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Conservative treatment outcomes of hydrocele in children: A retrospective review of a tertiary care center's experience

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Abstract

Objective: To elucidate epidemiological data and hydrocele progression, we reviewed pediatric patients diagnosed with hydroceles in our institution retrospectively.

Materials and Methods: We reviewed data from 355 pediatric patients with hydroceles. Questionnaires regarding age at diagnosis, time of delivery, presence of hydroceles in the father and brothers, age at recovery, age at surgery, cause of hydrocele (if present), type of hydrocele, associated pathologies, treatments, and post herniotomy complications were completed by reviewing patients' medical records and interviewing their families.

Results: Patients with congenital hydroceles were more frequently born prematurely (32.5%) than were patients with noncongenital hydroceles (15.9%; *P* =.001). Fathers of 10 patients (3.7%) and brothers of 21 patients (7.7%) also had hydroceles. Hydroceles were associated with inguinal hernias on the same side (12.2%), cryptorchidism (7.5%), varicoceles (6.0%), and testis torsion (0.5%). Among patients aged >1 year (n = 185), 27 did not undergo operations and healed spontaneously at an average of 5.30 ± 3.36 months. For children aged >1 year who did not undergo surgery, the rate of spontaneous recovery within 6 months was 77.8% and that within 1 year was 96.3%.

Conclusion: Until strong evidence of hydrocele-induced testicular damage in children arises, we recommend following up congenital hydroceles until at least 1 year and preferably 2 years of age.We recommend following up noncongenital hydroceles for at least 6 months and preferably 1 year if there is no associated pathology indicating the need for earlier surgery such as an inguinal hernia, cryptorchidism, tense hydrocele, testis torsion, or testicular mass.

Keywords: congenital hydrocele, communicating hydrocele

Introduction

A hydrocele is a benign pathology defined as an accumulation of fluid in the tunica vaginalis. The reported incidence of hydroceles in neonates is 4.7% [1]. Most cases of pediatric hydroceles are present at birth and are referred to as congenital hydroceles; those that occur later in life are referred to as noncongenital or acquired [2]. Some noncongenital hydroceles are associated with a history of infection [2, 3], trauma [2, 4], a testicular tumor [2], inguinal surgery [2, 3, 5], testis torsion [2], or surgical treatment of a varicocele [6]. Hydroceles can also be divided into noncommunicating and communicating hydroceles according to connection to the abdomen via a patent processusvaginalis [2, 7].

Most reports of hydroceles involve adults; very few articles have discussed hydroceles in pediatric patients [1, 3, 5, 8, 9]. Although surgeons have reached a consensus on conservative treatment of hydroceles in children aged <1 year, the management of hydroceles in older children remains controversial. Although some authors advise surgery for patients aged >1 year [4, 8], recent articles advise older age thresholds [10, 11] or a period of observation [1, 3] before deciding whether to perform surgery. Osifo and Osaigbovo1 discussed only congenital hydroceles and advised observation for 18 months. Christensen *et al* [3] discussed only newonset hydroceles in children aged >1 year and recommended 6-12 months of observation before deciding whether to perform repair. Koski *et al* [9] evaluated communicating hydroceles and observed spontaneous resolution; they therefore advised observation of communicating hydroceles.

Only 1 article [4] reviewed all hydrocele types and reported the findings and management of each; the authors observed a spontaneous resolution rate of 89% during the first 12 months. To the best of our knowledge, however, no study has analyzed all hydrocele types in children and discussed the management strategies for each in light of recent recommendations regarding conservative treatment. We focused on spontaneous resolution of hydroceles and the period required for resolution to avoid unnecessary surgical intervention after 1 year of age.

Materials and Methods

This study was approved by our Institutional Review Board and Ethics Committee.We retrospectively reviewed 355 patients aged <18 years with a diagnosis nof a hydrocele who were admitted to our Hospital in Department of Surgery from 2017 to 2020. Although our Hospital is a tertiary care referral center, it accepts direct admissions, and most patients are admitted without first being handled by primary care pediatricians. We searched for relevant cases in a case record using the diagnostic code for hydrocele and the surgical notes for hydrocele. A questionnaire was prepared to review the epidemiological factors for

hydroceles as cited in the literature2-7 and possible outcomes of hydroceles during follow-up or treatment. The medical records of 355 patients were reviewed, and the parents of 274 patients (77%) answered our telephone call and agreed to give detailed information. The data collected included age at diagnosis, time of delivery (term or preterm), presence of hydroceles in the father or brothers (for twins, whether they were monozygotic or dizygotic twins), age at recovery for cases not involving surgery (spontaneous resolution), age at surgery for cases involving surgery, cause of hydrocele (if present), type of hydrocele (communicating, noncommunicating, hydrocele of cord, or abdominoscrotal hydrocele), associated pathologies, treatment applied, and post herniotomy complications. Continuous data are expressed as mean ± standard deviation. The Mann-Whitney U test was used to calculate averages, and the chi-square test was used to compare the data. A *P* value of <.05 was considered statistically significant. All analyses were performed using SPSS Statistics Version 11.0 (SPSS Inc., Chicago, IL).

Results

The mean age at diagnosis was 27.65 ± 35.33 months (range 0-207 months). The age at diagnosis was <1 yearin 47.9% of patients, and <2 years in 62.3% of patients. The average time to resolution with only follow-up was 5.83 ± 4.61 months.. We found that 26% of the patients had been born prematurely. Patients with congenital hydroceles were more frequently born prematurely (32.5%) than were patients with noncongenital hydroceles (15.9%, *P* =.001). Preterm or term birth had no statistical effect on spontaneous resolution of hydroceles (*P* =.803).The fathers of 10 patients (3.7%) and brothers of 21 patients (7.7%) also had hydroceles. No significant difference was found when we compared congenital and noncongenital hydroceles according to their presence in the brothers or fathers (*P* =.182 and.354, respectively).The twin brother of 12 of 34 twins also had hydroceles; 6 of them were monozygotic twins, and 6 of them were dizygotic twins. Both twins had hydroceles in 8 of 30 twin pregnancies (26.7%).

Among patients with noncongenital hydroceles, 89 (61.4%) had no etiological factors, whereas 20 (13.8%) had a history of trauma, 14 (9.7%) had a history of infection, 13 (9.0%) had a history of inguinal surgery, 2 (1.4%) had a concurrent testicular tumor, 1 (0.7%) had a history of varicocelectomy, and 6 (4.1%) had other pathologies. Hydroceles were associated with inguinal hernias on the same side (12.2%), cryptorchidism (7.5%), inguinal hernias on the contralateral side (6.0%), varicoceles (6.0%), and testis torsion (0.5%).

We reviewed data at an average of 27.04 ± 12.51 months after the diagnosis. No postoperative complications or recurrence occurred in 91.2% of patients. However, a recurrent inguinal hernia occurred in 5 patients (2.8%), a contralateral inguinal hernia in 4 patients (2.3%) superficial infection in 4 patients (2.3%), a recurrent hydrocele in 3 patients (1.8%), and iatrogenic cryptorchidism in 2 patients (1.1%).

Among the patients aged >1 year (n = 185), 27 did not undergo surgical treatment and healed spontaneously at an average of 5.30 ± 3.36 months.

Patients with congenital hydroceles that spontaneously resolved were admitted at 4.45 ± 6.31 months and exhibited resolution at 10.41 ± 7.75 months. Eighteen of 23 patients (78.3%) with communicating hydroceles underwent operations. Among the remaining 5 patients, the hydroceles resolved within an average of 6.80 ± 5.50 months after diagnosis. Additionally, in 2 patients with cord hydroceles diagnosed at 2 and 6 months, spontaneous resolution occurred at 12 and 9 months, respectively (10 and 3 months after diagnosis, respectively). No hernias were found in any of these patients.

Discussion

In this study, 3.7% of the patients' fathers and 7.7% of the patients' brothers had a history of hydroceles. These ratio provide data regarding family predisposition. However, the ratio of twin brothers with hydroceles was much higher (26.7%), and the distribution of monozygotic and dizygoticvtwins was nearly equal. Thus, we believe that the etiological factors for hydroceles may be more closely related to the prenatal environment than to genetic factors. These prenatal factors might include the hormonal or nutritional status of the mother or chemicals to which the mother was exposed. Similarly, cryptorchidism, another inguinal pathology, is related to the mother's estrogen level during pregnancy [12]; we therefore believe that the hormonal status of the mother may also influence hydrocele development. According to our data, 40.5% of hydroceles were present on the right side. Some other authors have also reported right-sided prominence [5, 7, 8]. Notably, congenital hydroceles tend to be bilateral, whereas noncongenital hydroceles tend to be right-sided. Although Osifo and Osaigbovo[1] also reported bilateral dominance of congenital hydroceles (68.7%), Naji *et al* [4] reported right-sided prominence (52%) before 1 year of age. They stated that right-sided prominence may be due to delayed descent of the right testis [4]. Because our patients with congenital hydrocele displayed bilateral prominence, we believe that the etiology of congenital hydroceles may involve both sides. Such factors may be associated with fetal development (the fetus itself) or prenatal factors to which the fetus is exposed. To the best of our knowledge, no studies have addressed this topic, and further investigation is needed. The right-sided dominance of noncongenital hydroceles may be due to differences in anatomical structures (such as lymphatic drainage routes) between the right and left sides. Similarly, the occurrence of hydroceles after varicocelectomy has been explained by disturbance of lymphatic drainage [6]. We believe that this fact might explain the occurrence of hydroceles after inguinal surgery.

A preterm delivery rate of 28.1% has been reported among patients with congenital hydroceles [1]. We also found a higher ratio of preterm births among patients with congenital hydroceles (32.5%, *P* <.001) and noncongenital hydroceles (15.9%, *P* <.001) than among the Turkish population (11.7%) [13]. this higher ratio may reflect efficiently run neonatal intensive care units and the high ratio of prematurely born children followed by our Pediatricians. Still, we believe that prematurity of a system such as the lymphatic system may influence the development of congenital hydroceles.

In the present study, 38.6% of patients with noncongenital hydroceles had an etiological cause, whereas Christensen *et al*[3] reported that 6.6% of patients aged >1 year had an etiological cause. Christensen *et al* [3] also reported that of the 302 patients, 7 (2.3%) had a viral infection, 5 (1.6%) had a history of trauma, 5 (1.6%) had a history of inguinal surgery, and 3 (1.0%) had epididymitis. Moreover, the ratio

of hydroceles after inguinal hernia surgery in other studies was 0.16%-1.2%. [14, 15] Our high ratio may be due to the detailed questioning of the patients' families in addition to the review of the medical files. With respect to the data extracted from the files, etiological factors may have been less accurately reflected if the data were not noted. In the present study, the ratio of hydroceles caused by varicocelectomy was only 0.7%. We believe that varicocelectomy-induced hydroceles are less common in children than in adults because surgical management of varicoceles is less common in children than in adults. Therefore, we do not believe that the occurrence of hydroceles after varicocelectomy is a major factor among pediatric patients. Nearly 85% of patients aged <1 year have a history of a congenital hydrocele, whereas nearly 70% of patients aged >1 year have a history of a noncongenital hydrocele. It is logical that congenital hydroceles present earlier than noncongenital hydroceles. These results increased in surgical treatment of noncongenital hydroceles because noncongenital hydroceles usually present after 1 year of age, when surgery is advised. Our hydrocele recurrence rate (1.8%) is less than the reported ratios for adults (34.6%) [16]. Lym *et al* [17] reported recurrence of hydroceles or inguinal hernias on the same side in 7% of patients [17]. Our recurrence rate for both hydroceles and inguinal hernias on the same side was 4.6%, which is comparable. Our infection rate was 2.3% compared with 0.0%-1.5% in the pediatric literature [5, 18] and 14.0% in the adult literature [16]. because we completed the survey by telephone, we believe that no cases of recurrence treated surgically at another hospital were missed. Additionally, all patients were called to undergo a control examination on postoperative day 2, and infection treatment was administered to patients with any suspicious findings of surgical infection, such as hyperemia. We believe that our complication rate was more precise than that in previous studies. Naji et a [14] reported that 63% of patients aged <1 year exhibited spontaneous resolution. This ratio was 68.4% in our study. Osifo and Osaigbovo1 reported that 83.4% of congenital hydroceles had spontaneously resolved by the age of 18 months with peak resolution at 4-6 months. Twenty-seven patients aged >1 year did not undergo surgery. These patients healed spontaneously at an average of 5.30 ± 3.36 months. Notably, the overall average time of spontaneous resolution is similar to the average time of spontaneous resolution in patients aged >1 and >2 years. Similarly, Christensen *et al* [3] reported that among patients aged >1 year, 76% of those with noncongenital (acquired) hydroceles exhibited resolution at an average of 5.6 months. In the same study, the spontaneous resolution rate of hydroceles was 93% within 1 year.3 Additionally, Naji *et al* [4] reported that among patients aged 1-5 years, 83% of hydroceles resolved spontaneously. Their reported period of resolution matches our results. Because most of our patients were advised to undergo surgery after 1 year of age, not follow-up, we could not calculate the actual spontaneous resolution ratio. However, we believe that the present data and those of other authors1 [3, 4], are sufficient to advise follow-up.We believe that the follow-up period, not age, should determine whether surgery is performed for noncongenital hydrocele cases. After recognition of a hydrocele, if no other pathology requiring early surgery is present, we recommend waiting at least 6 months and preferably 1 year to decide whether surgery should be performed.

Other authors also recently shared this recommendation [1, 3, 18] However, could waiting for this period of time harm the testes? The pressure within a hydrocele is reportedly greater than the intra-abdominal pressure [19]. Magnetic resonance imaging of adult cases showed that the pressure exerted by the hydrocele decreases the diffusion in the testis [20]. This decrease was found to correlate with the volume of hydrocele, but not with the period of time for which the hydrocele was present [20]. Although significant improvement in diffusion was noted 3 months postoperatively, the authors commented that hydroceles may cause infertility due to decreased diffusion in the testis [20]. the permanent effect of a transiently decreased diffusion on the testis has not been studied. Only Dandapat *et al* [21] studied testis biopsies of 120 adults with unilateral large hydroceles. Histologically, they reported atrophy of the testis in 8% of cases, partial arrest at spermatogenesis in 10%, total arrest of spermatogenesis in 8% disorganized spermatogenic cells in the tubules in 42%, interstitial cell fibrosis in 85%, and thickening of the basement membrane in 78% [21] They found that the period for which the hydrocele was present was correlated with these changes [21]. We believe that it is inappropriate to generalize these results to children with hydroceles because the authors considered only adults with large hydroceles containing >300 mL of fluid (median, 558 mL) and a duration of 2-5 years. They also did not mention exclusion of patients with filariasis. Two studies evaluated testicular biopsies of children with hydroceles. Avolio *et al* [22] showed normal biopsy results in 3 children with abdominoscrotal hydroceles. Politoff *et al* [23] reported negative (normal) testicular biopsy results in 96.4% of patients with no associated pathology such as cryptorchidism, testicular torsion, or varicoceles. The authors concluded that a hydrocele on its own has no effect on fertility [23]. We found no article addressing the long-term follow-up of pediatric patients with hydroceles and believe that additional studies regarding the effect of hydroceles on testis function in children are needed.

This will allow proper assessment of the effect of waiting for the hydrocele to resolve spontaneously. Another issue is the surgical complications of herniotomy. The Guidelines on Pediatric Urology [10] state that there is no evidence that hydroceles are a risk factorfor testicular damage. The same guidelines mentioned that the rate of testicular damage is very low during hydrocele or inguinal hernia repair (0.3%) [10]. After inguinal operations to repair hernias or hydroceles, long-term follow-up examinations revealed a testicular atrophy rate of 0.3%- 1.0%, a decreased testicular volume in 5.8% of cases [5, 24], and a vas deferens injury rate of 0.06%-0.54% [5, 17]. Pathologic examinations also revealed an epididymis injury rate of 0.30%-5.62%, especially during hydrocelectomy [25, 26]. Moreover, there is a possibility of surgery-induced injury to the vas deferens or epididymis that cannot be detected by pathologicexamination [27]. We believe that these risks are higher in children because their anatomy is smaller and their tissues are more fragile than in adults. Therefore, until strong evidence of testicular damage secondary to hydroceles arises, we recommend following up patients with hydroceles for at least 6 months and ideally 1 year to avoid surgery and its complications.

However, high-pressure hydroceles are a different matter. As mentioned previously, increased pressure within a

hydrocele may compromise diffusion of the testis and lead to changes in biopsies in adults [20, 21]. Therefore, we do not believe that children with high-pressure hydroceles should be placed at such risk and thus recommend early surgery at the time of diagnosis, without waiting a period for spontaneous resolution in these cases. Most authors recommend immediate surgery for communicating hydroceles [3, 7]. We also prefer early surgery for communicating hydroceles. However, Koski *et al* [9] instead recommended observation without surgery for communicating hydroceles. They reported a complete resolution rate of 62.7% by a mean age of 11.7 months, whereas only 6 of 174 patients (3.4%) developed hernias during follow-up. [9] Christensen *et al*3 performed immediate surgery for communicating hydroceles in 97% of cases, but they also mentioned that the remaining communicating hydroceles in 5 patients resolved spontaneously. We found that the type of hydrocele does not affect the rate of spontaneous resolution,an observation shared by some other authors [1]. A limitation of this study was associated with documentation. Our ratio of communicating hydroceles (7.2%) is far below previously reported ratios (46.0%-66.5%) [1, 8]. We therefore believe that most cases of communicating hydroceles were documented as noncommunicating hydroceles. Additionally, the ratio of abdominoscrotal hydroceles is 1.25%-3.10% in the literature [22, 28]. However, we found no documented abdominoscrotal hydroceles among our patients. Finally, the size and tenderness of the hydrocele were not noted in some cases. Thus, we could not document these factors. Also, we think that a further prospective study, which observes noncongenital hydroceles for at least 1 year, is needed. This prospective study would give more precise data about spontaneous resolution ratios.

Conclusion

Until strong evidence of hydrocele-induced testicular damage in children arises, we recommend following up congenital hydroceles until at least 1 year of age and preferably 2 years of age. Likewise, we recommend following up noncongenital hydroceles for at least 6 months and preferably 1 year if there is no associated pathology indicating the need for earlier surgery such as an inguinal hernia, cryptorchidism, tense hydrocele, testis torsion, or testis mass. The optimal management of communicating hydroceles is still under debate; close monitoring without surgery may be preferred if no findings of herniation are present.

Conflicts of Interest

There are no conflicts of interest.

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