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Varicocele and sports participation

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Introduction

Varicocele is an abnormal dilatation of the pampiniform venous plexus that surrounds the testis resulting from venous incompetence of the spermatic veins [1]. Varicocele is the most frequent physical finding in infertile men and also is the most common andrological disease found during a male physical examination [2].

Varicocele occurs on the left side in 78-93% of cases, but it occurs more frequently as bilateral disease than previously documented. Varicocele is graded by an arbitrary scheme as grade I (small with palpable distension detected only during a Valsalva manoeuvre), grade II (moderate with easily palpable distension on upright examination), grade III (large with visible veins on upright examination).

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Prevalence of varicocele

Varicocele has a high prevalence of 4% to 23% in the general male population, and 29% or higher in athletes [3, 4], representing the most frequent disease found in infertile men. It has been detected in 35% (range 19-41%) of men with primary infertility and in 80% of men with secondary infertility (range 69-94%) [5, 6]. Epidemiological studies correlating sports and andrological diseases (e.g. varicocele) are rare.

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Clinical symptoms and consequences

Varicocele can be asymptomatic or induce testicular pain and the subjective feeling of a "bag of worms" around the testis. Varicocele influences the quantitative and qualitative characteristics of seminal fluid. The most common semen alterations observed in untreated subjects affected by varicocele are decreased motility (qualitatively and quantitatively), increased atypical spermatozoa, more immature cells, and reduced total number of spermatozoa.

The most accepted hypothesis to explain the pathophysiology of varicocele suggests different venous drainage between the left and right sides and a higher prevalence of absent venous valves on the left side. Multiple local mechanisms seem to be involved in varicocele development including upright posture, anatomic variability of vessels, valves, intra-abdominal pressure variations, and high body mass index. The deleterious effect of varicocele on spermatogenesis has been linked to influences on testicular functions including increased intra-scrotal temperature, venous reflux of toxic renal and adrenal metabolites, reduced oxygen tension, prostaglandins, and sperm cell apoptosis [7, 8].

Varicocele in athletes

Physical exercise has a range of effects on the male hypothalamus-pituitary-gonadal (HPG) axis and fertility, depending both on the type, intensity and duration of the activity, and on the fitness and characteristics of the individual [9].

To date, evaluations of semen characteristics and fertility in athletes have been carried out mainly on healthy male individuals. Most authors have not found any sports-related modifications of semen parameters or fertility. Others have found reduced total sperm count and/or reduced normal sperm motility and morphology related to the volume of training and the number of kilometres run per week [10, 11].

Few studies have evaluated the impact of physical activity on the spermatogenesis or fertility of male athletes with andrological diseases (e.g. varicocele) [12]. This is probably due to the fact that in-depth andrological evaluations are not common during athletes' pre-participation physical examinations (PPE).

Recent studies in athletes with varicocele showed that the percentage of spermatozoa with forward progression and normal morphology was significantly lower compared to non-athletes with the same degree of varicocele, whereas there was no decrease observed in the semen of healthy athletes [12]. Interestingly, a reduction of mean left testicular volume was observed in both athletes and non-athletes with varicocele, but mean left testis volume was significantly lower than the controlateral testis only in athletes with varicocele. In addition, Rigano et al. [13] found a positive correlation between the number of adolescent athletes with varicocele and the highest grade of varicocele compared with the group of non-athlete adolescents.

Athletic participation might be an "aggravating factor" in the pathogenesis of the observed varicocele-linked sperm alterations. Furthermore, the literature indicates that physical activity negatively influences seminal fluid in healthy athletes with a high level of training, in athletes with varicocele a lower level of training might be able to favour testicular and/or sperm alterations.

In athletes with varicocele, exercise-related deleterious, systemic factors (altered gonadotropins secretion, increased antigonadic stress-dependent hormones: corticotropin-releasing hormone (CRH), cortisol, and opioids) may be also involved in the genesis of testicular and seminal alterations. Several authors have shown that exercise-induced hormonal modifications of pituitary-testicular axis may result in alteration of both qualitative (pulsatile secretion and biological activity) and quantitative gonadotropin secretion [9, 14] and of testosterone production. There have been no studies to evaluate the effects of exogenous anabolic androgenic steroid administration in male athletes on the reproductive system and/or fertility in relation to varicocele.

Detection of varicocele

In many athletes, the discovery and diagnosis of an asymptomatic varicocele is detected during a clinical examination of the testicular vessels and gonads as part of the

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PPE. As in the general population, a varicocele is also diagnosed during the evaluation of scrotal pain or fertility status.

The physical examination of the athlete's scrotum and contents should be performed in both the recumbent and upright positions. A palpable varicocele feels like a "bag of worms", but can be significantly reduced in the recumbent position. If a suspected varicocele is not clearly palpable in the supine position, the athlete should be examined in the standing position after a Valsalva manoeuvre. The changes from supine to standing form the basis for the grading system of varicocele severity.

In athletes with a questionably palpable varicocele, the diagnosis can be confirmed by an ultrasound-Doppler examination of the testicular vessels. Ultrasound examination can be also performed to evaluate testicular volume (testis volume = $0.525 \times a \times b \times c$; where a, b, c are testis diameters), that is often reduced in the testis ipsilateral to the varicocele. Clinical guidelines suggest that ancillary diagnostic measures (e.g. ultrasonography, spermatic venography, thermography, radionuclide scanning, and magnetic resonance angiography) should not be used for the detection of varicocele in athletes without a palpable varicocele. However, ultrasonography may be indicated for clarification of an inconclusive physical examination of the gonads in infertile male athletes (e.g. sub-clinical varicocele).

Semen analysis (pH, viscosity, volume, sperm concentration, motility and morphology) and hormone evaluation (LH, FSH, prolactin, inhibin B, and testosterone) can be performed to further evaluate the clinical and seminal situation.

Varicocele treatment

The efficacy of varicocele treatment is still in doubt [15, 16], and the therapy decision is particularly difficult in adolescents [17]. In men with varicocele and infertility and/or semen abnormality, both surgical ligation and percutaneous embolisation of the refluxing veins is still controversial [14, 19], and is clearly not recommended by some authors [20]. However, the reported need for early treatment of varicocele in the general population [21, 22], together with the possibility that physical activity may represent an aggravating factor for spermatogenesis [12] lends support to scheduled in-depth follow-ups of athletes with varicocele (e.g. evaluation of testis volume and/or of semen characteristics and/or hormone evaluation), and treatment guided by clinical status (e.g. infertility, abnormal semen parameters, reduced testis volume), particularly in younger athletes. The treatment goal should be to preserve fertility status.

Varicocele, PPE and sport participation

Managing varicocele in athletes is consistent with the main purposes of the PPE and includes (1) identifying athletes with varicocele whose sport activity may expose them to additional risks (e.g. exacerbation of the disease, testicular trauma.), (2) recognising those athletes who require treatment or clinical monitoring, and (3) counselling athletes who may benefit from a change to another type of exercise.

A genital exam during the PPE would permit the detection of a high percentage of athletes affected by varicocele. The detection of a varicocele in athletes, while not limiting sports participation, would promote monitoring and/or treatment in athletes with infertility problems. As in the general population [8], the treatment in adult athletes with palpable varicocele, currently attempting to conceive, is indicated in the case of abnormal semen parameters or sperm functions, if the female partner has normal fertility. As with non-athletes, young athletes with varicocele with reduced ipsilateral testis size and/or abnormal semen analyses should be offered varicocele repair. When sport might be seen as an "aggravating factor"in the pathogenesis of the varicocele-linked sperm alterations, athletes with varicocele and normal testis size and/or semen analyses should be offered follow-up monitoring of testicular size and/or semen analyses every six months to one year, depending on the athlete's age, degree of varicocele, and the type of sport practiced (e.g. specific caution regarding sports where there is frequently increased abdominal pressure, etc.).

Conclusion

There is a high prevalence of varicocele in the general population, but particularly in athletes. As it represents the disease found

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most frequently in infertile men, an adequate follow-up and/or treatment is/are necessary according to individual clinical (e.g. pain, etc.) and functional status (e.g. seminal parameters, fertility, hormones). Sports physicians should be aware of an early diagnosis and management of varicocele in athletes, and use the PPE as an opportunity to evaluate for varicocele and prevent infertility.

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