

The prevalence of varicocele and varicocele-related testicular atrophy in Turkish children and adolescents

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Objective To determine the prevalence and site of varicocele and varicocele-related testicular atrophy in children and adolescents.

Patients and methods The study included 4052 boys aged of 2–19 years, divided into four age groups; the findings of a physical examination, any testicular atrophy and testicular volume were recorded.

Results Varicocele was detected in 293 (7.2%) of the 4052 boys; the prevalence was 0.79% in those aged 2–6 years, 0.96% at 7–10 years, 7.8% at 11–14 years and 14.1% at 15–19 years. The prevalence was 0.92% in 1232 children aged 2–10 years and 11.0% in 2531 adolescents aged 11–19 years ($P<0.001$). The prevalence increased significantly at age 13 years ($P<0.005$). The varicocele was unilateral in 263 of the 293 (89.7%) boys with

varicocele; of these, one (0.38%) was on the right and the others on the left side. Varicoceles were bilateral in 30 of 279 boys (10.8%) aged 11–19 years but none were detected in those aged <11 years. Varicocele-related testicular atrophy was not present in those aged <11 years, but seven boys (7.3%) aged 11–14 years and 17 (9.3%) aged 15–19 years had testicular atrophy. The difference in prevalence between the last two age groups with atrophy was not significant.

Conclusion These findings support the view that varicocele is a progressive disease and that the prevalence of varicocele and testicular atrophy increases with the puberty.

Keywords Varicocele, prevalence, testis, atrophy, boys, fertility

Introduction

Although varicocele is rare in children, the prevalence of varicocele in boys aged 10–19 years is reportedly 11–16% [1–3]. In a large epidemiological study the prevalence was 11.7% in the general population and 25.4% in the infertile male population [4,5]. In most affected adolescents the varicocele is grade 1, while in 35% it is grade 2 or 3 [6].

In these studies it was recommended that as varicocele is a progressive disease, it should be treated at an early age, because the testis is still developing [7,8]. In 50–75% of teenagers with varicocele the testicular volume on the affected side was smaller in adolescence [6,9–11]. Lipshultz and Corriere [12] reported that men with varicocele and subfertility had a significantly smaller testis on the affected side than did those subfertile patients with no varicocele. The aim of the present study was to determine the prevalence and the site of varicocele, and varicocele-related testicular atrophy, in boys from infancy to after puberty.

Patients and methods

The study comprised children from daytime care centres, primary, secondary and high schools. They were selected randomly from urban and rural locations to reflect the characteristics of the general population. Each boy was examined by two specialists and their findings confirmed. The study included 4052 boys aged 2–19 years, divided into four age groups (2–6, 7–10, 11–14 and 15–19 years). The findings of a physical examination, testicular consistency and testicular volume were recorded. All boys were examined in a warm room while supine, and upright with and without a Valsalva manoeuvre. Varicoceles were graded and the stage of puberty determined according to Marshall and Tanner's system. Those with varicocele were invited for a further assessment. Testicular volumes were measured using an ellipsoid Prader orchidometer; if there was a discrepancy in size of >2 mL [13] or of >10%, or a difference in consistency [14], the affected testis was considered atrophic. If there was testicular atrophy boys with varicocele underwent scrotal colour Doppler ultrasonography, as scrotal pathology with no varicocele was excluded. The chi-squared test was used for the statistical analysis.

Table 1 The prevalence of varicocele, laterality and any varicocele-related testicular atrophy in 4075 boys

Variable	Childhood			Adolescence			Total 2–19
	2–6	7–10	(2–10)	11–14	15–19	(11–19)	
Number	377	1144	1521	1232	1299	2531	4052
Prevalence (%)	0.79	0.96	0.92	7.80	14.08	11.02	7.2
Grade 1/2/3:							
Unilateral	2/1/0	5/6/0	14	41/38/12	51/74/33	249	263
Bilateral	—	—	—	5/0/0	25/0/0	30	30
Testicular atrophy, n (%)	—	—	—	7 (7.3)	17 (9.3)	24 (8.6)	24

Results

Table 1 shows the prevalence and grading of varicocele detected by physical examination, the side affected and any varicocele-related testicular atrophy in the four age groups. Overall, varicocele was detected in 293 (7.2%) of the 4052 boys. The difference in prevalence between those aged 2–6 and 7–10 years was not significant, but that between those aged 11–14 and 15–19 years was ($P < 0.001$). There was a statistically significant increase in prevalence at age 13 ($P < 0.005$; Fig. 1); at this age, the pubertal stage was 2 or 3.

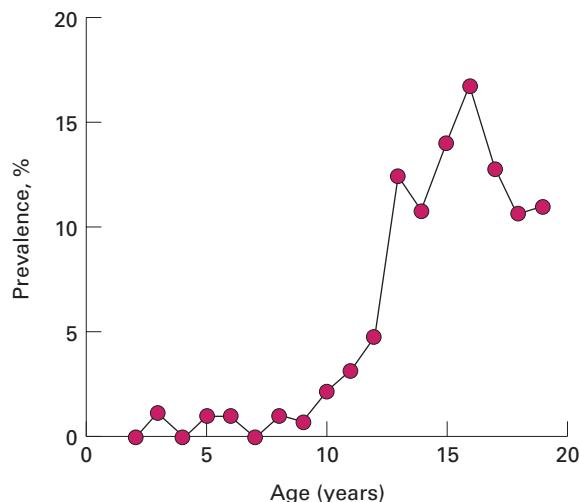
The varicocele was unilateral in 263 of the 293 (89.7%) boys with varicocele; one was right-sided (0.38%) and the others left-sided. Varicoceles were bilateral in 30 (10.8%) of the 279 boys and detected only in those aged 11–19 years. Varicocele-related testicular atrophy was not detected in any boy aged 2–10 years but seven (7.3%) of those aged 11–14 years and 17 (9.3%) aged 15–19 years had testicular atrophy. The difference between the last two groups was not significant; the prevalence was 8.6% in the adolescent group with varicocele.

Discussion

There are few reports of the prevalence of varicocele in children and adolescents; the prevalence is 0–1% in the prepubertal period, but 2–20.5% in adolescents [1, 9, 15]. In the first reported study, Horner [15] detected no varicoceles in English children <11 years old, but 20.5% of those aged about 15 years had a varicocele; the prevalence was not determined for specific age groups. Oster [1] assessed the prevalence of varicocele in 1072 Danish children aged 6–19 years, finding none in boys aged 6–9 years, but 16.2% in those aged 10–19 years. In that study, the prevalence was 5.7% at 10 years old and 19.3% at 14 years. In the present children, the prevalence at <10 years of age was 0.92% and 11.02% at 11–19 years. Buch and Cromie [13] reported that the varicocele initially presented during puberty,

with the incidence in 13-year-old boys already equivalent to that in the general male population. In the present boys, the prevalence of varicocele increased at or just before the age of 13 years (Fig. 1), with the difference between those >13 and <13 years old being significant. The difference between the 13-year-olds and those older than that was not significant.

Forti *et al.* [16] reported that the secretory activity of the testes of boys with idiopathic varicocele and in pubertal stage 2–4 was more than that in normal pubertal boys. They also suggested that after the important changes in testicular secretion occurring in pubertal stage 2, the testicular secretory pattern of the pubertal testis was similar to that of the adult testis. In the present study, all boys aged 13 years were either in pubertal stage 2 or 3; only 14% of the boys aged ≈15 years were at this stage, while others have reported the proportion to be 20.5% [15], 15% [6] and 19% [1]. However, in Horner's study [15], all children aged up to 15 years were included. All these results show that the prevalence of varicocele increases with age.

**Fig. 1.** The prevalence of varicocele according to age.

The prevalence of left varicocele is ≈ 90% and that of right varicocele <2% [17]; in the present boys, of 263 unilateral varicoceles, only one was on the right. The causes of a right-sided varicocele are compression or obstruction of the inferior vena cava or internal spermatic vein, and lateral transposition [18]. The prevalence of bilateral varicocele is 0–1% in healthy young men but is 15–20% in infertile men [19]. The prevalence of bilateral varicocele in children and adolescents has not been reported; previous studies only gave the prevalence of left unilateral varicocele. In the present children, bilateral varicocele was detected only in those aged 11–19 years. Currently, with the increasing use of venography and colour Doppler ultrasonography, and with the recognition of subclinical varicoceles in adults, the prevalence is nearer 50% [20,21].

Lipshultz and Corriere [12] first reported testicular atrophy secondary to varicocele, showing that it increased with age but was prevented by early treatment of the varicocele. Later, Lyon *et al.* [9] reported progressive testicular volume loss in 10% of adolescents with varicocele and in 20% of adult patients. In a similar study, Pozza *et al.* [10] detected 74% testicular atrophy and 90% abnormality in testis histology in adolescents with varicocele. In the present boys <10 years old, no testicular atrophy secondary to varicocele was detected, but 7.3% of those aged 11–14 years and 9.3% of those 15–19 years old had atrophy. This suggests that testicular atrophy increases with age. After varicocelectomy, testicular volumes were reported to increase in adolescents with testicular volume differences or atrophy. Laven *et al.* [22] reported increased left testicular volume after varicocelectomy, while no increase was found in an untreated group, although the serum hormone values were within the normal range in all patients. Lemack *et al.* [23] showed improved testicular volume in 89% of adolescents with testicular atrophy after microsurgical inguinal varicocelectomy. These findings support the view that varicocele is a progressive disease and that the prevalence of varicocele and testicular atrophy increases with pubertal stage.

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