EVALUATION OF SCROTAL DISEASES WITH RADIONUCLIDE IMAGING AND ULTRASONOGRAPHY

ERKAN IBIS*
K. METIN KIR*
ALI T. KEMALOGLU*
GÜNER ERBAY*
GÜLSEREN ARAS*

SUMMARY: We have examined 106 patients suffering from various scrotal disorders with radionuclide scrotal imaging (RSI) and scrotal ultrasound imaging (SUI). Results obtained from both methods were correlated with clinical diagnosis. RSI is superior in testicular torsion and scrotal inflammations, however, SUI is more successful in hydrocele and scrotal masses.

Key Words: Scrotum, radionuclide imaging, ultrasonography.

INTRODUCTION

Clinical evaluation of scrotal disorders has some difficulties. Diagnosis of scrotal disorders by radionuclide (RSI) and ultrasound (SUI) imaging has improved considerably due to technical developments (1,3,4). In subclinical cases; such as hydrocele edematous or infiltrated tissue and painful scrotum; physical examination of scrotum may be difficult. In these cases RSI and SUI are very helpful for proper diagnosis (1,8).

RSI with technetium-99 m pertechnetate was first introduced by Nadel *et al.* in 1973 in order to demonstrate the testicular blood flow and differentiate the acute epididymitis from forsion of testis (6,8,13). Since then, in addition to acute disorders, orchitis, abscess, hematocele, hydrocele and trauma have been evaluated by these procedures.

Ultrasound has been extensively used in medicine since its introduction. Mishkin *et al.* suggested it can be useful in diagnosis of acute and chronic scrotal pathologies (11). Advances in ultrasonography instrumentation made it possible to differentiate the testes lesions from paratesticular lesions and evaluate the anatomical changes in scrotum. Therefore, decision making for medical approach has become much easier (10,11,15).

*From Department of Nuclear Medicine, Ankara University School of Medicine, Ankara, Türkiye.

MATERIALS AND METHODS

The study group consisted of 106 patients and 8 normal individuals (age range: 7-67). The patients were referred from Ankara University Medical School, Department of Urology with the complaints of scrotal swelling and pain. Prior to medical or surgical treatment RSI and SUI were obtained in Ankara University Medical School, Nuclear Medicine Department. The results of RSI and SUI were correlated with clinical and histopathological findings (Table 1).

SUI was performed with a 5 MHz linear transducer (SAL-32B Toshiba). A sonographic bed between the transducer and the scrotal surface was used to optimize beam focusing and to allow better visualization of very superficial areas.

RSI was performed with the large field view Pho Gamma IV camera and Scintiview imaging console. The patient lay in a supine position. The scrotum was placed parallel to the face of the low energy collimator by utilizing a tape sling. The penis was taped back over the pubis. 10mCi (370 MBq) Tc-99m pertechnetate was i.v. injected as a bolus. 5-sec later the acquisition started and serial 2-sec images were recorded for 30-sec (dynamic study or radionuclide angiogram). At 5-min post injection "static images" of the scrotal area were obtained with 500K counts. RSI and SUI were reviewed by the same experienced physicians.

Interpretation of RSI and SUI Results

In normal RSI there is less perfusion in cords and testes than arteria femoralis during dynamic study (2,3). In static images, testicular activity is symmetrical, homogeneous and slightly more

Table 1: Final diagnosis and diagnostic sensitivity of SUI and RSI in patients with scrotal diseases.

Final Diagnosis	Number of patients	Lesions detected		Sensitivity	
		SUI	RSI	SUI	RSI
Acute epididymitis:	11	9	11	81.8 %	100 %
Chronic epididymitis:	7	2	4	28.5 %	57.1 %
Epididymal -architis:	11	10	11	90.9 %	100 %
Abscess:	3	2	3	66.6 %	100 %
Hydrocele:	31	31	23	100 %	74.1 %
Spermatocele:	13	11	8	84.6 %	61.5 %
Epididymal - cyst:	1	1	1	100 %	100 %
Varicocele:	3	3	2	100 %	66.6 %
Scrotal hemia:	2	2	2	100 %	100 %
Testicular torsion:	2	2	2	100 %	100 %
Cryptorchidism:	8	3	2	37.5 %	25 %
Solid testicular tumors:	14	13	11	92.8 %	78.5 %
Seminoma:	7	7	6		
Malignant teratoma.	3	3	2		
Embryonal cell Ca:	2	1	2		
Lymphoma:	2	2	1		
TOTAL:	106	89	80	83.9 %	75.4 %
Normal patients:	8	-	1		

* Sensitivity of modality is expressed as lesions detected/total lesions present.

intense than thigh activity (3,7). Evaluation of RSI is based on blood flow, tracer activity accumulation and intensity (7,9). In SUI, the normal adult testis is ovoid and measures approximately 4,5x3x3 cm, with regular shape and shows homogeneous echo pattern (7,8,15). In parenchyma, there may be linear septal echogenicity 15).

The epididymis is located along the posterior wall of testis and widens in the upper pole where it is termed globus major (15). Normally the epididymis displays more echogenic or isoechoic appearance when compared with testis (6,8,15). Vas deferens, spermatic cord, scrotal wall layers are not identified as a separate structure on sonograms. Scrotal space does not contain fluid (10). SUI is carried out to show echo structure in anatomical changes (8,10,15).

RSI of scrotal disorders : Scrotal infections (epididymitis, orchitis, abscess) and most of malignant tumors demonstrate increased tracer activity due to increased vascularity and blood-pool (6,14). However, flow phase time and activity concentration may show differentiation in these cases. In infections increased perfusion is seen during arterial phase. Variocele and malignant testicular tumors demonstrate increased perfusion in venous phase (2,5,6, 7). Spermatocele, cyst, hydrocele, testicular torsion, scrotal hernia and some malignant tumors are noted to have hypoactive (cold) pattern because of diminished perfusion (6,7,12,13).

SUI of scrotal disorders: In epididymo-orchitis, epididymis is enlarged and with edema and have hypo or hyperechoic pattern. The testis is hypertrophied with heterogenous parenchyma, edema, necrosis and hemorrhagy. Fluid collections are seen in scrotal spaces (8, 10,15).

Hydrocale is characterized with anechoic fluid pattern in tunice vaginalis. Spermatocele and epididymis cysts show focal, regular, circular or oval shaped echofree lesions. Scrotal gas and fecaloid material verify scrotal hernia (10,15).

Malignant tumors demonstrate homogenous or nonhomogeneous sonographic pattern with regular or irregular border. Some cases reveal echogenic bands (calcification, hair, bone tissue) and echofree cystic necrotic areas (3,10,15).

In variocele, dilated veins over testis surface or around epididymis are identified as echofree cystic tubuli (10, 15).

Early stage of testicular torsion may not show any distinguishable pattern except slightly reduced echo. After 24 h echogenicity of testis is significantly decreased, testis and epididymis are enlarged, besides reactive mild hydrocele and necrosis are noted (1).

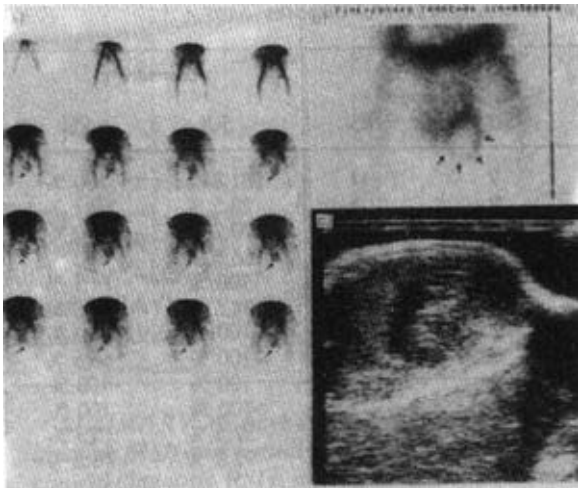

Figure 1: Abscess. Increased perfusion in radionuclide angiography (a), bull's eye appearance in static images (b), testicular hypertrophy, echo heterogenity with cyctic necrosis in scrotal ultrasonography (c).

RESULTS

Scrotal infections: 32 patients with acute or chronic epididymitis, orchitis and abscess were studied with dynamic and static radionuclide imagings. 29 cases showed increased activity during arterial phase (Figure 1). Only three with chronic epididymitis were normal. In 23 cases with inflammatory disease, hypertrophied and heterogeneous sonographic pattern in testis and/or with dilated epididymis were seen by SUI. Other nine SUI demonstrated no correlation suggesting infection.

Scrotal mass: In 38 patients (twenty-three hydroceles, eight spermatoceles, one epididymis cyst, two scrotal hernias, three seminomas, one malignant teratoma), the RSI appearance was hypoactive (Figures 2 and 3). 9 patients with scrotal mass (three seminomas, one malignant teratoma, two embryonal cell Ca, one lymphoma, two varicoceles) had increased activity in venous phase and static images. 17 cases (eight hydroceles, five spermatoceles, one varicocele, one seminoma, one malignant teratoma, one lymphoma) were normal because of small lesion sizes.

All hydrocele, cyst and varicocele were correctly diagnosed by SUI with an echofree appearance. Low level echogenicity were seen in three seminomas, one lymphoma case (Figure 4).

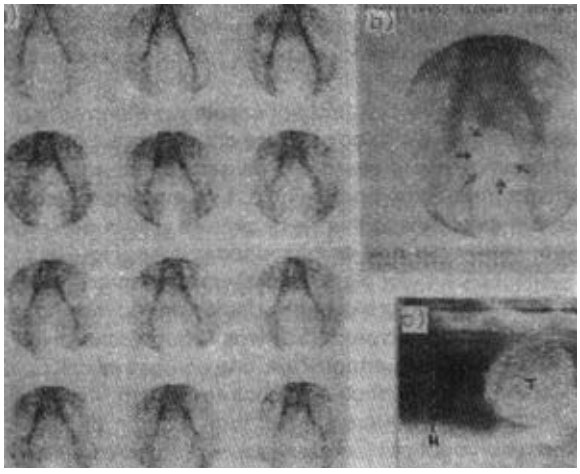

Figure 2: Normal radionuclide angiography (a), hypoactive area in static images (b), fluid collection in scrotum demonstrated with SUI (c), in an hydrocele case.

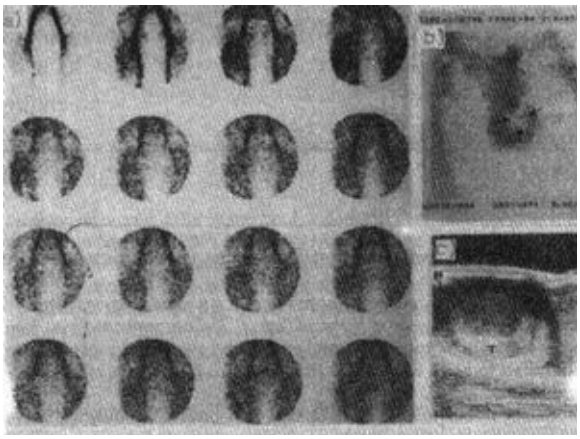

Figure 3: Seminoma. Normal perfusion (a), hypoactive area in static image (b), hypoechoic solid mass in ultrasonography.

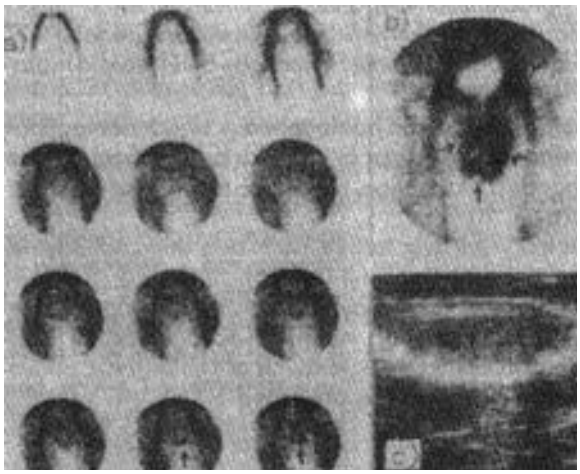

Figure 4: Malign teratoma. Increased perfusion in angiography (a), hyperactive area in static image (b), hyperechoic, slightly inhomogeneous solid lesion with an irregular contour (c), is shown.

Anechoic tubular dilated veins were observed in three varicoceles. Two scrotal hernia demonstrated moving intestinal anses in scrotum. SUI was unsuccessful only in three cases (two spermatocele, one embryonal cell Ca) 11 spermatoceles showed echofree pattern, the other not detected two were smaller than 4 mm in diameter. One embryonal cell Ca case was evaluated as an abscess. We had two testicular torsion which were studied 16 and 24 h after onset of scrotal pain. Both cases were characterized with decreased tracer activity and perfusion. In SUI the affected testis was enlarged and echogenicity was lower and heterogeneous.

There were 8 cryptorchidism patients, three of them were detected with SUI (two in inguinal area, one in pelvic area) and two were detected with RSI.

DISCUSSION

In our study, diagnostic sensitivity of SUI in infections is 71.8% while that of RSI is 90.6%, when combining both procedures, sensitivity increases to 93.7%. The poorest sensitivity was found in chronic epididymitis which was 28.5% for SUI while it was 57.1% for RSI. Due to normal or slightly increased perfusion in chronic epididymitis RSI may appear normal. Acute epididymitis and testicular torsion are needed to be differentiated because of different medical treatments. In both cases RSI is the most accurate method for the diagnosis and differentiation. The presence of a normal or decreased perfusion is mandatory for discrimination. Diagnostic sensitivity in scrotal masses for SUI is 95.3% and for RSI is 73.4%. Masses smaller then 1.5 cm can not be demonstrated with RSI. The smallest lesion detected with SUI in our study was 4 mm. SUI does not only detect the mass but distinguishes the seminomas and other non-seminomas masses as well. This was performed with 57.1% accuracy in our study.

Both methods have low sensitivity in cryptorchidism, which is 37.5% for SUI and 25% for RSI. Small testicle size and high back ground activity make it difficult to localize the testes.

By Chen *et al.*, diagnostic sensitivities for SUI and RSI were reported as 100% and 84% in scrotal masses, and as 47% and 94% in scrotal infections, respectively. In scrotal infections, we have found SUI was more sensitive than that reported by Chen *et al.* However, our findings of diagnostic sensitivity of RSI in scrotal infections, and SUI and RSI in scrotal masses are similar to those reported by Chen *et al.*

In our study, overall sensitivity for scrotal disorders is 83.9% for SUI and 75.4% for RSI when considering two tests together the sensitivity increases to 85.8%. On the other hand, the accuracy of our study was found 85.0% for SUI and 76.3% for RSI.

CONCLUSION

RSI is more sensitive than SUI in patient with scrotal infection and testicular torsion. However, in other scrotal diseases SUI is superior. Consequently, ease of use and non-invaziveness of SUI, made us decide to perform both methods together for the diagnosis of scrotal pathology.

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Correspondence:
Ankara University
Medical School,
Nuclear Medicine Department,
Cebeci/ Ankara, TURKIYE.