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ORIGINAL PAPER

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Testicular volume and masculine identity in men with unilateral cryptorchidism: results of a community-based survey in Korea

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Abstract We determined the influence of cryptorchidism on testicular volume and masculine identity in young men living in a community. Of the 27,202 men aged 20 years dwelling in the community, we randomly selected a 10% sampling fraction of whom 2,080 men (a response rate of 77.0%) agreed to participate in the study. All volunteers underwent a standard evaluation, including a detailed medical history and physical examination. For the evaluation of the influence of cryptorchidism on masculine identity, we used the Bem Sex Role Inventory (BSRI). Among participants, 38 (1.8%) had cryptorchidism or a history of surgery for cryptorchidism (right 15, left 21, bilateral 2). In total, 29 had had undergone surgery (mean age at the time of operation; 8.9 ± 3.9 years, range; 2–19 years). Of 25 men who had undergone orchiopexy due to unilateral cryptorchidism, the testicular volume of the affected side was significantly smaller than that of the contralateral side. Of the 36 patients with unilateral cryptorchidism, the contralateral testicular volume of men who had undergone orchiopexy was not different with that of those who had undergone orchiectomy or had not undergone surgery. When we compared the scores for masculinity and femininity using the BSRI between men with and without testis in the scrotum, there were no differences between the two groups. Our results demonstrate that delayed orchiopexy does not improve the testicular volume of the affected side or the masculine identity in men with unilateral cryptorchidism. In addition, these findings suggest that there is a need to increase the awareness of cryptorchidism among all parties involved in the health care of children.

Keywords Cryptorchidism · Prevalence · Orchiopexy · Testis · Masculinity

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Introduction

Cryptorchidism is a common congenital abnormality occurring in 2–5% of full-term boys at birth in Western countries. Most undescended testes descend by 3 months of age and the incidence rate spontaneously reduces to 1–2% by 3 months of age [4, 28].

Treatment of cryptorchidism is necessary to reduce the risk of future infertility, inguinal herniation, and testicular torsion. Many believe that it should be performed as early as possible, when irreversible changes occur in testicular morphology [5, 10, 14, 20, 22]. Over the past few decades, the recommended age of therapy has become younger and younger, so that currently therapy is recommended before 2 years and as early as 6 months [18]. However, previous studies have demonstrated that the age at orchiopexy was not correlated with testicular volume, histologic findings, semen quality or paternity [12, 13, 19, 29]. Furthermore, there are few published reports to date on the epidemiologic characteristics of cryptorchidism in ethnic Asians.

The presence or absence of a testis may affect body image [8, 25, 21] and one may assume that body image affects gender identity. To advance our understanding of this issue, it would be essential to establish a relationship between testicular status and masculine, identity but this has not been done to date. Thus, it will be beneficial to evaluate a relationship between testicular status and gender identity in young men since masculine identity is usually fixed by adolescence.

In this report, we present the prevalence and patient awareness of cryptorchidism and the association between masculine identity and testis in young adult men from in a single community.

Material and methods

South Korea has adopted national military service and all men are routinely examined at conscription at the Military Manpower Administration when they are 20 years old. From May to November 2001, this cross-sectional survey was conducted at the Military Manpower Administration in Taejeon. We obtained data on the demographic characteristics of total population in the community from records of the Military Manpower Administration. Of 27,202 men aged 20 years dwelling in the community of Choong-chung, South Province, 2,700 were randomly selected at a 10.0% sampling fraction after a sampling process by census district. After an introduction to the project, 2,080 (a response rate 77.0%) men agreed to participate in the study and gave their informed consent prior to their inclusion. The subjects' responses were anonymous.

All volunteers underwent a standard evaluation, including a detailed medical history and physical examination. However, before any other examinations, testicular volumes were measured with an ellipsoid orchidometer (Prader orchidometer, ASSI, N.Y.) because a subject's response could affect the measurement of testicular size. The body size of subjects including height and body weight was determined using an automatic measuring instrument (Fanics, Pusan, Korea). The evaluations consisted of interviewing the volunteers, and all men completed a self-administered questionnaire in written form. This questionnaire provided detailed information on previous history. Men who had cryptorchidism on physical examination or had a history of surgery for this disease also indicated their condition. In addition, if the subjects had a previous history of cryptorchidism, copies of hospital's records and radiologic findings, and the medical certificates that the subjects brought were reviewed, as testicular status is included at conscription. These records were complete for all subjects. The evaluations were performed by the same specialist (J.H.K.).

For men who were observed to have cryptorchidism on physical examination or had a history of surgery for cryptorchidism, we used the Bem Sex Role Inventory (BSRI) [3] for the evaluation of the influences of the testis on masculine identity since the BSRI was developed to examine gender identity. This inventory has been standardized for the Korean population [16]. The self-reported masculine (e.g. independent, athletic, aggressive, ambitious, analytical) and feminine characteristics (e.g. warm, yielding, shy, tender, sympathetic) consisted of 20 items. Each item had scores ranging from 1 to 7. Thus, the score range for masculine and feminine characteristics was 20–140. The masculinity and femininity scores were calculated as the sum of the scores divided by 20 (the numbers of characteristics). Survey responses were coded and descriptive analyses were performed on these participants. The body-mass index of each man was calculated as the body weight in kilograms divided by the square of the height in meters. We divided responders as men with or without cryptorchidism. Before comparing the testicular volumes between the two groups, we determined whether they had any of the specified exclusion criteria that could affect testicular volume, such as a previous history or present illness of epididymo-orchitis, testicular trauma, hydrocele, hernia, testicular torsion or varicocele. All results were expressed as the median (interquartile range) for quantitative variables and as number (percent) for qualitative variables. Of men who had undergone orchiopexy due to unilateral cryptorchidism, the testicular volume of the affected and contralateral sides was compared. Of patients with unilateral cryptorchidism, the contralateral testicular volume of men was compared among patients who had undergone orchiopexy, orchiectomy or did not undergo an operation. The results of the BSRI were compared between men with testis in the scrotum (having undergone orchiopexy; group 1) and those without testis (having undergone orchiectomy or those who did not undergo surgery; group 2). All comparisons were performed using the Mann-Whitney U-test, Kruskall-Wallis test or one-way analysis of variance (ANOVA). Statistical analyses were performed using a commercially available analysis program. A 5% level of significance was used for all statistical testing and all statistical tests were two-tailed.

Results

After applying our exclusion criteria, a total of 1,792 men without cryptorchidism (normal group) and 38 (1.8%) with cryptorchidism were included for comparison. Of the 38 patients with cryptorchidism, nine had cryptorchidism on physical examination and 29 had a history of surgery for cryptorchidism. Cryptorchidism occurred on the left side in 21, on the right side in 15, and bilaterally in two subjects. An additional four had retractile testes but these were excluded from the study. Of the 29 with a history of surgery, the mean age at the time of the operation was 8.9 ± 3.9 years, range (2–19 years). Orchiopexy (including bilateral orchiopexy in a single case) was performed on 26 and orchiectomy on three for severe testicular atrophy. Only one patient underwent surgery before the third year of life. Nine subjects (including bilateral cryptorchidism in one) who had cryptorchidism did not have a history of previous, unsuccessful surgery. No subjects had received a testicular prosthesis or hormone replacement therapy. Table 1 summarizes the patients' characteristics.

The testicular volume of the affected side in the cryptorchidism group was significantly smaller than that of the contralateral side, and also the right and left sides in the normal group. The testicular volume of the contralateral side in the cryptorchidism group was significantly larger than that of both sides in the normal group ($P < 0.001$). Testicular volume corrected on the basis of body-mass index (testicular volume/body-mass index) was compared between the two groups. The testicular

Table 1 Patient characteristics. For season of birth: *spring* March–May, *summer* June–August, *fall* September–November, *winter* December–February

Variable	Number of patients (%)
Area	
Major town	27 (71.1)
Large rural area	11 (28.9)
Educational level	
Middle school	1 (2.6)
High school	7 (18.4)
College (attending)	30 (78.4)
Season at birth	
Spring	8 (18.2)
Summer	10 (22.7)
Fall	9 (20.5)
Winter	11 (25.0)
Laterality	
Right	15 (39.5)
Left	21 (55.3)
Bilateral	2 (5.2)
History of operation	
Yes	29 (76.3)
No	9 (23.7)
Age at operation ($n = 29$)	
≤ 7 years	11 (37.9)
> 8 years	18 (62.1)
Type of operation ($n = 29$)	
Orchiopexy	26 (89.7)
Orchiectomy	3 (10.3)

volume/body-mass index of the affected side in the cryptorchidism group was significantly smaller than that of the contralateral side in this group as well as both sides in the normal group. This index for the contralateral side in cryptorchidism group was significantly larger than that of both sides in the normal group ($P < 0.001$, Table 2).

Of the 25 men who had undergone orchiopexy due to unilateral cryptorchidism, the median (25th–75th percentiles) testicular volume of the affected side was significantly smaller than that of the contralateral side (10.0 ml, range7.0–13.5 vs 15.0 ml, range 12.0–23.0, $P = 0.001$). The testicular parameters of patients who had undergone orchiopexy before they were 8 years old were not significantly different with those of patients who had undergone orchipexy after they were 8 years old (Table 3). Of the 36 patients with unilateral cryptorchidism, the contralateral testicular volume of men who had undergone orchiopexy was not different with that of those who had undergone orchiectomy or did not undergo surgery. Testicular volume corrected on the basis of body-mass index was compared among groups. There was no significant difference for the contralateral side (Table 4).

For evaluation of the influence of testis on masculine identity, we compared the scores of masculinity and femininity between men with and without a testis in the scrotum. The median (25th–75th percentiles) masculinity scores of groups 1 and 2 were 4.3 (3.1–4.7) and 4.6 (3.6–5.2), respectively. These were not significantly different ($P = 0.107$). In terms of the femininity score, there was also no difference between the two groups (group 1; 4.5, range4.1–4.8 vs group 2; 4.5, range 4.1–4.8, $P = 0.956$).

Discussion

The purpose of this study was to examine various aspects of testicular disease in young men. We found several characteristics of cryptorchidism in the Korean community studied. First, contrary to earlier reports [13], men with left-sided cryptorchidism occurred more frequently than those with right-sided. Second, although there may be a seasonal variation in the occurrence of true cryptorchidism, because the pituitary and chorionic gonadotrophins may play an important role [6], we did not find this variation. Third,

Table 2 Testicular parameters comparing the cryptorchidism and normal groups. Data are mean ± SD. The one-way ANOVA test were used with the same letters indicating non-significant differences between groups based on multiple comparison tests. One patient with bilateral cryptorchidism did not undergo surgery and was excluded

Variable	Cryptorchidism group		Normal group		*P* value
	Affected side ($n = 27$)	Contralateral side ($n = 36$)	Right side ($n = 1{,}792$)	Left side ($n = 1{,}792$)	
Testicular volume (ml)	10.59 ± 5.56^{A}	17.94 ± 6.61^{B}	15.93 ± 4.53^{C}	15.33 ± 4.58^{C}	< 0.001
Testicular volume/Body-mass index (ml×m^2/kg)	0.53 ± 0.28^{A}	0.85 ± 0.31^{B}	0.75 ± 0.23^{C}	0.72 ± 0.23^{C}	< 0.001

Table 3 Testicular parameters comparing patients who had undergone orchipexy before and after 8 years of age in unilateral cryoptorchidism. Data are medians (25th–75th percentiles). Mann-Whitney U-tests were used

Variable	Before 8 years of age ($n = 10$)	After 8 years of age ($n = 15$)	*P* value
Affected side			
Testicular volume (ml)	10.0 (9.5–14.0)	8.0 (5.0–15.0)	0.451
Testicular volume/Body-mass index (ml×m^2/kg)	0.54 (0.44–0.73)	0.42 (0.27–0.78)	0.495
Contralateral side			
Testicular volume (ml)	19.0 (12.0–25.0)	15.0 (12.0–20.0)	0.177
Testicular volume/Body-mass index (ml×m^2/kg)	0.83 (0.67–1.20)	0.76 (0.59–0.89)	0.216

Table 4 Contralateral testicular parameters for the orchiopexy group, orchiectomy group and no operation group in patients with unilateral cryoptorchidism. Data are medians (25th–75th percentiles). Kruskal-Wallis tests were used

Variable	Orchiopexy group ($n = 25$)	Orchiectomy group ($n = 3$)	No operation group ($n = 8$)	*P* value
Testicular volume (ml)	15.0 (12.0–23.0)	20.0 (10.0–28.0)	25.0 (12.0–25.0)	0.391
Testicular volume/body-mass index (ml×m^2/kg)	0.78 (0.64–1.06)	0.85 (0.45–1.43)	0.99 (0.61–1.10)	0.938

the timing of the operation was very late in this community (mean age at treatment 8.9 years). Finally, one of the most important characteristics in the study is that a significant number (23.7%) of patients with cryptorchidism were not corrected until they were 20 years old. Although, to date, no substantive data suggest that early surgical intervention improves fertility potential, there is a consensus that very early orchiopexy is advantageous. The fertility potential may be improved if the testis is moved to a normal scrotal position [26]. Furthermore, early orchiopexy may be beneficial in preventing infertility [9]. Our findings suggest that regular screening of the testicular position up to puberty is indicated for every boy.

We compared testicular volume in men with unilateral cryptorchidism. In patients who had undergone unilateral orchiopexy, the testicular volume of the affected side was significantly smaller than that of contralateral side. The contralateral testicular volume of men who had undergone orchiopexy was not different from that of those who had undergone orchiectomy or did not undergo surgery. It is well known that unilateral cryptorchidism has a bilateral effect [23]. Contralateral testis hypertrophy is common in patients with a non-palpable testis and the finding of contralateral testis hypertrophy provides evidence that the non-palpable testis is most likely absent [15]. If compensatory hypertrophy of the contralateral testis affords a potential for improved fertility, it seems logical that this would be a desirable outcome. Conversely, this phenomenon could represent an abnormal growth phenomenon that could adversely affect potential long-term fertilityor involve ipsilateral testicular damage. Histological assessment with the evaluation of semen parameters is needed to better assess the significance of these findings.

One of the main reasons for orchiopexy is to render a cryptorchid testis amendable to self-examination later in life. The risk of future testicular cancer is 1 in 1,000–2,500 compared with 1 in 100,000 for the general male population [7]. Orchiopexy does not reduce the risk of cancer [27], but is nevertheless indicated to allow easier detection of cancer through testicular self-examination or examination by a medical professional. However, of the patients who had undergone orchiopexy, none had performed testicular self-examination in our cohort.

The appearance of the external genitalia is the major determinant of social sexuality. The appearance of the male scrotum may be an important issue and one testis may be not enough to maintain a normal psychological function for some men [1]. Thus, another important reason for orchiopexy is to minimize the psychological disadvantage of an empty scrotum including cosmesis or self-image since cryptorchidism may contribute to psychopathology, especially in the area of masculine self-image.

Unfortunately, however, our knowledge of the impact of the testis on psychosexual development is rather rudimentary. For the evaluation of the influence of the testis on masculine identity, we used the BSRI. In normal Korean men, the median masculinity and femininity scores were 4.45 and 4.85, respectively [16]. On comparison, there were no differences between the two groups in the scores for masculinity and femininity using the BSRI between men with and without a testis in the scrotum. Although masculinity or femininity is probably highly culturally dependent, we believe that this will not affect our results since this index has been standardized for the Korean population. Further study is needed to determine whether testicular volume directly correlates with masculine identity.

Our findings must be interpreted with caution. First, it would be important not only to assess testicular status, but also testicular function for the evaluation of the influence of testis on masculine identity because this may be mediated or modified by androgens. Further studies on androgens are needed to confirm the present results. Second, the testicular volumes obtained by physical examination are subject to inter-observer variation and are often overestimates of the true volume [2, 11]. Testicular ultrasound is the most accurate and reproducible method to assess testicular volume and its variation [24]. However, the Prader orchidometer was shown to correlate with ultrasound measurement, although the degree of correlation was dependent upon the investigator's clinical experience [2]. In addition, our results can not have been influenced by intra-observer variation since this study employed the same examiner using the same method for the same population over the same time period. Third, there is evidence that attitudes concerning gender and sexuality differ significantly between various cultures [17] since the gender question is rooted in cultural diversity. Therefore, the generalizability of our findings may be limited to communities with socio-demographic and cultural characteristics similar to this community. However, our subjects had no history of psychological disturbance. In general, it may be assumed that patients with medical problems who consent to psychiatric/psychological evaluation are either psychologically minded or have sever psychological symptoms that makes them consider such evaluation. Thus, the sample in the study might not be biased toward psychopathology. Finally, the number of our cohort is rather small and thus our findings will have to be validated by additional studies in a larger series.

References

1. Adshead J, Khoubehi B, Wood J, Rustin G (2001) Testicular implants and patient satisfaction: a questionnaire-based study of men after orchiectomy for testicular cancer. BJU Int 88: 559
2. Behre HM, Nashan D, Nieschlag E (1989) Objective measurement of testicular volume by ultrasonography: evaluation of the technique and comparison with orchidometer estimates. Int J Androl 12: 395
3. Bem SL (1974) The measurement of psychological androgyny. J Consult Clin Psychol 42: 155
4. Berkowitz GS, Lapinski RH, Dolgin SE, Gazella JG, Bodian CA, Holzman IR (1993) Prevalence and natural history of cryptorchidism. Pediatrics 92: 44

5. Canavese F, Cortese MG, Magro P, Lonati L, Teruzzi E, De Sanctis C, Lala R (1998) Cryptorchidism: medical and surgical treatment in the 1st year of life. Pediatr Surg Int 14: 2
6. Czeizel A, Erodi E, Toth J (1981) An epidemiological study on undescended testis. J Urol 126: 524
7. Docimo SG, Silver RI, Cromie W (2000) The undescended testicle: diagnosis and management. Am Fam Physician 62: 2037
8. Elder JS, Keating MA, Duckett JW (1989) Infant testicular prostheses. J Urol 141: 1413
9. Engeler DS, Hosli PO, John H, Bannwart F, Sulser T, Amin MB, Heitz PU, Hailemariam S (2000) Early orchiopexy: prepubertal intratubular germ cell neoplasia and fertility outcome. Urology 56: 144
10. Fonkalsrud EW (ed) (1981) The undescended testis. Year Book Medical, Chicago
11. Fuse H, Takahara M, Ishii H, Sumiya H, Shimazaki J (1990) Measurement of testicular volume by ultrasonography. Int J Androl 13: 267
12. Gracia J, Gonzalez N, Gomez ME, Plaza L, Sanchez J, Alba J (1995) Clinical and anatomopathological study of 2000 cryptorchid testes. Br J Urol 75: 697
13. Gracia J, Sanchez-Zalabardo J, Sanchez-Garcia J, Garcia C, Ferrandez A (2000) Clinical, physical, sperm and hormonal data in 251 adults operated on for cryptorchidism in childhood. BJU Int 85: 1100
14. Hadziselimovic F, Herzog B, Seguchi H (1975) Surgical correction of cryptorchism at 2 years: electron microscopic and morphometric investigations. J Pediatr Surg 10: 19
15. Hurwitz RS, Kaptein JS (2001) How well does contralateral testis hypertrophy predict the absence of the nonpalpable testis? J Urol 165: 588
16. Jung JG (1990) The Korean sex role inventory (KSRI). Korean J Psychol 5: 82
17. Kuhnule U, Krahl W (2002) The impact of culture on sex assignment and gender development in intersex patients. Perspect Biol Med 45: 85
18. Lee PA (1995) Consequence of cryptorchidism: relationship to etiology and treatment. Curr Probl Pediatr 25: 232
19. Lee PA, O'Leary LA, Songer NJ, Bellinger MF, LaPorte RE (1995) Paternity after cryptorchidism: lack of correlation with age at orchidopexy. Br J Urol 75: 704
20. Mandat KM, Wieczorkiewicz B, Gubala-Kacala M, Sypniewski J, Bujok G (1994) Semen analysis of patients who had orchidopexy in childhood. Eur J Pediatr Surg 4: 94
21. Masi G, Millepiedi S, Brovadani P, Favilla L, Mucci M (1999) Psychopathological aspects of cryptorchidism in children and adolescents. Child Psychiatry Hum Dev 30: 75
22. Nagar H, Haddad R (1997) Impact of early orchidopexy on testicular growth. Br J Urol 80: 334
23. Nambirajan L, Agarwala S, Dinda AK, Mitra DK (2002) Fertility and unilateral undescended testis in the rat model III: ultrastructural changes in the contralateral descended testis. Pediatr Surg Int 18: 276
24. Paduch DA, Niedzielski J, Skoog SJ (1999) Diagnosis, evaluation and treatment of adolescent varicocele. Med Sci Monit 5: 1255
25. Ropponen P, Aalberg V, Rautinen J, Siimes MA (1994) Reflections of testicular damage on psychosexual development in adolescent males who survived childhood malignancies. Acta Paedopsychiatr 56: 273
26. Rozanski TA, Bloom DA (1995) The undescended testis: theory and management. Urol Clin North Am 22: 107
27. Swerdlow AJ, Higgins CD, Pike MC (1997) Risk of testicular cancer in cohort of boys with cryptorchidism. BMJ 314: 1507
28. Toppari J, Kaleva M (1999) Maldescendus testis. Horm Res 51: 261
29. Vinardi S, Magro P, Manenti M, Lala R, Costantino S, Cortese MG, Canavese F (2001) Testicular function in men treated in childhood for undescended testes. J Pediatr Surg 36: 385