

## A Review of 2625 Isolated Hydrocele Cases in Children

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### Abstract

**Introduction:** Inguinal hernias and hydroceles are the most frequently performed procedures in pediatric surgery departments. In this study, we aimed to define the spontaneous regression rate in different types of hydroceles, the regression age, the timing of surgery, and the optimal treatment approaches for each hydrocele type in cases with isolated hydroceles in children.

**Materials and Methods:** This historical cohort study included 2625 patients which were admitted between January 2004 and December 2012. The hydroceles were classified as: 'non-communicating hydroceles', 'communicating hydroceles', 'spermatic cord hydroceles' and 'abdomino-scrotal hydroceles' (ASH). Patients were divided into two groups with regard to their ages at diagnosis as follows: those presenting in the newborn period and before 24 months of age (Younger– Group 1) and those presenting after 24 months of age (Older – Group 2). Determining the type of isolated hydrocele, the decision making for follow-up or surgery, and the follow-up period were conducted by 7 attending pediatric surgeons and 6 residents.

**Results:** In Group 1, 93% of 1086 non-communicating hydroceles, 40% of 158 cord hydroceles, and 15% of 34 communicating hydroceles resolved during the follow-up, and the remaining patients with each type of hydrocele underwent surgery. In Group 2, 8.7% of 183 non-communicating hydroceles resolved during the follow-up.

**Conclusion:** The primary treatment of patients with isolated hydrocele should be decided regarding the type of hydrocele, along with age at admission, and accordingly, conservative or surgical treatment should be considered.

### Keywords

- Isolated Hydrocele
- Children
- Surgery

## Introduction

Inguinal hernias and hydroceles are the most frequently performed procedures in pediatric surgery departments. Despite large patient series that have been investigated extensively in the treatment of inguinal hernias in the literature,<sup>1</sup> reports on isolated hydroceles are scarce. Hydrocele is fluid that accumulates around the testicle between layers of the tunica vaginalis.<sup>2</sup> Hydroceles are classified into: communicating in which the processus vaginalis is open and fluid flows freely, non-communicating or otherwise called abdomino-scrotal hydrocele (ASH) and hydrocele of the spermatic cord.<sup>2</sup> Occasionally a hydrocele can expand through the inguinal canal into the retroperitoneum and form an abdomino-scrotal hydrocele.<sup>2</sup> In children hydrocele of the cord may present with a painless mass in the upper scrotum or inguinal canal.<sup>2</sup> In this study, we aimed to define the spontaneous regression rate in the types of hydroceles, the regression age, the timing of surgery, and the optimal treatment approaches for each hydrocele type in cases with isolated hydroceles in children.

## Materials and Methods

This historical cohort was conducted in a tertiary children's hospital after having obtained the approval of the Institutional Review Board. The patients diagnosed with isolated hydroceles between January 2004 and December 2012 were reviewed and a total of 2625 patients were included in the study. The patients who were determined to have been lost to follow-up or operated in other institutions were excluded. All of the patients included in this study were selected from those who had regular follow-up. Determining the type of isolated hydrocele, the decision making for follow-up or surgery, and the follow-up care were conducted by 7 attending pediatric surgeons and 6 residents.

The patients were divided into two groups according to their ages at diagnosis as follows: those presenting in the newborn period and before 24 months (Younger – Group 1) and those presenting after 24 months of age (Older – Group 2). Since current pediatric surgery textbooks suggest operating management of hydrocele by age two, we opted to use this age (2 years old) as a cut-off when determining the age groups.<sup>2</sup> Group 1 included 2028, and Group

2 included 597 patients. The hydrocele types and the course of hydroceles during the follow-up period were investigated. The hydroceles were classified as 'non-communicating hydroceles', 'communicating hydroceles', 'spermatic cord hydroceles' and 'abdomino-scrotal hydroceles'. The diagnosis and the hydrocele types were determined by questioning the parents (whether the swelling changed with physical activity), and physical examination findings. If the fluid in the hydrocele sac was in communication with the abdominal cavity, and parents indicated a variation in the size of swelling, the hydroceles were assumed to be communicating hydroceles, whereas in cases in which the fluid would not shift, and the parents indicated no change in the size of swelling with physical activity, they were considered as non-communicating hydroceles. Indications of surgery, surgical reports and the postoperative courses of the patients were reviewed.

In Group 1, patients with non-communicating hydroceles were re-examined every 3 months during the follow-up period, the mean follow-up period for non-communicating hydroceles was  $29 \pm 9.6$  months. The patients with spermatic cord hydroceles in Group 1 were selected for surgery if the hydrocele persisted at the end of the follow-up period. Elective surgery was planned for the patients with communicating or abdomino-scrotal hydroceles in Group 1.

Since according to the literature patients diagnosed at age two and over should undergo operation, we planned surgical treatment for the patients in Group 2 during the initial visit.

Statistical analysis of the data was carried out using SPSS for Windows version 15 software (SPSS Inc., Chicago, IL, USA). Descriptive statistics included frequencies, numbers and percentages relevant to the patients' data. The differences in variables of each group were compared using the Pearson Chi square test. P values of  $<0.05$  were considered as statistically significant.

## Results

The anatomic sides of the hydroceles in each group have been summarized in [Table 1](#). The types of the hydroceles in group 1 and group 2 have been summarized in [Table 2](#).

**Table 1: Anatomic sides of Hydrocele in groups 1&2**

	Bilateral N (%)	Right N (%)	Left N (%)	Total N (%)
Group 1	1278 (63)	486 (24)	264 (13)	2028 (100)
Group 2	38 (6.3)	354 (59.4)	205 (34.3)	597 (100)
Total	1316 (34.7)	840 (41.6)	469 (23.7)	2625 (100)

**Table 2: Hydrocele typs in group 1 and group 2**

Hydrocele Type	group 1 N (%)	group 2 N (%)
Non-communicating hydrocele	1715 (84.6)	270 (45.8)
Hydrocele of the cord	224 (11)	132 (22.3)
Communicating hydrocele	44 (2.2)	186 (31.2)
Abdomino-scrotal hydrocele	7 (0.4)	4 (0.30)
Others	38 (1.8)	5 (0.83)
Total	2028 (100)	597 (100)

In Group 1, 93% of 1086 non-communicating hydroceles, 40% of 158 cord hydroceles and 15% of 34 communicating hydroceles resolved during the follow-up period. The remaining patients

with each type of hydrocele, and all patients with abdomino-scrotal hydroceles underwent surgery. Spontaneous regression, operative percentages, and regression ages in both groups have been summarized in **Tables 3 and 4**.

The age at spontaneous resolution was different in each hydrocele type in Group 1. The mean resolution age was  $10.5 \pm 6.3$  months for non-communicating hydroceles in Group 1. Of the patients with non-communicating hydroceles in Group 1 whose hydroceles did not resolve during the follow-up and who underwent surgical repair, 21% were bilateral, 53% were right-sided, and 26% were left-sided non-communicating hydroceles. The mean ages were  $9.2 \pm 6.3$  and  $8.8 \pm 6.3$  months for spontaneous resolution of the cord and communicating hydroceles, respectively. Surgery was planned for the patients with cord hydroceles after a short follow-up period depending on the attending surgeon's preference and 40% of those patients showed spontaneous resolution while they were waiting for their elective surgery.

**Table 3: Operation and regression rate**

		Hydrocele typs				Total N (%)
		Abdominoscrotal hydrocele	Communicating hydrocele	Hydrocele of the cord	Noncommunicating hydrocele	
		N (%)	N (%)	N (%)	N (%)	
Group 1	Operation	7 (100)	29 (85)	95 (60)	76 (7)	207 (16)
	Spontaneous regression rate	0	5 (15)	63 (40)	1010 (93)	1078 (84)
	Total	7 (100)	34 (100)	158 (100)	1086 (100)	1285 (100)
Grup 2	Operation	4 (100)	148 (98)	106 (98.1)	167 (91.3)	4250 (96.3)
	Spontaneous regression rate	0	3 (2)	2 (1.9)	16 (8.7)	21 (3.7)
	Total	4 (100)	151 (100)	108 (100)	183 (100)	446 (100)

**Table 4: Spontaneous regression age**

	Hydrocele typs	Spontaneous regression age(month)	Age range
		Mean±SD	(month)
Group 1	Communicating hydrocele	$8.8 \pm 6.3$	2.4 – 15.1
	Hydrocele of the cord	$9.2 \pm 6.3$	2,8 – 15.5
Group 2	Non-communicating hydrocele	$10.5 \pm 6.3$	4.2 -16.9
	Non-communicating hydrocele	$36.1 \pm 10.4$	24.7 – 41.5

Elective surgery was planned for the patients with communicating hydroceles; however, 15% of them resolved while the patients were waiting for surgery. None of the abdomino-scrotal hydroceles showed spontaneous resolution while patients were waiting for elective surgical procedures, and thus they all underwent surgery.

In Group 1, the age at spontaneous resolution ranged from 2.4 -15.1 months in patients with communicating hydroceles; 2.8- 15.5 months in those with cord hydroceles and 4.2 -16.9 months in those with non-communicating hydroceles **Table 4**. Patients with bilateral or unilateral hydroceles demonstrated a statistically significant difference in terms of spontaneous resolution in Group 1. Of patients who displayed spontaneous resolution of non-communicating hydroceles in Group 1, 70% were bilateral, 18% were right-sided, and 12% were left-sided non-communicating hydrocele. In Group1 spontaneous resolution was significantly more frequent in bilateral hydroceles when compared to one sided hydroceles ( $P=0.018$ ). However, there was no significant difference between right-sided and left-sided hydroceles, in terms of resolution ( $P>0.05$ ). Although spontaneous resolution of hydrocele occurred in most of the patients with non-communicating hydroceles in Group 1, some patients presented again with ipsilateral inguinal hernia in the follow-up period. In follow-up, inguinal hernias were identified in 1.1% and communicating hydroceles were identified in 1.2% of patients with the initial diagnosis of non-communicating hydroceles. Ipsilateral inguinal hernias were detected in 1.5% of patients with cord hydroceles in the follow-up period.

As mentioned previously; elective surgery was scheduled for patients in Group 2. The mean age at surgery was  $59.1 \pm 14.6$  months in cases with non-communicating hydroceles,  $73.6 \pm 12.7$  months in those with communicating hydroceles,  $48 \pm 10.4$  months in those with cord hydroceles, and  $29 \pm 4.2$  months in the ones with abdomino-scrotal hydroceles. Elective surgery was postponed in some patients since they were not eligible (due to comorbid respiratory system infections, anemia, etc.). In Group 2, 8.7% of 183 non-communicating hydroceles resolved at a mean age of

months while the patients were waiting  $10.4 \pm 36.1$  to be eligible for elective surgery. All cases with abdomino-scrotal hydroceles in Group 2 underwent surgery. Skin incisions in the inguinal region were made in all patients who underwent surgery. Five patients (0.3%) in Group 1 and two patients (0.4%) in Group 2 had recurrence after surgery. Recurrent hydroceles were observed after surgery in four patients with non-communicating hydroceles, and inguinal hernia was seen in one patient with non-communicating hydrocele after surgery. The hydroceles recurred in two cases following procedures performed for abdomino-scrotal hydroceles, and those patients underwent revision procedures

### Discussion

Hydrocele surgery is one of the most frequently performed operations in pediatric surgery.<sup>3</sup> They mostly occur on the right side and are usually bilateral.<sup>2</sup>In our study, bilateral hydroceles were more prevalent in Group 1 **Table 1**, and this finding was consistent with the literature.<sup>(2, 4, 5)</sup> In the literature there are diverse opinions regarding the time of hydrocele operation. It was reported that hydroceles persisting beyond 6 months did not resolve spontaneously.<sup>6</sup> In a recent study published in 2015, all congenital hydroceles that persisted after 1 year of age had been treated surgically.<sup>7</sup> Controversially two studies recommend delaying hydrocele surgery until two years of age.<sup>(8, 9)</sup> Similarly, two international pediatric surgery organizations (International Pediatric Endosurgery Group and European Society for Pediatric Urology) have recommended surgical treatment of the non-communicating hydroceles after two years of age.<sup>(10, 11)</sup>

In our study, in 93% of group1 patients hydroceles resolved spontaneously at a mean age of  $10.5 \pm 6.3$  months. Of the patients with non-communicating hydrocele, 59% had resolved before the age of 12 months. The resolution of hydrocele occurred before 16.9 months of age in 95% of patients, and in 98% of the patients' hydroceles resolved by 24 months of age.

Although it is recommended to perform surgery in non-communicating hydroceles without any delay in patients older than two years,<sup>(4, 5, 8, 9)</sup> in our

study 1.4% of hydroceles in patients in group 1 and 8.7% in group 2, resolved spontaneously after two years of age. In group 1, spontaneous resolution was observed at 72 months of age in a patient in whom surgery had been postponed due to comorbid diseases. The mean spontaneous resolution age in 8.7% of non-communicating hydroceles was  $36.1 \pm 10.4$  months. Therefore, we suggest an additional six months follow up for patients over two years in whom hydrocele has not completely disappeared who have had considerable decrease in size of their hydroceles.

According to recent studies<sup>12</sup>, conservative management has become the treatment of choice, even in cases of communicating hydroceles. The conservative approach was suggested for the first time for communicating hydroceles in a study that included 174 patients under the age of 18 months, and the authors reported a spontaneous resolution rate of 63%.<sup>13</sup> In two recent studies, communicating hydroceles underwent operation after 12 months of age.<sup>(14, 15)</sup> In our study, the mean spontaneous resolution age of communicating hydroceles was  $8.8 \pm 6.3$  months, and the maximum age for resolution was 18 months. Resolution of hydrocele was observed before 15.1 months in 95% of patients with communicating hydroceles. Patent processus vaginalis ensuring fluid passage was observed in all patients with communicating hydroceles during surgery and high ligation was performed. We suggest follow up of these patients until they are at least 18 months of age. Since the communicating hydroceles did not show significant spontaneous regression until elective surgery, we suggest surgical treatment without any delay for patients with communicating hydroceles in Group 2.

The timing of surgery and the duration of follow-up for cord hydrocele are not clear in the literature. It has been proposed that most of the cord hydroceles resolve spontaneously during infancy.<sup>12</sup> Since cord hydroceles may be closely related to indirect inguinal hernias, some authors suggest operating cord hydroceles as soon as they are diagnosed, even if they disappear.<sup>16</sup> In a study including 27 cord hydroceles, 20 patients had surgery, and ipsilateral inguinal hernias were observed in 14 (70%) patients.<sup>17</sup> In our study, more than 95% of the

patients that had surgery for cord hydroceles had accompanying patent processus vaginalis. Two out of three patients had persistent cord hydroceles, and one patient's hydrocele resolved during the follow-up period of 6-12 months.<sup>17</sup> Similarly, in another study including 18 cord hydroceles, 12 (66%) underwent operation and 3 out of 5 (60%) cord hydroceles that were followed-up conservatively resolved spontaneously.<sup>18</sup> In our study, 40% of 158 cord hydroceles spontaneously resolved during the follow-up. It was demonstrated that 34% of surgeons had recommended surgical treatment of cord hydroceles at the time of diagnosis, whereas 50% of surgeons had opted to follow-up the patients until they were 1 year of age.<sup>12</sup> In our study, the rate of resolution of hydrocele is higher than that reported in the literature (40%). At the beginning of our study, there were controversies among the pediatric surgeons in our department regarding the timing of surgery for cord hydroceles. However, by the end of the study, most of the surgeons in the department opted to wait until at least 12 months of age since spontaneous resolution of the cord hydroceles was observed. In Group 2, cord hydroceles after the age of 2 years did not show significant resolution; therefore, we suggest operating patients with cord hydroceles who present after the age of 2 without any delay.

Although ASH is a benign entity, it has been reported that para-testicular malignant mesotheliomas may develop from ASH.<sup>19</sup> In addition, hydroureteronephrosis, lymphedema, appendicitis, hemorrhage, infection, cryptorchidism and cross-ectopic testis have been reported secondary to ASH.<sup>(19, 20)</sup> We did not encounter any of the aforementioned complications in our ASH cases, however postoperative recurrence was observed in two patients; one of which needed surgery. The most frequent possible cause of ASH recurrence is inadequate exposure, and ligation of the processus vaginalis.<sup>21</sup>

Some ASH cases may progress to adulthood,<sup>20</sup> and spontaneous or partial resolution (only abdominal part resolution) has been demonstrated.<sup>22</sup> A study conducted in 2014 indicated that ASH diagnosed in the newborn period regressed significantly by 4 months of age.<sup>23</sup> However, none of ASHs in either

of the two groups of our study resolved until the scheduled date for surgery, and all patients with ASH underwent surgery.

Only a few studies investigated isolated hydroceles in children, and postoperative complication rates were reported in even fewer studies. Various studies concerning adult hydroceles demonstrated higher complication rates ranging between 17.5 and 40%,<sup>24</sup> and recurrence rates ranging between 1.3 and 7% following hydrocele surgery.<sup>25</sup> In this study,

recurrence was observed in 5 patients (0.3%) in Group 1, and in 2 patients (0.4%) in Group 2.

In conclusion, the primary treatment modality in patients with isolated hydrocele should be selected as conservative or surgical according to the hydrocele type and age of the patient at the time of diagnosis. The cut-off age of 2 years for surgery suggested in the literature may not be a certain threshold for surgical decision making, and may change according to the hydrocele type and age at diagnosis.

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