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Ultrasound evaluation of varicoceles: guidelines and recommendations of the European Society of Urogenital Radiology Scrotal and Penile Imaging Working Group (ESUR-SPIWG) for detection, classification, and grading

Simon Freeman[1] · Michele Bertolotto[2] · Jonathan Richenberg[3] · Jane Belfield[4] · Vikram Dogra[5] · Dean Y. Huang[6] · Francesco Lotti[7] · Karolina Markiet[8] · Olivera Nikolic[9] · Subramaniyan Ramanathan[10] · Parvati Ramchandani[11] · Laurence Rocher[12,13] · Mustafa Secil[14] · Paul S. Sidhu[6] · Katarzyna Skrobisz[8] · Michal Studniarek[8] · Athina Tsili[15] · Ahmet Tuncay Turgut[16] · Pietro Pavlica[17] · Lorenzo E. Derchi[18] · members of the ESUR-SPIWG WG

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Abstract

Varicoceles are relatively common particularly in asymptomatic men and are even more prevalent in subfertile men, representing the most common potentially correctable cause of male infertility. Ultrasound (US) is the imaging modality of choice for varicocele evaluation, but there is no widely accepted consensus on examination technique, diagnostic criteria, or classification. In view of this uncertainty, the guideline writing group (WG) of the European Society of Urogenital Radiology (ESUR) Scrotal and Penile Imaging Working Group (ESUR-SPIWG) undertook a literature review and assessment of the quality of relevant evidence. The group then produced evidence-based recommendations for varicocele US examination, interpretation, and classification by consensus agreement. The results are presented in the form of 15 clinical questions with a brief summary of the relevant evidence and the authorised recommendations from the SPIWG. This paper provides a short summary of the evidence evaluation and the complete recommendations.

Key Points

- *Varicocele is a common clinical problem; it is highly prevalent amongst subfertile men and the most common potentially correctable cause of male infertility.*
- *Ultrasound is the imaging modality of choice for varicocele assessment, but there is no generally agreed consensus on the US examination technique or the criteria that should be used for diagnosis, grading, and classification.*
- *This paper summarises the recommendations of the ESUR-SPIWG for standardising the US assessment of varicoceles. This includes examination technique, image interpretation, classification, and reporting.*

Keywords Varicocele · Scrotum · Infertility, male · Ultrasonography · Ultrasonography, Doppler

Abbreviations

AGREE	Appraisal of Guidelines for Research and Evaluation
AVMs	Arteriovenous malformations
ESUR	European Society of Urogenital Radiology
GRADE	Grading of Recommendations Assessment, Development and Evaluation
H	Height
L	Length
OCEBM	Oxford Centre for Evidence Based Medicine
PICO	Patient Problem (or Population), Intervention, Comparison or Control, Outcome
Sec	Seconds
SPIWG	Scrotal and Penile Imaging Working Group
V	Volume
W	Width
WG	Guideline writing group

Simon Freeman and Michele Bertolotto are joint first authors (making an equal contribution to this manuscript).

✉ Simon Freeman
simonfreeman@nhs.net

Extended author information available on the last page of the article

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Introduction

Varicoceles are a common urological problem. Although often detected incidentally, they are more prevalent in patients with infertility or chronic scrotal discomfort [1] and represent the commonest potentially correctable cause of male infertility.

Clinical assessment is unreliable and highly dependent on the clinician's expertise [2]. US is the imaging modality of choice, although the need for US is debated [3, 4] and there is no consensus on the technique, diagnostic criteria or which of many different classification systems should be used [2]. Despite this, there is evidence that accurate imaging of varicoceles is helpful in treatment decisions [5–7].

Given these uncertainties, the guideline writing group (WG) of the ESUR-SPIWG undertook a literature review with the aim of producing evidence-based recommendations for standardising the technique and interpretation of the US examination. This paper summarises the evidence and provides the authorised SPIWG guidelines.

Materials and Methods

Guidelines were developed in accordance with the Appraisal of Guidelines for Research and Evaluation (AGREE) II document [8]. The WG formulated 15 questions after deliberating difficulties in their clinical practice, and these were transferred into PICO format [9, 10]. Four biomedical literature databases (PubMed, Web of Science, Embase, and the Cochrane Library) were searched for all relevant articles published before 2018 in English, German, French, or Italian. The quality of evidence was rated according to the Oxford Centre for Evidence Based Medicine (OCEBM) 2011 levels of evidence (Table 1) [11] and recommendations graded using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system (Table 2) [12]. The recommendations were circulated to all members of the SPIWG and discussed in detail at the SPIWG meeting in September 2018 and modifications agreed. Consensus was obtained by vote according to the modified Delphi technique [13] with members able to approve, reject, or abstain from each recommendation.

Results

Question 1: What is the evidence for correlation between varicocele, spermatogenesis damage, and infertility?

There is a male contribution to infertility in approximately half the cases where a cause can be identified [6]. Varicocele is the most common treatable cause [14] and has an estimated prevalence of 15% in the general population [15], 40% in primary, and 75–81% in secondary male infertility [16–18]. Seventy-five percent of men with a varicocele are however fertile [19] and 80% have normal semen parameters [20].

Many different mechanisms have been proposed to explain the link between varicoceles and impaired spermatogenesis. A multifactorial etiology is likely involving heat, oxidative stresses, adrenal catecholamine reflux, and androgen deprivation [21–25].

Although sperm quality frequently improves following varicocele treatment, there is conflicting evidence regarding the value in improving male fertility [7, 26–32]; many studies have concluded that the current level of evidence is insufficient for a definitive opinion. Guidelines for varicocele repair in subfertility are also inconsistent [3, 6, 33].

Question 2: How are varicoceles classified by ultrasound?

Several different US sonographic classifications have been proposed for varicocele assessment [34–44] (Table 3). Unfortunately, there is no standardisation; US technique, parameters assessed, and diagnostic criteria are highly variable, making direct comparison or meta-analysis of pooled data problematic. A clear consensus has not been reached and there is no universally recognized system. Potentially conflicting results may be obtained in the same patient depending on

Table 1 Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence (diagnosis)

Level	
1	Systematic review of cross sectional studies with consistently applied reference standard and blinding
2	Individual cross sectional studies with consistently applied reference standard and blinding
3	Non-consecutive studies, or studies without consistently applied reference standards
4	Case-control studies, or "poor or non-independent reference standard"*
5	Mechanism-based reasoning

Source: OCEBM Levels of Evidence Working Group. "The Oxford 2011 Levels of Evidence." Oxford Centre for Evidence-Based Medicine. http://www.cebm.net/index.aspx?o=5653. Accessed: 9 May 2018

Table 2 Grading of Recommendations Assessment, Development and Evaluation (GRADE)

Code	Quality of Evidence	Definition
A	High	Several high-quality studies with consistent results
		In special cases: one large, high-quality multicentre trial
B	Moderate	One high-quality study
		Several studies with some limitations
C	Low	One or more studies with severe limitations
D	Very low	Expert opinion
		No direct research evidence
		One or more studies with very severe limitations

Source: https://www.essentialevidenceplus.com/product/ebm_loe.cfm?show=grade. Accessed 9 May 2018

the classification system used, and there is a low predictive value for treatment outcomes.

Recommendation 1

Grey-scale and Doppler US modes are used to assess the parameters required for varicocele classification. There is no universally recognized classification system (LoE 3, GoR C). Strong consensus (21 approve/0 reject /0 abstain: 100%)

Question 3: Should the size of the dilated veins be measured? Should measurements be performed standing or supine, at rest or during the Valsalva maneuver? Which size threshold should be used for the dilated veins?

There is a wide variation in the threshold venous diameter recommended for diagnosis of varicoceles, the measurement site, patient position, and need for Valsalva [38, 45–54]. A venous diameter of 3 mm is commonly considered to be the threshold for diagnosis of a varicocele although higher and lower values have been advocated [39, 49, 50, 53, 55, 56] (Fig. 1).

It is critically important to document the patient's position and the sampling site. The majority of investigators examine the patient in both supine and erect positions and during Valsalva, measuring the largest vein irrespective of location.

Recommendation 2

Given the widespread methodological variability that exists in measurements of venous diameter in varicocele assessment, it is critically important to document the patient's position, whether measurement was made at rest or during the Valsalva manoeuvre, and the location of the measured veins relative to the spermatic cord or testis (LoE 1, GoR A). Strong consensus (21/0/0, 100%)

Recommendation 3

Measurement of the largest vein, irrespective of location, with the patient in the upright position and during the Valsalva manoeuvre is recommended (LoE 5, GoR D) Strong consensus (21/0/0, 100%)

Recommendation 4

A maximum venous diameter of 3mm or more can be considered diagnostic for a varicocele when measured with the patient in the upright position and during the Valsalva manoeuvre, (LoE 2, GoR B). Strong consensus (20/1/0, 95%)

Question 4: When to measure testicular size at ultrasound, and how?

Venous reflux due to a varicocele is associated with reduced testicular volume which may be reversed by varicocele repair [57–59]. Normal testicular volume, measured by US, varies widely between different studies and in different populations. A total testicular volume greater than 20–24 ml is associated with normal testicular function in Caucasian and African men [60–63]. Lower testicular volumes are reported in infertile patients [63–66].

Three different formulae are used to calculate testicular volume from US measurements of length, width, and height. The most accurate has been shown to be Lambert's formula ($V = L \times W \times H \times 0.71$) [67–69].

Recommendation 5

Testicular volume should be measured in all cases as it correlates with testicular function in both infertile patients and patients with a varicocele (LoE 1, GoR A). Strong consensus (21/0/0, 100%)

Table 3 Classifications of varicocele according to ultrasonographic criteria

Study, year	Patient position	Grades				
Hirsh et al (1980) [35]	Standing	[1] No spontaneous reflux, inducible with Valsalva	[2] Intermittent spontaneous reflux	[3] Continuous spontaneous reflux		
Dhabuwala et al (1989) [36]	Supine	[1] Reflux < 2 sec	[2] Reflux > 2 sec	[3] Spontaneous reflux increasing with Valsalva		
Sarteschi et al (1993) [37]	Standing and supine	[1] Inguinal reflux only during Valsalva in not enlarged vessels	[2] Supra-testicular varicosities with reflux only during Valsalva	[3] Peritesticular reflux only during Valsalva in enlarged vessels. Visible but not dilated vessels when supine. Enlarged when standing	[4] Enlarged vessels in supine and standing positions, with increasing caliber with Valsalva. Reflux at rest, increasing during Valsalva. Possible testicular hypotrophy	[5] Enlarged vessels in supine and standing positions, with caliber not increasing with Valsalva. Reflux at rest, not increasing during Valsalva. Testicular hypotrophy. Intratesticular varices may be present
Hoekstra and Witt (1995) [38]	Standing	[1] Dilated veins < 2.5 mm without flow reversal after Valsalva	[2] Dilated veins 2.5–3.5 mm and flow reversal after Valsalva	[3] Dilated veins > 3.5 mm and flow reversal after Valsalva		
Chiou et al (1997) [39]	Supine	Maximum vein diameter (mm) 0: < 2.5 mm 1: 2.5–2.9 mm 2: 3.0–3.9 mm 3: ≥ 4 mm	Plexus/sum of diameter of veins 0: no plexus identified 1: plexus with sum diameter > 3 mm 2: plexus with sum diameter 3–5.9 mm 3: plexus with sum diameter ≥ 6 mm	Change of flow velocity on Valsalva maneuver 0: < 2 cm/sec or duration < 1 sec 1: 2–4.9 cm/sec 2: 5–9.9 cm/sec 3: ≥ 10 cm/sec	Total score 0–9 ≥ 4: presence of varicocele	
Cornud et al (1999) [40]	Not specified	[1] Brief reflux < 1 sec	[2] Intermediate reflux < 2 sec decreasing during and stopping prior to the end of Valsalva	[3] Permanent reflux > 2 sec and with a plateau aspect throughout the abdominal strain		
Oyen (2002) [41]	Supine	[1] Slight reflux (< 2 sec) during Valsalva	[2] Reflux (> 2 sec) during Valsalva, not continuous	[3] Reflux at rest or continuous during the entire Valsalva maneuver		
Pauroso et al (2011) [42]	Supine	[1] No varicosities seen. Reflux in the vessels of the inguinal canal that is observed only during Valsalva	[2] Small varicosities with reflux seen only during Valsalva	[3] Enlarged vessels whose caliber increases during Valsalva	[4] Obvious vessel enlargement with basal reflux that does not increase during Valsalva	
Iosa and Lazzarini (2013) [43]	Standing and supine	[1] Reflux > 1 sec only during Valsalva	[2] Spontaneous, discontinuous reflux not increasing by Valsalva	[3] Spontaneous, discontinuous reflux increased by Valsalva	[4A] Spontaneous, continuous reflux not increased by Valsalva	[4B] Spontaneous, continuous reflux increased by Valsalva
Patil et al (2016) [44]	Standing	[0] Reflux time < 1 sec	[1] Reflux time 1–2.5 sec	[2] Reflux time 2.5–4 sec	[3] Reflux time > 4 sec	

Scores are reported in square brackets

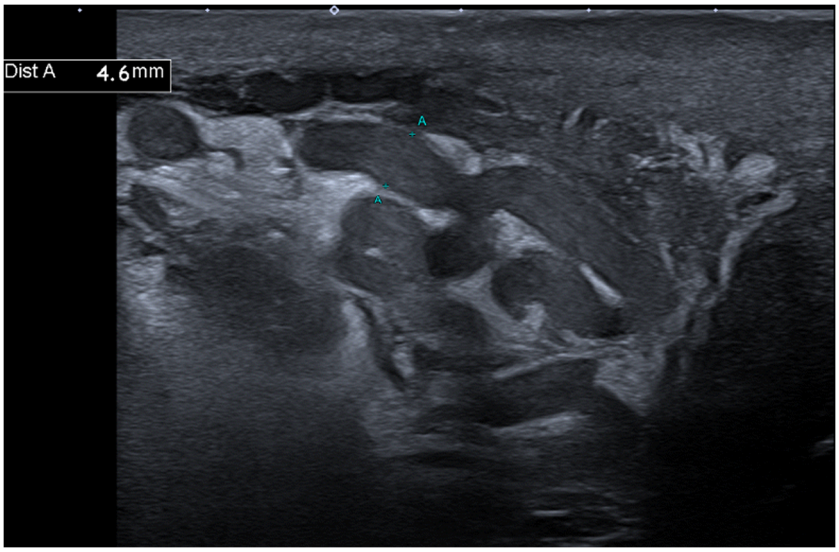

Fig. 1 Grey-scale image of a varicocele. There are multiple serpiginous dilated veins with a venous diameter of more than 3 mm

Recommendation 6

Accurate measurement of the three diameters of the testis is required to obtain testicular volume estimation. Use of Lambert's formula (V=LxWxHx0.71) is recommended. The mathematical formula used to calculate the volume should be reported (LoE 2, GoR B). Broad consensus (19/1/1, 95%)

Question 5: How should US be performed in patients with varicoceles?

The patient should be examined at rest and during Valsalva in the supine and erect positions; the standing position is often more informative. Bilateral grey-scale, colour, and spectral Doppler analysis are recommended.

Testicular volume should be calculated and the size of the largest vein measured, irrespective of venous location (within the inguinal canal or scrotum), patient position (supine or erect), or whether measurement was obtained with or without Valsalva. Colour and spectral Doppler should be used to detect and characterise venous reflux at the level of the inguinal canal, supratesticular region, and level of the testis (Fig. 2).

Recommendation 7

A standardised protocol is required for varicocele ultrasound examination. A grey-scale and colour Doppler examination, with spectral Doppler analysis, should be performed bilaterally with the patient supine and standing, during spontaneous breathing and during the Valsalva manoeuvre. (LoE 2, GoR B). Strong consensus (21/0/0, 100%)

Question 6: Is Doppler evaluation of venous reflux needed and which parameters should be measured?

Venous reflux is believed to be the primary cause of testicular damage [70] which may be reversed if reflux is eliminated [71]. Evaluation of reflux is critical for the diagnosis of varicocele and prediction of treatment outcomes; continuous flow reversal or reflux triggered by Valsalva is strongly associated with postoperative improvement in semen quality [52, 70, 72].

Assessment of flow direction, changes with patient positioning, and Valsalva are made with colour Doppler and verified with spectral Doppler which should also measure the duration of reflux [44].

Recommendation 8

Demonstrating and evaluating reflux flow in patients being assessed for varicoceles is the most important part of the Doppler ultrasound study (LoE 3, GoR C.) Strong consensus (21/0/0, 100%)

Recommendation 9

Colour Doppler interrogation should be supplemented with spectral Doppler analysis. Reflux duration is the essential parameter to be measured (LoE 3, GoR C). Measurement of the reflux peak velocity is optional (LoE 5, GoR D). Strong consensus (21/0/0, 100%)

Question 7: How long should reflux last to make the diagnosis of varicocele?

The duration of venous reflux recommended for the diagnosis and grading of varicoceles varies significantly between different studies [36, 40, 41, 43, 44, 55, 73, 74]. Brief reflux

(< 1 sec) during Valsalva is often considered to be physiological [40, 43, 44]. Intermediate reflux has been defined as lasting < 2 sec with decreasing velocity during, and finishing before the end of, Valsalva and is considered to be an indeterminate finding. Permanent reflux lasts > 2 sec and shows a plateau throughout Valsalva; studies suggest that this degree of reflux is always associated with abnormality on venography [40, 60]. Reflux lasting > 2 sec is therefore considered to represent the most useful parameter for varicocele diagnosis (Fig. 3).

Recommendation 10

Reflux in the testicular veins lasting more than 2seconds with the patient standing and during the Valsalva manoeuvre should be considered to be abnormal (LoE 4, GoR C). Strong consensus (21/0/0, 100%)

Question 8: Is reflux velocity clinically important, and how should it be measured?

Several investigations suggest that measurement of peak reflux venous velocity might be useful to predict the need for varicocele repair [55, 75–82]. There is a lack of consistency between the studies regarding the US technique. Mostly, angle correction was not performed and therefore velocity measurements cannot be regarded as accurate. Measurement of this parameter cannot be recommended in routine clinical practice.

Recommendation 11

There is insufficient data to recommend using reflux peak velocity measurements as a factor in determining the need for varicocele repair (LoE 5, GoR C). Strong consensus (21/0/0, 100%)

Question 9: How should US examinations be reported in patients with varicoceles?

The SPWIG believes that the following information should be included in the US report:

- Testicular volume, echogenicity, and echotexture.
- Testicular or extra-testicular abnormalities.
- Presence of varices at grey-scale and colour Doppler US, and relationships to the testis (inguinal canal, supratesticular, around the testis, intratesticular).
- Diameter of the largest vein measured while standing and during the Valsalva maneuver.
- Changes of flow at colour and spectral Doppler according to the patient's position, before and during Valsalva. Evaluation of reflux peak velocity is optional.

A standardised report may be useful for this purpose (Table 4). It is not considered mandatory to grade varicoceles according to a classification system but, if utilised, the Sarteschi classification is preferred [20, 37].

Recommendation 12

When issuing reports on patients with varicoceles the examination technique should be described (LoE 1, GoR A). Strong consensus (21/0/0, 100%)

Recommendation 13

Grading varicoceles according to the Sarteschi classification may be helpful in clinical practice. For standardisation purposes it is recommended that all the US parameters used to evaluate the patient are also reported. (LoE 5, GoR D). Strong consensus (21/0/0, 100%)

Question 10: Is evaluation of intratesticular Doppler waveforms worthwhile in imaging varicoceles?

It has been proposed that increased intratesticular venous pressure secondary to varicocele may decrease testicular arterial blood supply resulting in impaired spermatogenesis [83, 84].

Studies evaluating intratesticular arterial blood flow have shown conflicting results, some showing no changes [85–87] but other showing alterations in volume flow [88], peak systolic velocity, and resistive or pulsatility indices [89, 90]. These studies are of interest in further understanding the pathophysiology of varicoceles but are not currently useful for routine clinical practice.

Recommendation 14

Evaluation of intra-testicular blood flow in patients with varicoceles is an active research field which might provide a valuable insight into the mechanisms that create testicular parenchymal damage. At present however, this evaluation cannot be recommended for clinical use. (LoE 3, GoR C) Strong consensus (21/0/0, 100%)

Question 11: Can evidence-based recommendations be provided for imaging right-sided varicoceles?

Clinical varicoceles are usually left-sided and unilateral; bilateral varicoceles are diagnosed in approximately 10% of patients [91]. Subclinical right-sided varicocele is however much more frequent [92–96] and bilateral disease underdiagnosed by clinical examination. Patients with left-sided varicoceles should therefore be carefully examined for right-sided disease by US [93–96]. Isolated right-sided

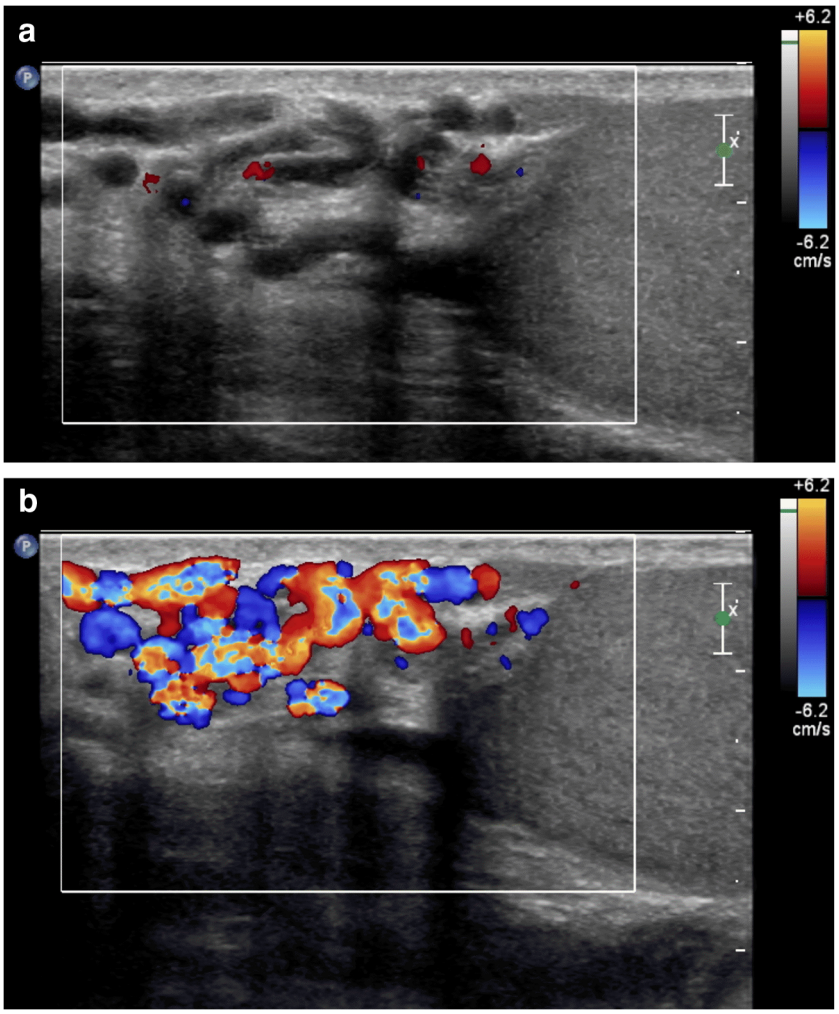

Fig. 2 Small varicocele lying above the testis (Sarteschi grade II). Colour Doppler images obtained at rest (**a**) and during Valsalva (**b**) showing that reflux is detected only during Valsalva

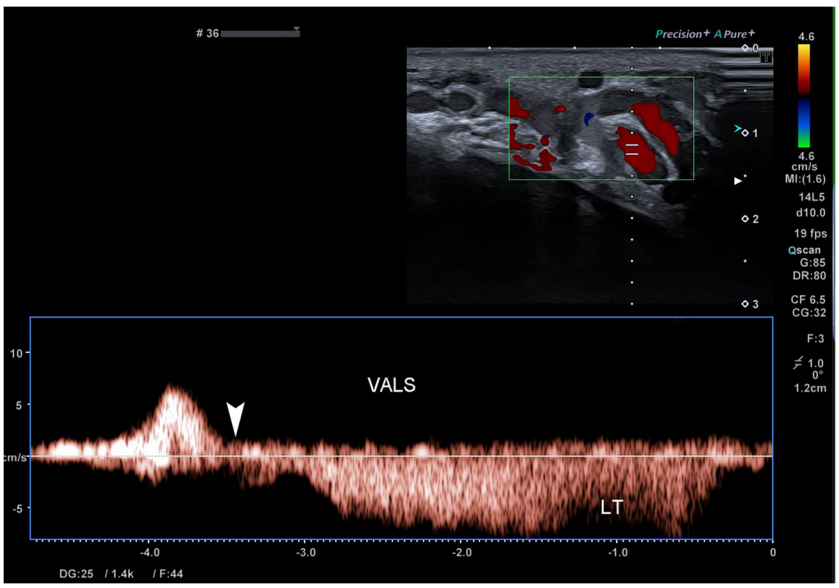

Fig. 3 Spectral Doppler analysis during Valsalva. Flow reversal demonstrated on the implementation of Valsalva (arrowhead) and persisting for more than 2 sec

Table 4 Example of a standardised US report for varicocele

	R	L
Testicular diameters (L, W, H) in mm		
Testicular volume (Lambert's formula: LxWxHx0.71) in mls.		
Testicular echogenicity abnormality Yes/No		
Intratesticular varicocele Yes/No		
SUPINE position		
Diameter of the largest vein (mm)		
Location of the largest vein (Spermatic cord /peritesticular)		
Spontaneous reflux at colour Doppler (Yes/No)		
Reflux during Valsalva manoeuvre Yes/No		
Level where reflux is identified (inguinal canal, supratesticular, peritesticular)		
Reflux velocity (optional)		
STANDING position		
Diameter of the largest vein (mm)		
Location of the largest vein (Spermatic cord /peritesticular)		
Spontaneous reflux at colour Doppler (Yes/No)		
Reflux during Valsalva manoeuvre Yes/No		
Duration of reflux (s)		
Level where reflux is identified (inguinal canal, supratesticular, peritesticular)		
Reflux velocity (optional)		

CONCLUSION:

Testicular atrophy: Yes/No

Varicocele: Yes/No

Varicocele Grade (Sarteschi's classification):

Any other relevant findings:

varicocele is found in < 1% of patients [91], is usually subclinical and identified on US only during Valsalva [94, 96].

Due to the infrequency of clinical right-sided varicoceles, there is a belief that this should prompt the search for a secondary retroperitoneal cause. The literature does not support this approach in the majority of cases although US may rarely identify congenital venous anatomical variants [93, 97] and venous obstruction in high-risk cases.

Recommendation 15

Bilateral colour Doppler US should be performed in patients with left-sided varicoceles as it will frequently reveal subclinical right-sided varicoceles. (LoE 3, GoR B) Strong consensus (21/0/0, 100%)

Recommendation 16

In patients with an isolated clinical right-sided varicocele, US can be extended to the abdomen to look for abdominal and retroperitoneal pathology, as well as congenital vascular anomalies. (LoE 5, GoR D). Strong consensus (21/0/0, 100%)

Question 12: Is imaging follow-up necessary for subclinical varicoceles?

The need for treatment of subclinical varicoceles is controversial [6], especially in pre-pubertal boys and adolescents where the significant risk of over-treatment [98] must be weighed against the risk of progression to clinically evident disease and reduced testicular function [99, 100]. Practice varies widely regarding follow-up for non-operated patients but is specifically recommended in two groups who are at increased risk of progressive testicular dysfunction: adolescents with testicular hypotrophy and adolescents and young adults with normal testicular volume and semen analysis. Annual follow-up should include physical examination, US, and semen analysis [101].

Recommendation 17

In patients with subclinical varicoceles imaging follow-up is recommended in all adolescents who have not undergone surgical repair and in young adults with normal semen analysis and normal testicular volume (LoE 3, GoR C). Strong consensus (20/0/1 100%)

Question 13: Should patients be followed up after varicocele treatment?

Following treatment, US can be used for the assessment of early complications and later for the detection of persistent or recurrent disease [102–115]. Accurate clinical examination following surgery is highly dependent on the experience of the clinician and will frequently detect enlarged veins, particularly for treated high-grade disease, even following successful treatment. Only US is able to determine whether there is persisting venous reflux that may require additional treatment. There are currently no generally accepted recommendations for imaging following varicocele repair.

Practice varies regarding the need for routine US following treatment [3, 103, 107]. Where subfertility is the indication for surgery, semen analysis should form the basis for follow-up with US reserved for cases where this remains unsatisfactory.

Recommendation 18

After varicocele repair US can be used to identify early postoperative complications (LoE 3, GoR C). Strong consensus (21/0/0, 100%)

Recommendation 19

Sperm analysis forms the basis of follow-up following varicocele repair. The data available does not support the routine use of US (LoE 1, GoR A). Broad consensus (18/1/2, 95%)

Recommendation 20

Colour Doppler US can be used after varicocele repair if semen analysis remains unsatisfactory to evaluate testicular volume and identify signs of persistent or recurrent disease (LoE 2, GoR B). Strong consensus (21/0/0, 100%).

Question 14: Is it always necessary to examine the abdomen for tumours in patients with a newly discovered varicocele?

Case reports and small series suggest that patients with retroperitoneal tumours may present with a varicocele [116–120]; however, varicoceles are common and retroperitoneal tumours rare. There is no compelling evidence to suggest that a retroperitoneal or renal tumour in a patient with a varicocele is more likely than in a man without a varicocele [42, 117, 119, 121]. Varicoceles are almost never the only clinical feature of a retroperitoneal tumour and usually a feature of advanced cancer stage which will frequently be detected by clinical examination [122–126]. The incidence of secondary right-sided varicocele is probably lower than for the left-sided varicocele [127].

Evidence does not support mandatory abdominal US in all patients with varicoceles. An exception is in children aged below 9 years of age; varicoceles are rare in this age group [128, 129] and the US examination should include the abdomen [130].

Although the incidence of an occult retroperitoneal mass is very low, the sonologist is justified in extending the scan to the abdomen whenever the varicocele is of acute onset, large or fails to decompress in the supine position (Fig. 4).

Recommendation 21

Extended US examination to the abdomen is recommended in children less than 9 years of age presenting with acute varicocele (LoE 2, GoR B). Strong consensus (21/0/0, 100%)

Recommendation 22

There is insufficient evidence to conclude that an extension of the ultrasound examination to the abdomen is mandatory in all adult patients with a varicocele. The ultrasound practitioner should use their clinical judgement to decide whether to proceed to an abdominal examination, particularly if the varicocele is large, of recent onset and persists with the patient in the supine position (LoE 5, GoR D). Strong consensus (21/0/0, 100%)

Question 15: What are the pitfalls in US when imaging varicoceles?

Spermatoceles, cysts, tubular ectasia, post-vasectomy changes, and Zinner syndrome [131] can mimic varicoceles but can usually be differentiated with colour Doppler.

Uncommon extra-testicular masses may present with a clinical suspicion of a varicocele; these include arteriovenous malformations (AVMs), cavernous haemangiomas, and lymphangiomas [132–134]. The correct diagnosis can usually

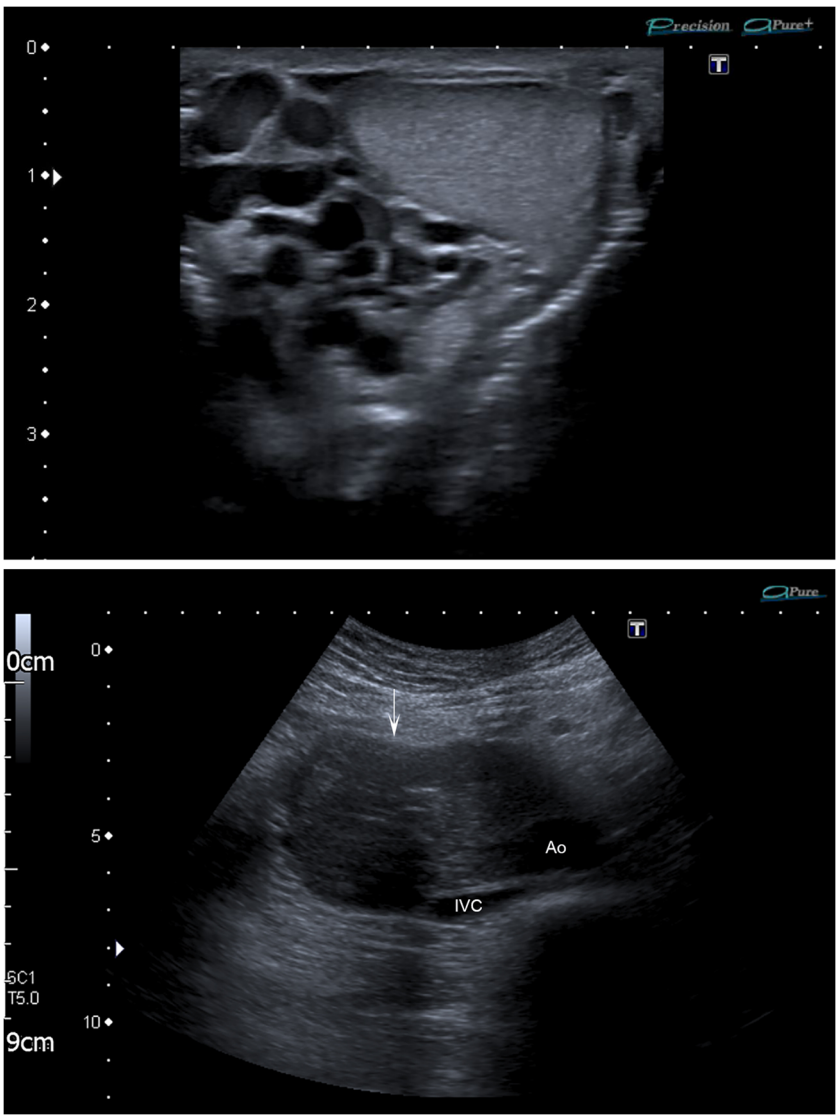

Fig. 4 A patient presenting with an acute-onset large right-sided varicocele. On scrotal ultrasound, multiple dilated veins are seen around the testis, remaining distended with the patient in the supine position (**a**). Extending the examination to the abdomen (**b**) demonstrates a retroperitoneal mass (arrow) anterior to the aorta (Ao) and IVC, subsequently proven to represent an asymptomatic lymphoma mass

be made with US, although MRI is the modality of choice for detailed evaluation. Intratesticular varicoceles can be mimicked by a number of conditions [135] including tubular ectasia of the rete testis, intratesticular AVMs, and haemangiomas.

Recommendation 23

In patients being investigated for a clinically detected varicocele, the possibility of rare varicocele mimics should be considered. The correct diagnosis can usually be made by combining the grey-scale and Doppler US features (LoE 5, GoR D.) Strong consensus (21/0/0, 100%)

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Compliance with ethical standards

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Conflict of interest The authors of this manuscript declare no relationships with any companies, whose products or services may be related to the subject matter of the article.

Statistics and biometry No complex statistical methods were necessary for this paper.

Informed consent Written informed consent was not required for this study because this paper provides a summary of available evidence and expert opinion; no new studies on patients were involved.

Ethical approval Institutional Review Board approval was not required because this is an evidence summary and expert recommendation paper. No new studies on human patients were undertaken specifically for this paper.

Study subjects or cohorts overlap All previous studies cited as evidence in this paper are acknowledged in the references.

Methodology
• Multicentre authored paper on behalf of the Scrotal and Penile Imaging Working Group of the European Society of Urogenital Radiology (ESUR-SPIWG). Literature review, evidence summary, and expert recommendations.

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Affiliations

Simon Freeman[1] · Michele Bertolotto[2] · Jonathan Richenberg[3] · Jane Belfield[4] · Vikram Dogra[5] · Dean Y. Huang[6] · Francesco Lotti[7] · Karolina Markiet[8] · Olivera Nikolic[9] · Subramaniyan Ramanathan[10] · Parvati Ramchandani[11] · Laurence Rocher[12,13] · Mustafa Secil[14] · Paul S. Sidhu[6] · Katarzyna Skrobisz[8] · Michal Studniarek[8] · Athina Tsili[15] · Ahmet Tuncay Turgut[16] · Pietro Pavlica[17] · Lorenzo E. Derchi[18] · members of the ESUR-SPIWG WG

[1] University Hospitals Plymouth NHS Trust, Derriford Hospital, Derriford Road, Crownhill, Plymouth, Devon PL6 8DH, UK

[2] Department of Radiology, Ospedale di Cattinara, University of Trieste, Strada di Fiume 447, 34149 Trieste, Italy

[3] Brighton and Sussex University Hospitals NHS Trust, Royal Sussex County Hospital, Eastern Road, Brighton BN2 5BE, UK

[4] Royal Liverpool University Hospital, Prescot street, Liverpool L7 8XP, UK

[5] Department of Radiology, University of Rochester, 601 Elmwood ave, Rochester, NY 14642, USA

[6] King's College Hospital NHS Foundation Trust, Department of Radiology, King's College Hospital, Denmark Hill, London SE5 9RS, UK

[7] Andrology, Female Endocrinology and Gender Incongruence Unit, Department of Experimental and Clinical Biomedical Sciences, University of Florence, Viale Pieraccini 6, I-50139 Florence, Italy

[8] Department of Radiology, Medical University of Gdansk, Mariana Smoluchowskiego 17, 80-214 Gdansk, Poland

[9] Faculty of Medicine, Center of Radiology, Clinical Center of Vojvodina, University of Novi Sad, Hajduk Veljkova 1-9, Novi Sad 21000, Serbia

[10] Department of Clinical Imaging, Weill Cornell Medical College, Al-Wakra Hospital, Hamad Medical Corporation, PO Box 82228, Doha, Qatar

[11] Perelman School of Medicine, University of Pennsylvania, 3400 Spruce Street, Philadelphia, PA 19104, USA

[12] Department of Adult Diagnostic and Interventional Radiology, Bicetre University Hospital, 78 avenue du Général Leclerc, 94270 Le Kremlin Bicêtre, France

[13] Imagerie par Résonance Magnétique Médicale et Multi-Modalités, CNRS UMR8081, Service Hospitalier Frédéric Joliot, 4, Place du Gal Leclerc, 91401 Orsay Cedex, France

[14] Faculty of Medicine, Department of Radiology, Dokuz Eylul University, Izmir, Turkey

[15] Department of Clinical Radiology, Medical School, University of Ioannina, University Campus, 45110 Ioannina, Greece

[16] Department of Radiology, Faculty of Medicine, Istinye University, Istanbul, Turkey

[17] Private Hospital S.M. Maddalena, Occhiobello, Rovigo, Italy

[18] Department of Health Sciences (DISSAL), Emergency Radiology, University of Genoa, Policlinico San Martino, Largo R. Benzi, I16122 Genoa, Italy