

Scintigraphic Detection of Varicoceles in Infertile Men

Teruhiko Takayama Seigo Kinuya* Masahisa Onoguchi
Shiro Tsuji Takatoshi Michigishi* Norihisa Tonami*

ABSTRACT

We studied scintigraphic detection of varicoceles in 35 patients with infertility problems using static images, a time-activity curve (TAC), and a new index. According to the results of physical examination and sonography, subjects were categorized into three groups : group G1 (n=4) with bilateral varicocele, group G2 (n=18) with unilateral (left) varicocele, and group G3 (n=13) without varicocele. Scrotal scintigraphy was performed with 740 MBq of ^{99m}Tc -HSA. Static images detected one bilateral and three left varicoceles in group G1. In group G2, 83.3% (15 cases) and 94.4% (17 cases) were interpreted as positive on images in the supine and the erect position, respectively. TAC was categorized into three types (A, B, and C) by the presence of asymmetry of both curves. In group G2, 77.8% (14 cases) showed type A or B in which asymmetry was clearly shown, and was positive. A new index was defined for the quantitative assessment of scrotal blood flow : $\%L (\%) = [2L / (L+R) - 1] \times 100$. In group G2, 61.1% (11 cases) and 72.2% (13 cases) showed more than 10% of $\%L$ in the supine and the erect position, respectively, and were positive. On the other hand, group G3 included two cases in which scintigraphy showed positive results and it seemed to be sonographic false negative. The sensitivity of TAC or $\%L$ was lower than that of static image, but they are excellent in the objectivity. It was concluded that sonography appears to be useful and suitable as a screening method for the detection of varicocele in patients with infertility problems. When scintigraphy is performed to exclude sonographic false negative, diagnosis of varicoceles should be performed based on the results of static image of scintigraphy, TAC and quantitative assessment.

KEY WORDS

Varicocele, Scrotal scintigraphy, ^{99m}Tc -HSA, Supine position, Erect Position

INTRODUCTION

A varicocele is formed by elongation, dilatation, and tortuosity of the veins of the pampiniform plexus and has been noted to be a common cause of male infertility¹⁾⁻⁵⁾. Apart from clinical examination, techniques for the diagnosis of varicocele include sonography^{6), 7)}, thermography⁸⁾, venography^{9), 10)}, and scintig-

raphy¹¹⁾⁻¹⁶⁾. They are methods based on blood reflux in the internal spermatic vein and have some limitations. Sonography requires an experienced operator. Thermography is not a widely available procedure. Venography is generally accepted as the golden standard in the detection of retrograde blood flow in varicocele⁹⁾, but this method is invasive, uncomfortable, and

Department of Radiological Technology, School of Health Science, Faculty of Medicine, Kanazawa University

* Department of Nuclear Medicine, School of Medicine, Kanazawa University

Table 1. Clinical data

Group	No	Age	PE	US	SUP	ERC	TAC	%L(S)	%L(E)
G1 (n=4)	1	32	Neg	B	L	L*	A	32	19
	2	31	L	B	L	L	B	26	22
	3	37	Neg	B	Neg	L*	C	11	38
	4	28	Neg	B	B	B	C	-4	11
G2 (n=18)	5	38	L	L	L	L*	A	16	33
	6	27	L	L	Neg	L	A	36	32
	7	28	L	L	L	L*	A	23	23
	8	28	L	L	L	L	A	22	11
	9	27	Neg	L	L*	L	A	20	13
	10	41	L	L	L	L	B	42	44
	11	26	L	L	L	L*	B	24	34
	12	30	Neg	L	L	L*	B	27	26
	13	33	Neg	L	L	L	B	19	23
	14	36	Neg	L	L	L	B	19	23
	15	29	Neg	L	L	L	B	4	12
	16	33	L	L	L	L	B	7	10
	17	36	Neg	L	L	L	B	23	-1
	18	33	L	L	L	L	B	-4	-7
19	31	L	L	L	L	C	-5	12	
20	40	Neg	L	Neg	L	C	6	7	
21	22	L	L	L	L	C	2	6	
22	35	Neg	L	Neg	Neg	C	-1	6	
G3 (n=13)	23	38	Neg	Neg	L	L	A	30	21
	24	33	Neg	Neg	L	L	B	16	25
	25	31	Neg	Neg	Neg	R	C	0	9
	26	29	Neg	Neg	Neg	Neg	A	19	-9
	27	33	Neg	Neg	Neg	Neg	A	18	3
	28	35	Neg	Neg	Neg	Neg	A	18	1
	29	46	Neg	Neg	Neg	Neg	B	22	-22
	30	37	Neg	Neg	Neg	Neg	B	18	3
	31	30	Neg	Neg	Neg	Neg	B	7	6
	32	31	Neg	Neg	Neg	Neg	B	0	26
	33	29	Neg	Neg	Neg	Neg	C	4	-3
	34	33	Neg	Neg	Neg	Neg	C	-1	-8
	35	28	Neg	Neg	Neg	Neg	C	-14	8

PE= Physical examination, US=Ultrasonography, SUP=Static image in the supine position, ERC=Static image in the erect position, TAC=time activity curve, %L(S)=Value of %L in the supine position, %L(E)=Value of %L in the erect position, Neg=Negative, *=Excellent image, B=Bilateral, L=Left

can lead to misinterpretation¹⁰. On the other hand, scrotal scintigraphy is a simple, safe, non-invasive test that can be routinely performed in any nuclear medicine department¹¹.

In spite of various reports in the early 1980s about varicocele scintigraphy, the sensitivity was too low for accurate imaging¹². Most of the varicocele scintigraphy studies were based only on visual interpretation of static images.

They hardly mentioned to quantitative analysis. We compared images between in the supine and the erect position to evaluate the effect of patient's positioning on static images and tried a quantitative approach.

The purpose of this study was to investigate the diagnostic role of scrotal scintigraphy using static images, a time-activity curve and quantitative assessment.

MATERIALS AND METHODS

We studied 35 patients with infertility problems, and in whom varicocele had been suspected (Table 1). Their ages ranged from 22 to 41 years (mean \pm S.D. : 32.4 \pm 4.8 years). Scrotal sonography was performed in the department of Urology using real-time scanner with a 5-MHz transducer (ASU-25V-OG, Aloka Corp.). Twenty-two patients were diagnosed having varicoceles by physical examination and/or sonography. All subjects were categorized into three groups : group G1 (n=4) with bilateral varicocele, group G2 (n=18) with unilateral (left) varicocele, and group G3 (n=13) without varicocele.

Scrotal scintigraphy was imaged both in the supine and the erect positions to estimate the effect of patient's positioning on static images. Firstly, the patient lay in the supine. A small-field gamma camera (Pho Gamma V, Siemens Corp.) equipped with a parallel hole, all-purpose collimator was positioned anteriorly over the patient's scrotum. Data were stored in a Medical Data Systems computer. To shield the scrotum from surrounding background activity, flexible lead shields (0.5 mm lead equivalent) were attached to the upper part of the thighs. The penis was taped to the anterior abdominal wall in the midline. After a bolus injection of 740 MBq of ^{99m}Tc-labeled human serum albumin (HSA), sequential sixteen 5-sec frame images and a 100-sec static image (proximately 500 kilocounts) were acquired. Subse-

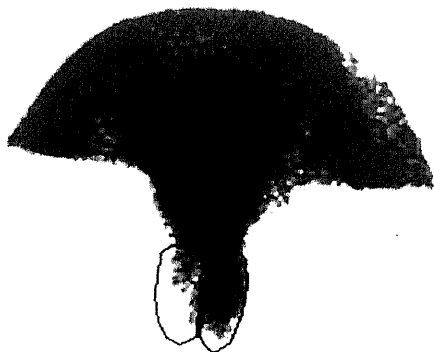


Fig. 1. Regions of interest created on bilateral scrotums

quently, a 100-second static image was acquired in the erect position. All images were acquired with a 64 \times 64 matrix. The energy discrimination was centered on 140 keV with a 20% window. Time-activity curves (TACs) were generated from the 3 min-counts in the regions of interest created on the bilateral scrotums (Fig. 1). As shown in Fig. 2, TACs were visually inspected and categorized into three types according to the presence of asymmetry of radioactivity : type A with prominent asymmetry at the early phase, type B with asymmetry at the delayed phase, and type C without asymmetry.

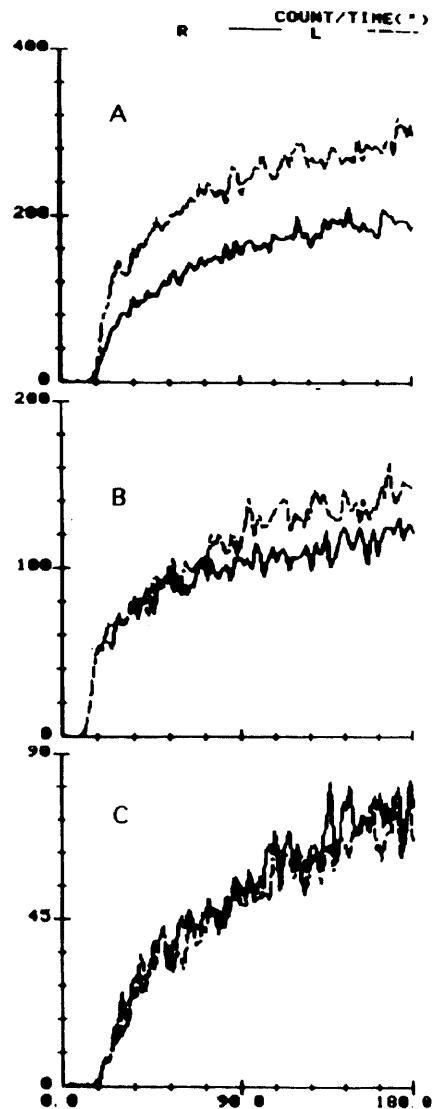


Fig. 2. Three types of time-activity curves (TACs). Type A with prominent asymmetry of blood flow at the early phase, type B with asymmetry at the delayed phase, and type C without asymmetry.

Table 2. Comparison of images, TAC and %L

	Left (n=18)			Bilateral (n=4)			Total (n=22)		
	+	-	%	+	-	%	+	-	%
Image Supine	15	3	83.3	3	1	75	18	4	81.8
Erect	17	1	94.4	4	0	100	21	1	95.4
TAC	14	4	77.8	2	2	50	16	6	72.7
%L Supine	11	7	61.1	3	1	75	14	8	63.6
Erect	13	5	72.2	4	0	100	17	5	77.2

+: Positive interpretation, -: Negative interpretation, TAC=Time-activity curve

delayed phase, and type C without asymmetry. A new index was defined for the quantitative assessment of scrotal blood flow: $\%L(\%) = [2L / (L+R) - 1] \times 100$.

Scintigraphy was visually interpreted by two experienced nuclear medicine physicians without any results of physical examination and sonography. The difference between two interpreters was solved by consensus. Static image was positive when there was a small area of focal activity in either hemiscrotum.

RESULTS

1) Visual interpretation of static images

Static image detected only one case with bilateral varicocele in group G1. The remaining three cases were detected as the left varicocele. In group G2, 83.3% (15cases) and 94.4% (17 cases) were positive in the supine and the erect position, respectively (Table 2). On the other hand, group G3 included two cases in which scintigraphy showed positive result, and it seemed to be sonographic false negative.

2) Estimation of blood flow with TAC

Group G1 included two of type C, and each one of type A and B. In group G2, 77.8% (14 cases) showed type A or B in which prominent asymmetry of scrotal blood flow was shown, and was positive.

3) Quantitative analysis

Three cases and four cases in group G1 showed more than 10% of %L in the supine and the erect position, respectively. In group G2, 61.1% (11 cases) and 72.2% (13 cases) showed more than 10% of %L in the supine and the

erect position, respectively, and were positive.

4) Case presentation (No 3)

As shown in Fig. 3, static image in the supine position showed no focal activity and was interpreted as negative, but image in the erect position showed markedly increased radioactivity in the left scrotum and was interpreted as the left varicocele. TAC showed Type C. The values of %L were 11% and 38% in the supine and the erect position, respectively.

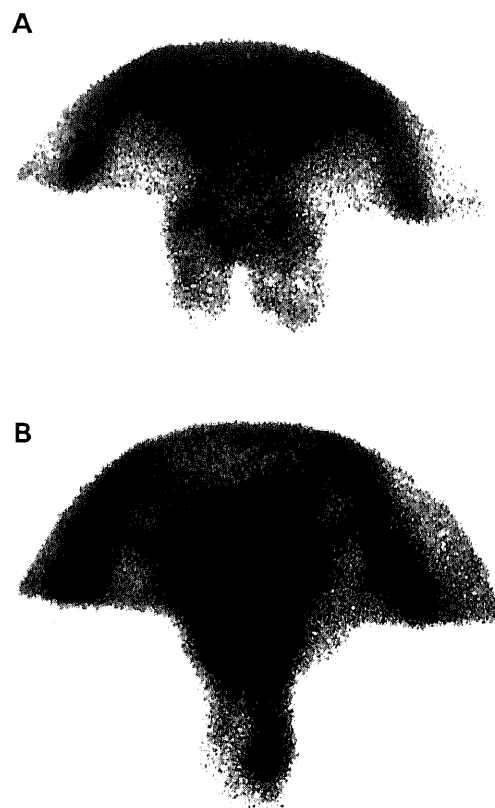


Fig. 3. Static images in the supine (A) and the erect positions (B)

DISCUSSION

It is well known that a varicocele is a contributing factor in oligospermia. However, it has been also pointed out that many men with varicocele remain fertile¹²⁾. The incidence of varicocele in large groups of young people varied from 4 to 16%, whereas in men visiting infertility clinics up to 39% was found¹²⁾. We investigated the diagnostic role of scrotal scintigraphy using visual interpretation of static images, time-activity curves, and quantitative assessment.

In normal scintigraphy, scrotal radioactivity is symmetrical and slightly more intense than thigh activity. Increased radioactivity in the scrotum suspects the presence of varicocele. Other conditions including acute and chronic orchitis, trauma and testicular tumors may cause a unilateral increase in the blood pool scintigraphy and may be a source of false positive¹⁾. Conversely, when scintigraphic diagnosis of epididymo-orchitis is undertaken, care must be taken to exclude a varicocele⁶⁾. From 80 to 98% of varicoceles are unilateral and left-sided, whereas bilateral varicoceles occur in up to 20% of cases and unilateral right varicocele is consistently uncommon⁶⁾. Although sonography detected four cases of bilateral varicoceles in this study, scintigraphy detected only one of them. Since there is no asymmetry in bilateral varicocele, it causes the major source of false negative. In cases with unilateral varicocele, 83.3% (15 cases) and 94.4% (17 cases) were positive in the supine and the erect position, respectively. The sensitivity of scintigraphic detection of unilateral varicocele was lower than that of sonography.

We compared images between both positioning to estimate the effect of patient's positioning on images. Six cases (two of bilateral and four of left) showed better image in the erect position, whereas only one case showed better image in the supine position. Therefore, erect position seemed to be preferable for imaging.

We categorized TAC into three types and estimated asymmetry of scrotal blood flow. In

group G2, 77.8% (14 cases) was type A or B, in which asymmetry was clearly shown, and was positive. Six cases (two in group G1 and four in group G2) showed type C. On the other hand, group G3 included four cases showing type A. These four cases showed more than 10% of %L in the supine position, but three cases showed less than 10% of %L in the erect position. Since TACs were generated from the 3 min-counts in the regions of interest, they are related to the radioactivity on dynamic images (sequential sixteen 5-sec frames) and a static image (100-sec image). On the other hand, a static image and %L in the erect position aren't related to TAC because they were obtained from the data after 3 minutes. We can't explain why the change of patient's positioning caused prominent left-to-right difference of scrotal blood flow, but the effect of gravity may be related to the difference. In order that TACs would be helpful for the diagnosis of varicocele, it is desirable for TAC to be acquired in the erect position. We acquired dynamic images, but they were excluded in this study. Because some authors reported that a dynamic flow study gave no supplementary information, and was less sensitive than static images^{2), 13)}.

A new index of %L was defined for the quantitative assessment. In group G2, 61.1% (11 cases) and 72.2% (13 cases) showed more than 10% of %L in the supine and the erect position, respectively. Case presentation showed asymmetry of scrotal blood flow in the erect position, but symmetry in the supine position. Group G3 included two cases in which scintigraphy showed positive result and it seemed to be sonographic false negative. The sensitivity of TAC or %L was lower than that of static image, but they are excellent in the objectivity.

In conclusion, sonography appears to be useful and suitable as a screening method for the detection of varicocele in patients with infertility problems. When scintigraphy is performed to exclude sonographic false negative, diagnosis

of varicoceles should be performed based on the results of static image of scintigraphy, TAC and quantitative assessment.

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シンチグラフィによる不妊男性の精索静脈瘤の検出

高山 輝彦, 絹谷 清剛, 小野口昌久
辻 志郎, 道岸 隆敏, 利波 紀久

要 旨

不妊を主訴に受診した患者35人を対象に、シンチグラフィの静態像、時間放射能曲線 (TAC)、指標を用いた定量評価によって精索静脈瘤の検出能を検討した。対象を理学所見あるいは超音波検査 (US) の結果によって3群に分類した。G 1 群 (n=4) ; 両側に精索静脈瘤を認めた群, G 2 群 (n=18) ; 片側 (左側) に認めた群, G 3 群 (n=13) ; 認めない群。静態像による評価では、G 1 群の両側性 4 例を両側性 1 例, 片側性 (左側) 3 例として検出した。G 2 群の検出率は臥位像で83.3% (15/18), 立位像で94.4% (17/18) であった。TAC は、両曲線の左右差の有無によってタイプ A, B, C に分類した。左右差の明瞭なタイプ A と B を異常とすると、G 2 群では77.8% (14/18) が陽性であった。血流の左右差の定量評価のために、新しい指標 $\%L = [2L / (L + R) - 1] \times 100\%$ を算出した。10%以上の $\%L$ を異常とすると、G 2 群では臥位で61.1% (11/18), 立位で72.2% (13/18) が陽性であった。一方、US で精索静脈瘤が認められなかったG 3 群13例中2例には、シンチグラフィで精索静脈瘤が検出され、USによる偽陰性と考えられた。TAC や指標による検出感度は静態像に比べ低かったが、客観性に優れている。以上より、シンチグラフィによる精索静脈瘤の診断には、画像、TAC、指標による定量評価を総合して検討することが重要と思われた。