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The Significance of the Contralateral Testis Size Measurement with Ultrasonography in Predicting Monorchism in Boys with Nonpalpable Testicles

Palpe Edilemeyen Testisli Çocuklarda Monoorşidizmi Öngörmede Ultrasonografiyle Ölçülen Kontralateral Testis Boyutunun Önemi

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What's known on the subject? and What does the study add?

Previous studies have proven the relationship between testicular hypertrophy and undescended testis. However, these evaluations are done with a caliber and/or orchidometer, which are not quite accurate, compared to testicular ultrasonography. The present study investigated the utility of testicular ultrasonography and shown specificity and sensitivity levels of different contralateral testis diameter in predicting monorchism. Of all diameters, a contralateral testis greater than 20 mm can predict monorchism with an accuracy of 80% sensitivity and 83% specificity.

Abstract

Objective: The aim of this study was to determine the significance of contralateral testis size in predicting monorchism in pediatric patients with unilateral undescended testis.

Materials and Methods: The data of patients who underwent surgical operation by a single pediatric urologist for undescended testis between 2013 and 2016 was evaluated retrospectively. The patients were grouped as having monorchism (M), nonpalpable intra-abdominal testis (NPIAT), and palpable undescended testis (PUDT). The dimensions of the testes were measured ultrasonographically and recorded before operation. Patients with nonpalpable testis underwent diagnostic laparoscopy and patients with PUDT underwent inguinal orchiopexy.

Results: A total of 57 children with a mean age of 31 (11-60) months were evaluated. Of the children, 12 had M, 9 had NPIAT and 36 had PUDT with a similar mean age ($p>0.05$). The size of the descended testis was found to be significantly small in NPIAT* and PUDT** groups compared to the M group (*$p<0.05$, **$p<0.001$). However, the size of the undescended and descended testes was found to be similar between NPIAT and PUDT groups ($p>0.05$).

Conclusion: The size of the testis in the scrotum might help to localize the position of the undescended testis.

Keywords: Monorchism, nonpalpable intra-abdominal testis, palpable undescended testis, testis, ultrasonography

Öz

Amaç: Çalışmanın amacı tek taraflı inmemiş testisi olan çocuk hastalarda monoorşidizmin öngörüsünde kontralateral testis boyutunun öneminin değerlendirilmesidir.

Gereç ve Yöntem: 2013 ve 2016 yılları arasında kliniğimizde tek cerrah tarafından ameliyat edilen inmemiş testisi olan çocuk hastaların verileri retrospektif olarak değerlendirildi. Çocuklar monoorşidizm (M), intraabdominal palpe edilemeyen testis (İAPET) ve palpe edilebilen inmemiş testis (PEİT) olarak gruplandırıldı. Uygulanan cerrahi yöntem öncesinde testis boyutları ultrasonografik olarak ölçüldü ve kaydedildi. Palpe edilemeyen testisi olan çocuklara tanısal laparoskopi, PEİT'si olan çocuklara inguinal orşiopeksi operasyonları uygulandı.

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Bulgular: Çalışmaya alınan 57 çocuğun yaş ortalaması 31 ay (11-60) olarak saptandı. Bu hastaların 12'si M, 9'u İAPET ve 36'sı PEİT olduğu izlendi ve yaş grupları arasında anlamlı bir fark saptanmadı (p>0,05). M grubu ile İAPET grubu* ve PEİT grubu** arasında kontralateral testis boyu açısından anlamlı fark vardı (*p<0,05, **p<0,001); ancak İAPET grubu ve PEİT grubu arasında kontralateral ve inmemiş testis boyutları açısından anlamlı fark saptanmadı (p>0,05).
Sonuç: Skrotal testis boyutları inmemiş olan testisin lokalizasyonu ile ilgili bilgi verebilir.
Anahtar Kelimeler: Monoorşidizm, palpe edilemeyen intraabdominal testis, palpe edilebilen inmemiş testis, testis, ultrasonografi

Introduction

Undescended testis is one of the most common congenital defects in pediatric population. The overall incidence for undescended testis at birth is 3.7% (1) and 1.1% of these cases would persist up to the age of one year (2). Any children with undescended testis should be operated between 6 and 18 months of age (3,4). If left untreated, fibrosis will occur (5) which would lead to decrease in testicular size, and consequently to function lost. Thus, there are two major concerns in the treatment of undescended testis: increased risk for infertility and testicular malignancy (6,7). Despite all the risks, orchiopexy is the gold standard treatment for undescended testis (5). Ultrasonography is not a reliable and efficient tool in the diagnosis of undescended testis (8). Diagnostic laparoscopy is suggested to be the best method for the diagnosis of undescended testis as it has the advantage of ease of use and flexibility, and high diagnostic accuracy (9,10,11,12). Up to date, no study has shown the efficiency of physical findings in predicting the presence of the impalpable undescended testis. The present study aimed to evaluate the value of testis size in the scrotum in predicting the location of the contralateral testis in case of cryptorchidism.

Materials and Methods

Children who underwent surgical operation for undescended testis in the Department of Pediatric Urology at Marmara University, Faculty of Medicine between 2013 and 2016 were evaluated retrospectively. Medical chart of each child were recorded prospectively. A total of 57 consecutive prepubertal boys with unilateral undescended testis were evaluated. The cohort was divided into 3 groups according to the status of the undescended testis: monorchism (M), nonpalpable intra-abdominal testis (NPIAT), and palpable undescended testis (PUDT) (Figure 1). M is the state in which there are no testicular tissues on the undescended side. NPIAT is the state where testis cannot be palpated during the routine physical examination of the scrotum and inguinal channel but can be found inside the abdominal cavity during the laparoscopic exploration. PUDT is the state where the testis is not in the scrotal cavity but can be palpated during physical examination (13). Prior to any intervention, children were assessed with the aid of ultrasonography and inspections were done both for scrotum and for inguinal channels. The largest diameter of each descended and undescended testis was recorded. The largest diameter of each undescended testis was also measured by a surgical ruler at the time of the surgical intervention and, by this way, verification of the ultrasonographic measurements were done. Since there were no significant differences in diameter measurements between surgical ruler and ultrasonography driven ones, only the ultrasonographic measures are provided in the article. The surgical intervention choice was diagnostic laparoscopy in case of nonpalpable testis (M and NPIAT groups) and was inguinal orchiopexy in PUDT group.

Statistical Analysis

Statistical analyses were performed using the SPSS software version 20 (IBM Corp. Armonk, New York). Descriptive analyses were done and distribution of the variables were assessed by the Kolmogorov-Smirnov test. Age and testicular size did not show a normal distribution. Thus, comparisons between the groups were done using the Mann-Whitney U test. Data was provided as median (minimum-maximum) values. A p value of less than 0.05 was considered to indicate statistical significance.

Results

The number of children in M, NPIAT and PUDT groups was found to be 12, 9 and 36, respectively. The median age of the study cohort was found to be 31 months (11-60). Age and testicular diameter in each group are provided in Table 1. The median age of children within the M group, NPIAT group and PUDT group was 15 months (11-60), 25 months (11-60) and 36 months (11-

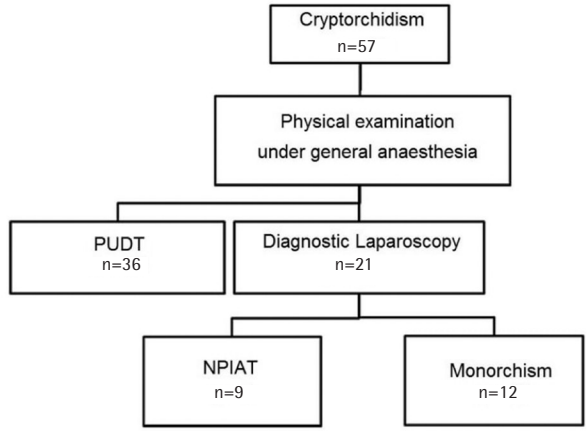

Figure 1. A flow diagram reflecting the process of patient selection

PUDT: Palpable undescended testis, NPIAT: Nonpalpable intra-abdominal testis

72), respectively. There was no statistically significant difference between the groups (p>0.05). The median largest diameter of the undescended testis in NPIAT group and PUDT group was found to be 12 mm (11-19 mm) and 14 mm (5-25), respectively and similar to age, no statistically significant difference was found between the two groups (p>0.05). The median largest diameter of the descended testis in M group, NPIAT group and PUDT group was found to be 25 mm (19-36), 18 mm (13-24) and 16 mm (10-33), respectively. Interestingly, the median largest testicular size of the descended testis was found to be significantly greater in M than in NPIAT group (p<0.005) and PUDT group (p<0.001) (Table 1). However, no significant difference was observed in the largest testicular diameter of the descended testis between NPIAT and PUDT groups (p=0.458).

M was evaluated at various contralateral testicular diameters with the aid of ultrasound using a cut-off value of 18 mm-25 mm. Each diameter's sensitivity and specificity levels are provided in Table 2.

Discussion

The present study evaluated the significance of the contralateral testis size measurement with the aid of ultrasonography in predicting M in boys with nonpalpable testicles, and found that the median contralateral testicular diameter to be significantly high in M compared to that in boys with NPIAT and PUDT. The median contralateral testicle length in boys with M was 7 mm longer than that in boys with PUDT and was 9 mm longer that in boys with NPIAT.

Contralateral testicular hypertrophy phenomenon in M in humans was initially proposed and proven by Laron and Zilka (14). They reported a significant increase in mean prepubertal testis volume in patients with M (3.75 mL) compared to that in normal population (1.64 mL) with the aid of orchidometer and caliber (14). This significant difference in size remained up to age (14,15,16). However, a testicular hypertrophy is not always a must in all patients with atrophic contralateral testis. The presence of a testis, related to the degree of atrophy, has been shown to have an impact on testicular hypertrophy. Koff (17) studied testicular size in undescended testis in 37 boys. He reported that patients with M (n=12), descended normal testis (n=19) and descended atrophic testis had the mean testis length of 2.22 cm, 1.51 cm and 1.78 cm, respectively; and determined a diameter of 2 cm or a size of 2 cc of testicular hypertrophy as a cut-off value for expecting M on contralateral side in children between 8 months and 3 years of age. On the contrary, Huff et al. (18) reported that the volume of the contralateral descended testis was not a reliable criterion for differentiating an absent testis from an intra-abdominal testis in a boy with a unilateral impalpable testis, since in their cohort of 109 children, 80%

Table 1. Age (months) and diameter of the largest testicular size (mm) is provided for each group (mm) (Mann-Whitney U)

	Monorchism group (n=12) [Median, (minimum, maximum)]	Nonpalpable intra-abdominal testisgroup (n=9)	Palpable undescended testis group (n=36)
Age (months)	15 (11-60)	25 (11-60)	36 (11-72)
Contralateral scrotal testis size (mm)	25 (19-36)	18 (13-24)*	16 (10-33)**
Undescended testis size (mm)	-	12 (11-19)	14 (5-25)

*p<0.005

**p<0.001

Table 2. Sensitivity and specificity of contralateral compensatory testicular cut-off lengths to predict monorchism in boys with palpable undescended testis and nonpalpable intra-abdominal testis

Contralateral testis size	Predicting monorchism				Sensitivity	Specificity
	TP	FP	FN	TN		
≥18 mm	12	13	0	32	1.00	0.71
≥19 mm	12	13	0	32	1.00	0.71
≥20 mm	10	9	2	36	0.83	0.80
≥21 mm	10	6	2	39	0.83	0.87
≥22 mm	10	5	2	40	0.83	0.89
≥23 mm	9	3	3	42	0.75	0.93
≥24 mm	9	3	3	42	0.75	0.93
≥25 mm	8	1	4	44	0.67	0.98

TP: True positive, FP: False positive, FN: False negative, TN: True negative

of monorchid patients (47% of all cohort) had a contralateral testicular size smaller than 2 cm. However, they also found that the volume of the contralateral descended testis in boys with an absent testis was significantly greater than that in boys with intra-abdominal testes.

Several other authors proposed different cut-off values with different measurements methods, such as Takihara orchidometer, ruler and caliper, and introduced cut-off values of 1.8 cm (19,20), 2 cm (13,21) and 2 standard deviation above the normal mean volume (22) to predict monorchism. Our data has shown a sensitivity of 0.83 and a specificity of 0.80 for testicular diameter of 20 mm or more in diagnosing M with the help of ultrasonography (Table 2).

Most of the researchers preferred to use an orchidometer, ruler and caliper to determine testicular size as these methods are cheap and fast resulting ones. These methods are shown to be effective in testicular volume calculation and testicular size estimation, however, the best method in determining testicular size or volume is reported to be ultrasound (23). To our knowledge, this is the first study in the literature evaluating the relationship between testicular hypertrophy and undescended testis with ultrasound as the measurement tool. No standardization is available for the assessment of testicular measurements, and methods (21).

Study Limitations

The present study has two important limitations: retrospective design and relatively small number of patients. However, it is superior to the previous ones as the assessment method in size calculations was ultrasonography which is reported to be the best accurate tool. Since the data was not normally distributed and patient population was small, it is hard to suggest a cut-off value for testis size to predict monorchism.

Conclusion

A contralateral testicular diameter greater than and equal to 20 mm can predict M in boys with unilateral unpalpable testis with 80% sensitivity and 83% specificity. This finding can provide preoperative counseling and planning for appropriate surgical approach. Ultrasonography is a good and consistent tool in evaluating testis diameter. However, the present study cannot provide a better cut-off value for contralateral testicular diameter due to small sample size.

Ethics

Ethics Committee Approval: Retrospective study.

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: F.Ş., T.T., C.A., Ç.A.Ş., Concept: C.A., Ç.A.Ş., Design: C.A., Ç.A.Ş., Data Collection or Processing: Ç.A.Ş., Y.T., T.E.Ş., R.A., A.Ş., Analysis or Interpretation: Y.T., T.E.Ş., Literature Search: Ç.A.Ş., Y.T., T.E.Ş., Writing: Ç.A.Ş., Y.T.

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