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Original article

Volume alteration of undescended testes: Before and after orchiopexy

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ABSTRACT

Objectives: We used ultrasound to investigate the volume of undescended testes before and after orchiopexy, and compared these data with normally descended testes.
Materials and Methods: We retrospectively reviewed boys in the age range of 0–18 years who had undergone unilateral or bilateral orchiopexy due to undescended testes (International Classification of Diseases-Ninth Revision, ICD-9 752.51) in National Taiwan University Hospital, Taipei, Taiwan between January 2010 and December 2013. A total of 116 boys received preoperative testicular ultrasound evaluation, and 75 of them received regular ultrasound during a mean follow-up period of 2.5 years. The volume of the testes was calculated by applying Hansen formula [testicular volume = length (L) × width $(W)^2$ × 0.52] and compared with a cohort of 92 boys constructed for normative values of testicular volume from The Netherlands.
Results: The mean volume of the 145 undescended testes among 118 boys was 0.238 mL. The volume of the undescended testes was significantly smaller ($p < 0.001$) than the mean normative value of 0.418 mL. The volume of postorchiopexy undescended testes (0.356 mL) revealed a growing trend in the mean 2.5-year follow-up with a significance increase of size ($p = 0.001$), but has not yet reached the normal testicular size (0.604 mL).
Conclusion: The preorchiopexy volumes of undescended testes are significantly smaller than normative values. The follow-up postorchiopexy volumes of undescended testes actually increased in size, although they were still smaller than normative values. These Taiwanese testicular growth curves should become reference values in pediatric clinical practice when evaluating testicular development.
Keywords: cryptorchidism, orchiopexy, testicular volume, treatment outcome, undescended testis

1. Introduction

Undescended testes (UDT) are one of the most common congenital urological diseases. The prevalence of cryptorchidism at birth varies from 1% to 9%, and the testes mostly descend during the first ½ year of life. The prevalence is reported to be about 1% among boys at 1 year of age. The volume of the testes is significantly related to the semen profile and the testicular function, since 80–90% of the testes were composed of seminiferous ducts. Bahk et al[1] reported that the testicular size reflexes the degree of spermatogenesis, testosterone level, and semen profile. Therefore, accurate measurement of the testicular size is crucial for evaluating the development of testes.

Several kinds of tools were applied to evaluate the size of testes, such as orchidometry, use of rulers and calipers, and ultrasound. Although the traditional methods are still reliable, ultrasound is a more preferable and accurate means of measuring testicular volume.[2] We aim to record the undescended testicular size and normally descended testes (NDT) to establish the growth and developmental chart. We sought to compare our data with the nomogram reported by Goede et al[3] from The Netherlands. Furthermore, we recorded the testicular volume after orchiopexy to determine the postoperative outcome of UDT.

2. Materials and methods

We retrospectively searched medical charts of children (< 18 years old) who received unilateral or bilateral orchiopexy due to UDT (International Classification of Diseases-Ninth Revision, ICD-9 752.51) in National Taiwan University Hospital, Taipei, Taiwan between January 2010 and December 2013. Patients' clinical characteristics, concomitant diseases, laterality of the diseases, age of orchiopexy, pre- and postoperative scrotal echo findings, and

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intraoperative findings were collected. Patients who underwent orchiopexy for retractile testes were excluded. A total of 225 patients were admitted for surgical management of UDT. The operative procedures were performed by three pediatric surgeons and two general urologists.

2.1. Definition of UDT

Congenital UDT were defined as the absence of the testicle in the scrotal position since birth. All testes that could not be pulled down to the scrotum at clinical examination by a urologist or pediatric surgeon were documented as UDT. If a testis could be pulled down to the scrotal position and retained in the scrotum during clinical examination, or the testis was found in the scrotum after general anesthesia before operation, it was finally defined as a retractile testis, and not UDT.

2.2. Ultrasonography of the testes

Patients without pre- and postoperative scrotal echo were not included in the testicular volume analysis. A total of 118 boys received preoperative testicular ultrasound evaluation, and 75 of them received regular ultrasound during a mean follow-up period of 2.5 years. High-resolution ultrasound was applied, and the image was uploaded to electronic medical record systems. Testicular length, width, position of the testes, and any abnormal findings were well documented. The testicular volume was then calculated with Hansen formula:

$$\text{Testicular volume} = \text{length } (L) \times \text{width } (W)^2 \times 0.52.^{4} \quad (1)$$

2.3. Statistical analysis

The measured volume of the testes was calculated and analyzed with SPSS statistic software, version 22.0 (IBM Corp., Chicago, IL, USA).

3. Results

3.1. Patient characteristics

From January 2010 to December 2013, 234 boys underwent orchiopexy for management of UDT in National Taiwan University Hospital (Figure 1). Eight boys received orchiectomy because of atrophic testis, and in one boy testis was found to be absent after exploration. Of patients recruited in this study, 67 (29.8%) had bilateral UDT, 67 (29.8%) had right-sided UDT, and 91 (40.4%) had left-sided UDT. The median operative age was 1.25 years (range, 50–4360 days), and the average operative age was 2.1 years.

Among the patients, 53 boys presented underlying diseases, including 11 boys with genetic diseases (Prader–Willi syndrome, mitochondrial disorders, Robinow syndrome, etc.), six boys with neurological diseases (cerebral palsy, seizure, etc.), eight boys of congenital cardiovascular diseases (atrial septal defect, ventricular septal defect, and total anomalous pulmonary venous return), six boys with nephrourological diseases (hypospadias, hydronephrosis, nephrotic syndrome, etc.), eight boys with psychiatric problems (attention deficit hyperactivity disorder, autism, etc.), seven boys with endocrine diseases (hypogonadism), five boys with gastrointestinal anomalies (diaphragmatic hernia, tracheoesophageal fistula, etc.), and two boys with orthopedics disorders. Among the 159 boys with unilateral UDT, only 22 (13.8%) had concomitant diseases and eight (5%) of them had minor diseases such as asthma, autism, and attention deficit hyperactivity disorder. Among the 67 boys with bilateral UDT, up to 31 (46.3%) boys had major underlying diseases.

3.2. Preoperative volume: UDT versus NDT

A total of 118 boys with UDT received preoperative scrotal echo. The testicular volume of UDT was 0.238 ± 0.014 mL (number of testes, 145) and that of NDT was 0.418 ± 0.020 mL (number of testes, 91). The volume of UDT was significantly smaller than the mean normative value ($p < 0.001$). Testicular volumes of NDT and UDT according to age groups are described in Figure 2. The normogram

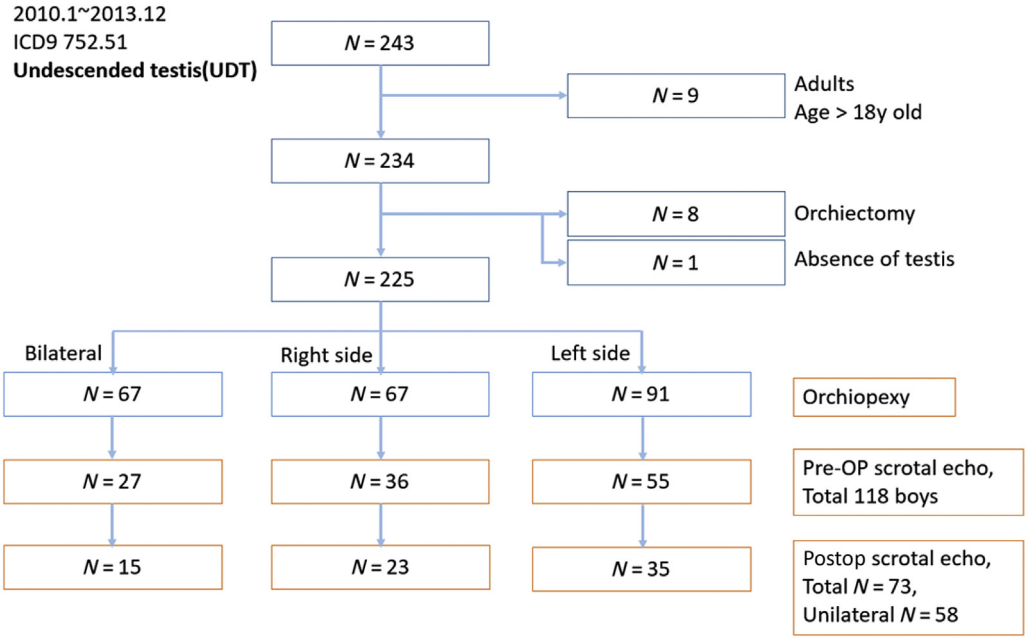

Figure 1. Study profile. UDT = undescended testes.