The value of palpation, varicoscreen contact thermography and colour Doppler ultrasound in the diagnosis of varicocele

J. W. Trum1,2, F. M. Gubler1, R. Laan1 and F. van der Veen1

1Sections of Gynaecology and Reproductive Endocrinology and Infertility, Department of Obstetrics and Gynaecology, 2Department of Radiology, Academic Medical Center, Meibergdreef 9 1105AZ Amsterdam, The Netherlands

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Introduction

The prevalence of palpable varicocele is presumed to be higher among fertile men (21–41%) than in the general male population (4.4–22.6%) (Saypol, 1981). Some authors think a varicocele to be an aetiologic factor in male infertility (Nagler and Zippe, 1991; Takihara et al., 1991). A varicocele is present in a significantly higher percentage of men with secondary (81%) as compared with primary infertility (35%) (Gorelick and Goldstein, 1993). Gorelick and Goldstein (1993) state that the detrimental effect of a varicocele on spermatogenesis is a progressive phenomenon and that it is a matter of time before testicular damage becomes clinically evident. This explanation is questionable, since it may be simply a sign of ageing. Subclinical varicocele is defined as reflux in the internal spermatic vein without palpable distention of the pampiniform plexus (Comhaire et al., 1976). Published data suggest that subclinical varicocele is present in 24–83% of infertile men (Comhaire et al., 1976; Hirsh et al., 1980; Dale McLure and Hricak, 1986). Treatment of primary varicocele has been the subject of much debate. When the results of treatment of patients with subclinical varicocele are compared with those of patients with clinical varicocele there seem to be no notable differences (Dhabuwalla et al., 1992; Marsman and Schats, 1994). Literature data covering 5471 surgically treated patients show pregnancy rates of 0–50% with an average of 36% (Mordel et al., 1990). None of the reviewed studies, however, was performed according to the strict criteria of a randomized controlled clinical trial. One randomized clinical trial comparing different treatments of varicocele showed surgical ligation and radiological embolization to be equally effective in terms of pregnancies following treatment (Nieschlag et al., 1993). In a recently published randomized clinical trial no significant difference in pregnancy rate between occlusion of the vena spermatica and counselling was seen; however, the authors emphasized the need for further controlled studies (Nieschlag et al., 1995).

Selection of patients with both clinical and subclinical varicoceles is mandatory before such a study can be carried out. Various non-invasive methods for diagnosing a varicocele have been described. Contact thermography using a thermovision infra red camera is a reliable diagnostic test with a sensitivity of 84–98% and a specificity of 81–100% [World Health Organization (WHO), 1985; Hamm et al., 1986]. As an alternative to the infra red camera an easier, quicker and cheaper method using liquid crystal contact colour thermography was developed. The test had a sensitivity of 100% and a specificity of 50%, but the sample size was too small to draw firm conclusions (Pochaczyszyn et al., 1986). Another larger study concluded that contact thermography had a sensitivity of only 20% and the use was limited to quantification of a clinical varicocele (Basile-Fasole et al., 1986). Reports on colour Doppler scrotal ultrasound describe varying results; some found a high sensitivity and specificity up to 95% (Gonda et al., 1987; Fobbe et al., 1989), one reported a high sensitivity of 93% but a specificity of only 33% (Petros et al., 1991) and in one study both sensitivity and specificity were low (Eskew et al., 1993). This may in part be explained by varying degrees of skilfulness of the examiners. In view of these discrepancies, three non-invasive methods for the detection of a varicocele were evaluated in our institute. We compared liquid crystal contact colour thermography (Varicoscreen®), colour Doppler ultrasound as well as physical examination, with spermatic venography as reference strategy.

Materials and methods

Male partners of couples with at least 12 months' infertility who had abnormal semen analyses according to the WHO guidelines (WHO, 1987) were included in the study. The study was approved.
by the ethics committee and all patients gave informed consent prior to examination. All men were given a general physical and genital examination by the first author, resident in obstetrics and gynaecology with a longstanding experience in this field. The scrotal contents were examined with patients in standing position. Volume, position and consistency of testes and epididymes as well as presence of the vasa deferentia were noted. Palpation of the pampiniform plexus was done with and without the patient performing a Valsalva manoeuvre. Direct visible varicoceles were graded class III. Direct palpable varicoceles were graded class II. Varicoceles only palpable during Valsalva manoeuvre were graded class I. Men with Klinefelter’s syndrome, inflammation or infection of the scrotal and/or inguinal skin, or elevated follicular stimulating hormone (FSH) and/or thyroid stimulating hormone (TSH) were excluded. All men underwent Varicoscreen thermography performed by the same physician. Thermography was performed using a flexible thermostrip Varicoscreen (Amsaten, De Pinte, Belgium) containing heat sensitive liquid crystals calibrated at different temperatures varying from 31.3 to 35.3°C. The patient had to stand for 5 min with the lower part of his body uncovered to cool the scrotum in a room where the temperature did not exceed 22°C. The Varicoscreen was applied to the scrotum with the patient standing. The test was considered negative when the temperature of the skin was symmetrical and did not exceed 32.5°C. The test was positive when there was a uni- or bilateral colour change corresponding to temperatures of 32.8°C or higher. Because the purpose of each non-invasive screening method was to select patients in whom a varicocele was suspected, we considered all cases with bilateral temperature rise as true positives if venography demonstrated at least a unilateral (left or right sided) varicocele. Colour Doppler scrotal ultrasound was carried out by the second author, a skilled radiologist, and was performed using a 7.5 MHz high-resolution linear array transducer (Acuson, Mountain View, California) with pulsed and colour Doppler capabilities. The patient was examined supine and the scrotal contents on both sides were visualized. On gray-scale sonography the presence of any paratesticular anechoic, tortuous tubular structures, i.e. widened spermatic veins, was noted. On colour Doppler ultrasound scans visualization of augmentation of venous flow during a Valsalva manoeuvre was noted. Doppler samples of the spermatic vein were obtained during Valsalva manoeuvres and while breathing normally. Reflux, whether Valsalva-induced or spontaneous, defined as caudate flow in the internal spermatic vein, was considered abnormal if it lasted longer than 1 s.

In this study we used pathological reflux as the only diagnostic criterion for a varicocele. Patients without reflux, or with Valsalva-induced reflux for a time period <1 s were considered normal. Patients showing reflux >1 s were considered to have a varicocele.

After the above mentioned diagnostic tests, all patients underwent internal spermatic venography using the Seldinger technique through the right femoral vein. Both the left and right renal vein were catheterized, and contrast material was infused while the patient performed the Valsalva manoeuvre in the upright position. Retrograde flow of contrast material, through the internal spermatic vein, toward the testis was the venographic criterion for the diagnosis of a varicocele. Clinicians were blinded for the results of the different diagnostic tests.

The results of the comparison of the various diagnostic tests are expressed in terms of sensitivity, specificity, and likelihood ratios. Sensitivity is defined as a true positive test result. Specificity is defined as a true negative test result. The likelihood ratio of a positive test is the sensitivity divided by (1 – specificity). The

Accuracy of physical examination, compared with presence or absence of reflux with retrograde venography

<table>
<thead>
<tr>
<th>Physical examination</th>
<th>Venography</th>
<th>Reflux present</th>
<th>Reflux absent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distention present</td>
<td>22</td>
<td>10</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Distention absent</td>
<td>9</td>
<td>22</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>32</td>
<td>63</td>
<td></td>
</tr>
</tbody>
</table>

CI = confidence interval.

Sensitivity 71% (95% CI 0.52–0.86); specificity 69% (95% CI 0.50–0.84); likelihood ratio positive test 2.3 (95% CI 1.3–4.0); likelihood ratio negative test 0.4 (95% CI 0.25–0.77).

Accuracy of varicoscreen, compared with presence or absence of reflux with retrograde venography

<table>
<thead>
<tr>
<th>Varicoscreen</th>
<th>Venography</th>
<th>Reflux present</th>
<th>Reflux absent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature &gt;32.8°C</td>
<td>30</td>
<td>29</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Temperature &lt;32.8°C</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>32</td>
<td>63</td>
<td></td>
</tr>
</tbody>
</table>

Sensitivity 97% (95% CI 0.83–1.0); specificity 9% (95% CI 0.02–0.25); likelihood ratio positive test 1.1 (95% CI 0.94–1.2); likelihood ratio negative test 0.33 (95% CI 0.04–3.1).

Accuracy of colour Doppler ultrasound, compared with presence or absence of reflux with retrograde venography

<table>
<thead>
<tr>
<th>Colour Doppler ultrasound</th>
<th>Venography</th>
<th>Reflux present</th>
<th>Reflux absent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflux present</td>
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<td>32</td>
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<tr>
<td>Reflux absent</td>
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<td></td>
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<tr>
<td>Total</td>
<td>31</td>
<td>32</td>
<td>63</td>
<td></td>
</tr>
</tbody>
</table>

Sensitivity 97% (95% CI 0.83–1.0); specificity 94% (95% CI 0.79–0.99); likelihood ratio positive test 16 (95% CI 4.0–59); likelihood ratio negative test 0.03 (95% CI 0.005–0.24).

The likelihood ratio of a negative test is (1 – sensitivity) divided by the specificity.

Results

Out of 63 subjects included in the study, a varicocele was determined by spermatic venography in 31 of them, corresponding to a prevalence of 49%. A left-sided varicocele was seen in 26 cases (84%), a right-sided varicocele in two cases (6%) and a bilateral varicocele in three cases (10%).

Table I shows the results of clinical palpation compared with presence or absence of reflux with retrograde venography. Sensitivity of clinical examination was 71% [95% confidence limit (CI) 0.52–0.86] and specificity 69% [95% CI 0.50–0.84]. In nine cases a varicocele was present with venography but not demonstrated clinically and considered subclinical. In 10 cases clinical findings were false positive (left-sided seven, right-sided two, bilateral one).

Table II shows the results of Varicoscreen compared with
spermatic venography. Sensitivity of Varicoscreen was 97% (95% CI 0.83-1.0), specificity 9% (95% CI 0.02-0.25). In 54 cases there was a bilateral temperature rise >32.8°C. In four cases the temperature rise was on the left side only and in one case on the right side only.

Table III shows the results of colour Doppler ultrasound compared with spermatic venography. Sensitivity of colour Doppler ultrasound was 97% (95% CI 0.83-1.0) and specificity was 94% (95% CI 0.79-0.99). There was one false negative case where a bilateral varicocele demonstrated with venography was missed by ultrasound. In two false positive cases, one bilateral and one left-sided varicocele were suspected sonographically but not confirmed with venography. In one case a bilateral varicocele was suspected sonographically while only a left-sided varicocele was seen with venography. This case was recorded as true positive.

Discussion

In the diagnosis of varicocele, spermatic venography is generally considered the reference strategy. It is an invasive technique offering prompt treatment in case a varicocele is present. The prevalence of varicocele in ~40% of an infertility population implies that large numbers of patients might be submitted to this invasive diagnostic procedure. For this reason, various non-invasive diagnostic tests have been developed. We compared three non-invasive tests: physical examination, Varicoscreen and colour Doppler ultrasound using strict criteria, with the spermatic venography. Our results show that physical examination has a sensitivity of 71% (95% CI 0.52-0.86) and a specificity of 69% (95% CI 0.50-0.84).

A low sensitivity could be explained by the presence of subclinical varicoceles. These are depicted with venography but not palpated on physical examination. In our study this occurred in 29% of the cases. Reviewing the literature comparing results of venography with physical examination, the presence of subclinical varicoceles varied from 24 to 50% (Comhaire et al., 1976; Tremblay et al., 1980; WHO, 1985; Basile-Fasole et al., 1986; Pochaczewsky et al., 1986; Petros et al., 1991). In the same studies the false positive rate, i.e. a varicocele palpated on physical examination but not demonstrated with venography, varied from 24 to 60% and in only one study was as low as 5% (Comhaire et al., 1976). In our study the false positive rate was 31%. It is impossible to consider all false negative findings on palpation to be subclinical varicoceles, without taking into account the high number of false positive findings. In view of these results, we think that the existence of a subclinical varicocele is questionable. Palpation of the pampiniform plexus is therefore not a good screening test. The Varicoscreen (liquid crystal contact thermography) was used, conforming to the instructions for use, and had a sensitivity of 97% (95% CI 0.83-1.0) but a specificity of only 9% (95% CI 0.02-0.25). A specificity of 9% means that almost all subjects have to undergo a spermatic venography. Varicoscreen as a screening method is therefore of no value whatsoever.

Colour Doppler ultrasound proved to be a good screening method with a sensitivity of 97% (95% CI 0.83-1.0) and a specificity of 94% (95% CI 0.79-0.99), providing our criterion of pathological reflux for the diagnosis of a varicocele was used as described in an earlier report (Dol et al., 1993). With an accuracy of 95% we accomplished better results than previous studies (Gonda et al., 1987; Fobbe et al., 1989; Petros et al., 1991; Eskew et al., 1993).

We suggest that all infertility patients undergo a Doppler sonography. Those presenting with a varicocele could be randomized for a clinical trial comparing the results of treatment of varicocele versus no treatment.

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References


Diagnosis of varicocele


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