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The Role of Additional Epididymis Resection during Hydrocelectomy: Is It of Any Benefit in Comparison to Simple Hydrocelectomy?

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Abstract

Introduction: Open hydrocelectomy via scrotal incision is the standard approach for secondary hydroceles. Traditionally, the Swiss urologic community offer hydrocelectomy with additional resection of the epididymis in elderly men with completed family planning. It is believed that the additional resection of the epididymis reduces the postoperative recurrence rate of hydroceles. However, there is no evidence supporting this theory. Therefore, the aim of this study was to compare the recurrence and complication rates for patients with secondary hydroceles undergoing either pure hydrocelectomy (puH) or hydrocelectomy with additional resection of the epididymis (HRE). ***Materials and Methods:*** We reviewed all male patients who underwent surgical therapy for secondary hydroceles between May 2003 and February 2019 at our institution. Patient's baseline and perioperative characteristics as well as postoperative characteristics including complications and recurrence rates were gathered and compared between different surgical techniques. ***Results:*** A total of 234 patients were identified. puH was performed in 93 (40%) cases and HRE in 141 (60%) patients. Patients in the HRE group were older (median age: 62 vs. 38 years, $p < 0.001$), had a higher ASA-Score ($p < 0.001$), were more often on platelet aggregation inhibitors (19% vs. 7.5%, $p = 0.01$), and had a longer median operative time (75 vs. 64 min, $p < 0.001$). During a median follow-up of 46 months, a similar number of recurrent hydroceles were found for puH (7 [7.5%]) and HRE (6 [4.5%]) ($p = 0.3$). Complications were observed in 19 (20%) cases after puH compared to 25 (18%) cases after HRE ($p = 0.6$). Patients after puH experienced more often severe complications (Clavien-Dindo Grade 3b) compared to the HRE group (5 vs. 12%, $p = 0.046$). ***Conclusion:*** puH and HRE showed similar results in terms of overall low recurrence rates and also in terms of postoperative complications, even though patients who underwent puH experienced slightly higher severe complications. Both procedures are safe and effective, but it seems that HRE does not provide a relevant clinical benefit in comparison to puH for the management of men with secondary hydroceles.

Introduction

A secondary or acquired hydrocele is the most common form of hydrocele in adults, and in most cases, no underlying cause can be found (idiopathic hydroceles).

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Rarely secondary hydroceles arise from local trauma, previous groin, or scrotal surgery or other rare causes [1–5]. Secondary hydroceles require only treatment if a patient is symptomatic and a simple resection of the hydrocele sac (hydrocelectomy) is permanently curative in 94–99% of all cases [6, 7].

However, while hydrocelectomy is the gold standard technique worldwide for any secondary hydroceles, an additional resection of the epididymis in men with completed family planning has historically become common in the Swiss urologic community. The rationale for this procedure arises from the hypothesis that a potential, concomitant chronic inflammation of the epididymis maintains a hydrocele and may even promote its recurrence. Despite some studies on surgical outcome in terms of recurrence and complication rates between various hydrocelectomy techniques [6–10], no studies investigated the impact of a chronic epididymis inflammation on recurrence rates. Furthermore, no study has compared hydrocelectomy alone (puH) and hydrocelectomy with additional resection of the epididymis (HRE) in adult men with secondary hydrocele so far.

The aim of the present study was to compare the outcome (recurrence and complications) of puH in comparison to HRE. We hypothesized that patients undergoing HRE would have a lower rate of recurrence in comparison to patients undergoing puH.

Materials and Methods

We retrospectively reviewed data from a consecutive cohort of patients who underwent hydrocelectomy due to secondary hydrocele between May 2003 and February 2019 in our tertiary urological department at the University Hospital of Zurich, Switzerland. Patients were identified by retrieving the International Classification of Disease (ICD-10) code for hydrocele from the electronic patient chart. All male patients suffering from secondary hydrocele treated by either puH or HRE were included for analysis. Exclusion criteria were primary/hereditary hydrocele, follow-up less than 30 days, and age under 18 years.

The primary objective of this study was to compare the rate of recurrence between the two different surgical procedures. Recurrence was defined as a new onset of a hydrocele on the treated side within the follow-up period. The secondary objective was to compare the complication rates between the two surgical procedures. Complications were recorded within the first 30 days after surgery, and the severity of complications was assessed using the Clavien-Dindo classification [11].

The assessment of preoperative patient characteristics included age, American Society of Anesthesiologists classification (ASA), diseases associated with immunosuppression (organ transplant recipient, diabetes, human immunodeficiency virus, autoimmune or rheumatoid disease, regular use of steroid medication), anticoagulation/platelet aggregation medication, the hydrocele side, and etiology. The following perioperative characteristics were noted: side of surgery, operation time, and the need for drainage placement. Postoperative characteristics included histology of the removed epididymis, length of hospital stay, complications, recurrence, time until recurrence, need for reintervention, and follow-up time.

All patients who were treated by puH underwent hydrocele resection using the technique of von Bergmann [12]: In brief, an incision of the hydrocele sac was done after complete mobilization of the hydrocele. A partial resection of the hydrocele sac was then performed, leaving a margin of 1–2 cm, which was finally sutured to ensure hemostasis. In the HRE group, patients underwent complete excision of the hydrocele sac followed by removal of the epididymis. Drainage at the end of the procedure was at the surgeons' preference but not mandatory.

All patients received a single-shot intraoperative antibiotic therapy. Patients treated with anticoagulant medications discontinued these 5–7 days before surgery and were bridged using subcutaneous low-molecular-weight heparins. Platelet aggregation inhibitors as primary prevention were discontinued, while those for secondary prevention were maintained. The postoperative follow-up was not standardized and was performed at the surgeon's discretion, according to the patient's complaints or desire, or in the context of other urological diseases.

Fisher's exact test and Pearson's χ^2 test were used to assess associations between categorical variables, while Mann-Whitney U test was used to assess differences in continuous variables between the two surgical techniques. All tests were two-sided and a p value <0.05 was considered as statistically significant. All statistical analyses were performed using R (Version 4.0.3, Vienna, Austria, 2020).

Results

A total of 571 patients were identified. After applying the inclusion and exclusion criteria, 234 patients remained for the final analysis. Of these, 93 (40%) underwent puH and 141 (60%) HRE. Bilateral surgery was performed in 11 (12%) and 27 (19%) patients who underwent puH and HRE, respectively. Baseline characteristics of all patients and stratified by surgical procedure are summarized in Table 1. Patients who underwent HRE showed a significantly higher median age ($p < 0.001$) and a higher ASA score ($p < 0.001$) were more frequent under platelet aggregation inhibition ($p = 0.01$) and experienced a longer surgery duration ($p < 0.001$). Histologic examination of the surgically removed epididymis in the HRE group was available for 77 (55%) HRE patients and revealed that chronic inflammation was present in 49 (64%) of these patients.

During a median follow-up of 46 months, a total of 13 (5.5%) recurrent hydroceles were observed. A total of 7 (7.5%) recurrences were seen in the puH and 6 (4.5%) in the HRE group ($p = 0.3$). Of the 77 patients with available histologic epididymis examination, 2 (4%) of the 49 patients with chronic inflammation experienced recur-

Table 1. Clinical and therapeutic characteristics of 234 patients treated with hydrocelectomy for secondary hydrocele stratified by the surgical procedure

Characteristic	Overall (n = 234)	Type of surgery		
		hydrocelectomy alone, (n = 93)	hydrocelectomy and epididymectomy, (n = 141)	p value
Age, years	55 (40, 65)	38 (27, 49)	62 (53, 69)	**<0.001**
ASA				
1	23 (20)	16 (42)	7 (9)	**<0.001**
2	69 (61)	22 (58)	47 (62)	
3	22 (19)	0 (0)	22 (29)	
Missing	120	55	65	
Immunosuppression				
Autoimmune disease	4 (1.5)	0 (0)	4 (3)	0.2
Diabetes	1 (0.5)	0 (0)	1 (0.5)	
Organ transplanted	3 (1.5)	0 (0)	3 (2)	
Steroid medication	9 (4)	2 (2)	7 (5)	
Anticoagulation medication	16 (7)	4 (4.5)	12 (8.5)	0.2
Platelet aggregation medication	34 (15)	7 (7.5)	27 (19)	**0.01**
Side of hydrocele				
Left	88 (38)	43 (46)	45 (32)	0.06
Right	108 (46)	39 (42)	69 (49)	
Bilateral	38 (16)	11 (12)	27 (19)	
Etiology of hydrocele				
Idiopathic	171 (73)	66 (71)	105 (74)	0.15
Local inflammatory processes	36 (15)	12 (13)	24 (17)	
Previous surgery (e.g., varicocele surgery, previous scrotal surgery, inguinal hernia repair)	21 (9)	10 (11)	11 (8)	
Trauma	3 (1.5)	2 (2)	1 (1)	
Inguinal comorbidities (e.g., hernia, cryptorchidism)	3 (1.5)	3 (3)	0 (0)	
Side of surgery				
Bilateral	4 (2)	1 (1)	3 (2)	>0.9
Unilateral	230 (98)	92 (99)	138 (98)	
Surgery duration, min	70 (50, 90)	64 (50, 80)	75 (56, 95)	**<0.001**
Drainage insertion	62 (26)	26 (28)	36 (26)	0.7
Histology of epididymis specimen				
Chronic inflammation	–	–	49 (64)	–
No chronic inflammation	–	–	28 (36)	
Missing	–	–	64	
Duration of inpatient stay, days	5 (4, 6)	4 (4, 6)	5 (4, 6)	0.2
Follow-up, months	46 (6, 101)	60 (3, 103)	44 (14, 98)	>0.9

Data are presented as median (IQR) or n (%). Mann-Whitney U test, Pearson's χ^2 test, and Fisher's exact test.

rence. An overview of the characteristics of patients who experienced recurrence stratified by the surgical procedure is given in Table 2.

Overall, 44 (19%) patients showed postoperative complications, 19 (20%) in the puH group, and 25 (18%) in the HRE group (p = 0.6). Characteristics of complications for the two groups are shown in Table 3. Patients who experienced postoperative complications did not differ in immunosuppression status or in the use of anticoagulation or antiplatelet medication between groups (p = 0.6, p > 0.9, and p = 0.4, respectively). Hematoma was the most common complication seen (n = 25; 10.5%), followed by local infection (n = 8; 3.5%), wound dehiscence (n = 7; 3%), prolonged postoperative pain (n = 3; 1.5%), and scrotal edema (n = 1; 0.5%). No difference in the type of complication was found between the two groups. A significant difference in the severity of complications was found between groups, with increased Clavien-Dindo 3b complications in patients undergoing puH (11 [12%] patients in the puH and 7 [5%] patients in the HRE group; p = 0.046).

Table 2. Recurrence rate of 234 patients treated with hydrocelectomy for secondary hydrocele and characteristics of patients with recurrence (*n* = 13), stratified by the surgical procedure

Characteristic	Hydrocelectomy alone	Hydrocelectomy and epididymectomy	*p* value
All patients (*n* = 234)			
Patients	93 (100)	141 (100)	
Recurrence	7 (7.5)	6 (4.5)	0.3
Patients with recurrence (*n* = 13)			
Patients	7 (100)	6 (100)	
Duration until recurrence, months	1 (1, 6)	4 (2, 12)	0.5
Resurgery performed for recurrence	4 (57)	4 (67)	>0.9
Etiology of hydrocele			
Idiopathic	6 (86)	3 (50)	0.4
Local inflammatory processes	1 (14)	1 (17)	
Previous surgery	0 (0)	2 (33)	

Data are presented as median (IQR) or *n* (%). Mann-Whitney U test, Pearson's χ^2 test; and Fisher's exact test.

Table 3. Complication rate of 234 patients treated with hydrocelectomy for secondary hydrocele and characteristics of patients with postoperative complications (*n* = 44), stratified by the surgical procedure

Characteristic	Hydrocelectomy alone	Hydrocelectomy and epididymectomy	*p* value
All patients (*n* = 234)			
Patients	93 (100)	141 (100)	
Complications	19 (20)	25 (18)	0.6
Type of complications			
Hematoma	13 (14)	12 (8.5)	0.2
Infection	4 (4.5)	4 (3)	0.7
Wound dehiscence	1 (1)	6 (4.5)	0.2
Prolonged pain	1 (1)	2 (1.5)	>0.9
Scrotal edema	0 (0)	1 (0.5)	>0.9
Clavien-Dindo classification			
1	4 (4.5)	10 (7)	0.4
2	2 (2)	5 (3.5)	0.7
3a	2 (2)	3 (2)	>0.9
3b	11 (12)	7 (5)	**0.046**
Patients with complications (*n* = 44)			
Patients	19 (100)	25 (100)	
Immunosuppression	1 (5.5)	3 (12)	0.6
Anticoagulation medication	2 (11)	2 (8)	>0.9
Platelet aggregation medication	2 (11)	6 (24)	0.4
Drainage insertion	10 (53)	9 (36)	0.3

Data are presented as *n* (%). Mann-Whitney U test, Pearson's χ^2 test, and Fisher's exact test.

Discussion

A secondary hydrocele results from an imbalance between fluid production and reabsorption in the cavum serosum testis in which a constant turnover of fluid occurs [13]. It is known that the parietal layer of the tunica vaginalis testis has well-defined vessels of the lymphatic vascular system in healthy male [3]. Previous studies have shown that in patients suffering from secondary hydrocele, these lymphatic channels are usually damaged, lead-

ing to reduced reabsorption of fluid by the tunica vaginalis testis [2, 14]. Özdilek [2] and colleagues further postulated that in the acute form, there is initially an overproduction of fluid, and in the chronic hydrocele, it is increasingly a case of improper reabsorption. To date, however, the causes and maintenance of the acute and chronic secondary hydroceles have not been fully identified, and there is no evidence on the underlying cause of its recurrences after surgical treatment; it is postulated that inflammation, micro- or macrotrauma, or iatrogenic causes (e.g., after inguinal surgery) may be responsible [13]. Moreover, Campbell [15] noted back in 1927 during hydrocele surgery that the epididymis was "rarely normal." He described an enlargement and chronic induration, fibrosis, scarring, and atrophy of the epididymis, which may indicate the epididymis as a possible player in this pathogenesis, providing a rational to perform an additional epididymectomy. However, to date, no association between chronic epididymitis and the pathophysiology of secondary hydrocele has been studied or described.

To the best of our knowledge, the present study is the first to investigate the impact of additional removal of the epididymis after hydrocele sac resection on the recurrence rate and postoperative complications. We were not able to confirm our hypothesis and found no differences between the surgical procedures in terms of recurrence and complication rates. Of note, we found a significant higher rate of severe complications in patients after puH in comparison to HRE.

Up to date, several studies aimed to investigate the recurrence rates of hydroceles between different surgical techniques [6, 7, 9]. Tsai et al. [7], who described the largest cohort of patients who underwent different surgical techniques for hydrocele repair, demonstrated a similar recurrence rate of 6% as found in our study. Little is known about the etiology of recurrent hydroceles and inflammatory processes of the epididymis have been postulated to be partly responsible for the development, maintenance, and recurrence of hydroceles [4, 5]. Therefore, we examined the histologic findings of epididymal specimens from the HRE group, which revealed chronic inflammation of the epididymis in 64% of patients. The fact that 4% of these patients experienced recurrence, further underlines our findings, that a chronic inflammation of the epididymis has only a partial influence on hydrocele recurrence.

The complication rates of various surgical hydrocele resection techniques have been investigated in several studies [6, 7, 9, 10]. However, complication rates after hydrocele resection in these studies vary from 15% to 92%, which is due to the different definitions of complications (e.g., the severity of scrotal edema, including recurrences). For the main complications hematoma and infection, a more homogeneous complication rate of 7.5–16% is reported, which is also in line with our findings. Interestingly, we observed an increased incidence of severe complications (need of reintervention) after puH in comparison to HRE. One possible explanation might be that the group of puH had more complex and/or larger hydroceles, suggested by the higher rate of intraoperative drain insertion in this group. Still we can note that additional removal of the epididymis, which is related to an increased tissue dissection, even in older patients with a higher ASA score and an increased use of platelet aggregation inhibitors, was not associated with more or severe complications.

Our study has limitations. First, the retrospective study design is associated with different treatment patterns, different surgeons with different expertise, and a nonstandardized follow-up. Second, the rate of our endpoints, recurrence and complications, is low, resulting in limited statistical power using direct comparison between groups. Moreover, the small number of events further precludes regression analysis to identify risk factors by adjustment for potential confounders. Third, we had no information on the impact of additional epididymal removal on semen quality, as this procedure was only performed if family planning was completed. Since this is especially important in young patients, a postoperative semen analysis would be warranted in case of future studies in this field. However, despite all the mentioned limitations, this cohort is still one of the largest in the current literature.

Conclusion

In the present study, we found that puH and HRE for the treatment of secondary hydroceles showed similar recurrence and complication rates, with however slightly higher rate of severe complications in the puH group. We conclude that both procedures are safe and effective, but it seems that HRE does not provide a relevant clinical benefit in comparison to puH for the management of men with symptomatic hydroceles.

Statement of Ethics

All patients treated and enrolled in the study after 2014 signed a general consent that their medical data can be used for research. For patients treated and enrolled in the study before 2014, there is

an exemption from requiring written informed consent. This exemption, the use of medical data from patients who signed a general consent as well as the study protocol was approved by the Local Ethics Committee (Ethics Committee of the Canton of Zurich; approval number BASEC-Nr. 2019-02447). The research was conducted ethically in accordance with the World Medical Association Declaration of Helsinki.

Conflict of Interest Statement

All authors have no conflict of interest and nothing to disclose.

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Author Contributions

Nico C. Grossmann and Natalia Gröbli: conception, data acquisition, interpretation and analysis of data, and manuscript drafting. Noémie Lautenbach and Andres Affentranger: data acquisition and manuscript editing. Daniel Eberli and Tullio Sulser: interpretation and analysis of data and manuscript editing. Thomas Hermanns and Cédric Poyet: conception, interpretation and analysis of data, manuscript editing, and supervision. All authors read and approved the final version of the manuscript and agree to be responsible for all aspects of the work.

Data Availability Statement

The data that support the findings of this study are not publicly available due to information that could compromise the privacy of research participants but are available from the corresponding author on reasonable request.

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