy state, infected epididymal cyst, infarcted testis due to vascular abnormality such as polyarteritis or compression by an inguinal hernia, and periappendiceal abscess with extension via a patent processus vaginalis (5,11).

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