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Published in:
European Urology Open Science

DOI (link to publication from Publisher):
[10.1016/j.euros.2023.09.005](https://doi.org/10.1016/j.euros.2023.09.005)

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Publication date:
2023

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Forss, M., Bolsunovskyi, K., Lee, Y., Kilpeläinen, T. P., Aoki, Y., Gudjonsson, S., Hervé, F., Järvinen, P., Malde, S., Miyazawa, K., Sairanen, J., Sander, L., Violette, P. D., Witte, L. P. W., Guyatt, G. H., & Tikkinen, K. A. O. (2023). Practice Variation in the Management of Adult Hydroceles: A Multinational Survey. *European Urology Open Science*, 58, 1-7. <https://doi.org/10.1016/j.euros.2023.09.005>

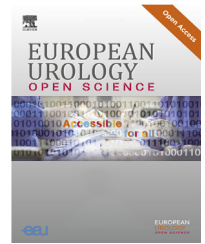
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European Association of Urology



Reconstructive Urology

Practice Variation in the Management of Adult Hydroceles: A Multinational Survey

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Article info

Article history:

Accepted September 14, 2023

Associate Editor:

Véronique Phé

Keywords:

Hydrocele
Physicians' practice patterns
Practice variation
Surgical procedures, operative
Survey
Treatment outcome

Abstract

Background: Although hydrocele is one of the most common urologic pathologies, it is seldom studied, and the major urologic associations have no guidelines for the management of adult hydroceles.

Objective: To characterize international practice variation in the treatment of adult hydroceles.

Design, setting, and participants: An international survey was conducted addressing the management of hydroceles among urologists in Belgium, Denmark, Finland, Iceland, Japan, and the Netherlands from September to December 2020. We invited a random sample of 170 urologists from each country (except Iceland).

Outcome measurements and statistical analysis: Urologists' treatment options, factors relevant for decision-making, expected patient satisfaction, and outcomes after aspiration versus surgery were assessed.

Results and limitations: Of the 864 urologists contacted, 437 (51%) participated. Of the respondents, 202 (53%) performed both hydrocelectomies and aspiration, 147 (39%) performed hydrocelectomies only, and 30 (8%) performed aspiration only. In Belgium (83%), the Netherlands (75%), and Denmark (55%), urologists primarily performed hydrocelectomies only, whereas in Finland (84%), Japan (61%), and

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Iceland (91%), urologists performed both hydrocelectomies and aspiration. Urologists favored hydrocelectomy for large hydroceles (78.8% vs 37.5% for small), younger patients (66.0% for patients <50 yr vs 41.2% for ≥ 70 yr), patients with few or no comorbidities (62.3% vs 23.1% with multiple comorbidities), and patients without antithrombotic agents (53.5% vs 36.5% with antithrombotic agents). Most urologists considered patient satisfaction to be highest after hydrocelectomy (53.8% vs 9.9% after aspiration) despite believing that hydrocelectomy is more likely to cause complications (hematoma 77.8% vs 8.8% after aspiration). Estimates varied between countries.

Conclusions: We found a large variation in the treatment of adult hydroceles within and between countries. Optimization of hydrocele management globally will require future studies.

Patient summary: Our international survey shows that treatment of adult hydrocele varies considerably within and between countries.

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1. Introduction

Hydrocele is a common and bothersome condition in adults [1]. A recent Swedish study found an annual incidence of 60 per 100 000 [2], suggesting that there may be >100 000 new cases of hydroceles every year in the European Union alone. Owing to these large numbers, the associated surgical treatment hydrocelectomy is one of the most common urologic procedures. Despite its frequency, investigators have conducted little research on the benefits and harms of different treatments of hydroceles.

When hydroceles cause symptoms that are sufficiently bothersome to patients, these warrant treatment. Treatment options include aspiration (we will refer to aspiration with or without sclerotherapy, unless otherwise specified) and surgery (hydrocelectomy) [3–5]. A Cochrane meta-analysis published in 2014 identified four randomized trials including 275 patients comparing aspiration with sclerotherapy to surgery. Pooled results showed more hydrocele recurrences after aspiration with sclerotherapy (49.5%) than after surgery (4.3%; risk ratio [RR] 9.4, 95% confidence interval [CI] 1.8–48.8). On the contrary, evidence suggested fewer complications, such as infections, after aspiration with sclerotherapy than after surgery (1.3% vs 8.3%; RR 0.3, 95% CI 0.1–1.1) [6]. In a recent observational study of >800 patients undergoing hydrocelectomy, one in six patients had moderate or severe surgical complications within 90 d after surgery [7].

Despite their frequency, major urologic associations, including the European Association of Urology and the American Urological Association, have no practice guidelines for the management of adult hydroceles. Owing to a lack of high-quality evidence and guidelines, we hypothesized that there exists substantial practice variation in the management of hydroceles between and within countries. To explore current practice patterns, we conducted an international survey addressing the management of hydroceles among urologists.

2. Materials and methods

2.1. Survey

We surveyed practicing urology consultants and residents in the Netherlands, Japan, Iceland, Finland, Denmark, and Belgium (the French-speaking association) between October and December 2020. We identified urologists from the registers of the national urologic associations in all countries except Denmark, where we directly contacted the 11 major urology departments of which seven participated (*Supplementary material*). We chose the six participating countries on the basis of a likelihood that we could obtain a representative sample of urologists, supported by the comprehensive lists of urologists available from these countries. In Japan, the ethics committee (The Research Ethics Committee of University of Fukui, #20200133) gave approval for conducting the survey. In all other countries, the survey was exempted from an ethical review. The reporting of the survey conforms to the STROBE and CHERRIES checklists [8,9].

An experienced, international group of clinicians and methodologists generated and drafted the questionnaire. Subsequently, three urologists from each of the six participating countries pilot tested and reviewed the questionnaire, and provided feedback related to its structure and content. Third, three hydrocele patients reviewed the questionnaire and provided feedback. We created the final version by incorporating all feedback.

The questionnaire consisted of 21 questions in four sections: (1) respondent characteristics, (2) questions regarding practice patterns of aspiration (with or without sclerotherapy), (3) questions regarding practice patterns of surgery (hydrocelectomy), and (4) decision-making and expected outcomes between aspiration and surgery (*Table 1*). Questions addressed the frequency of use of the treatment options, factors potentially relevant for decision-making between aspiration and surgery (including the size of hydrocele [according to the urologists' own view], patient age, comorbidities, and use of antithrombotic agents) and expected patient satisfaction and outcomes (including the risk of complications and recurrence) after treatment (*Supplementary material*).

We randomly selected 170 urologists from each country to participate in the survey. We estimated that approximately half of the urologists invited would participate. Considering each country, with approximately 85 participants per country, one achieves 95% CI of

Table 1 – Selected ^a questions from the survey

| Question | Response options |
|--|---|
| 4. Have you participated in the diagnostics and/or treatment of adult male hydroceles during the last 24 mo? | Yes/no |
| 5. In your clinical work during the last 24 mo, did you perform aspiration (with or without sclerotherapy) or supervise aspiration (with or without sclerotherapy) performed by residents? | Yes/no |
| 6. When you perform aspiration, how often do you also perform sclerotherapy? (Choose the closest option) | Always/75% of cases/50% of cases/25% of cases/never |
| 14. In your clinical work during the last 24 mo, did you perform hydrocele surgery (hydrocelectomy) or supervise hydrocele surgery performed by residents? | Yes/no |
| 16. Do you typically administer prophylactic (ie, preventive) antibiotics before and/or after surgery (hydrocelectomy)? | Yes/no |
| 21. After which procedure do you think patients are more satisfied? | Aspiration with or without sclerotherapy/no difference/surgery (hydrocelectomy) |

^a Full questionnaire is available in the [Supplementary material](#).

approximately $\pm 10\%$ in the case of the most extreme variation in the binary outcome (when 50% agree and 50% disagree with an option). We considered this precision sufficient. This number of invited urologists ($n = 170$ per country) was also close to maximum in the smaller participating countries (Finland and Denmark). In Iceland, we surveyed all 14 practicing urologists who belonged to the national association. Altogether we sent the survey to 864 urologists.

In the Netherlands, Iceland, Denmark, and Belgium, participants received, through an e-mail, a link to an electronic survey created with Survey Monkey (San Mateo, California, USA); in Japan, all received a mail survey; and in Finland, as part of a formal study, we randomized half of the urologists to a mail and half to an electronic survey [10].

Respondents received the closed, voluntary survey up to three times (without monetary incentives). The electronic survey group received a link to survey via an e-mail (with the possibility to review/change responses). One week before the first round, we sent a notification e-mail about the upcoming survey. Participants received the first round in October 2020, the second round in November 2020, and the final reminders in December 2020.

2.2. Statistical analysis

We used descriptive statistics to characterize the sample and examine the distribution of key outcomes. We reported several choices as counts and percentages with calculated 95% CIs, and constructed a logistic regression model to explore the factors associated with whether urologists perform aspiration, including (1) country, (2) position as a urologist (consultant or resident), (3) age (<50 or ≥ 50 yr), and (4) gender as independent variables in the model. Our model had eight degrees of freedom, and due to a high number of respondents, we had no overfitting problem [11,12]. We calculated correlations and conditional probabilities to study how beliefs regarding the outcomes of patients are related to treatments that urologists perform. We performed all analyses using SPSS version 27 (IBM Corp, Armonk, New York, USA).

3. Results

3.1. Respondents

Of the 864 urologists contacted, 437 (51%) replied. The highest response rate was in Iceland (79%), followed by Finland (72%), Japan (59%), the Netherlands (45%), Denmark (45%), and Belgium (29%). Of the 437 respondents, 393 (90%) had participated in the management of adult male hydroceles in the past 24 mo and were therefore included in further analyses; we refer to them subsequently as “urologists” (Table 2). We found no significant differences in the

age distributions of participating urologists between countries. Of the 393 urologists, 368 (93.6%) answered to all questions related to decision-making and outcomes (questions 20 and 21 in the survey; see the [Supplementary material](#)). In all other questions of the survey, data completeness was even higher and $>99.5\%$ in the key questions (questions 5 and 14). The proportion of urologists performing aspiration only, hydrocelectomy only, or both did not differ by the response round ([Supplementary Fig. 1](#)).

3.2. Operations performed

Of the urologists, 61.8% (95% CI 56.8–66.7) had performed aspiration and 90.8% (95% CI 87.5–93.5) hydrocelectomy in the past 24 mo. Results showed large practice variation between and within countries: in Belgium, the Netherlands, and Denmark, most urologists performed only hydrocelectomies, while in Iceland, Finland, and Japan, most urologists performed both procedures ([Fig. 1](#) and [Supplementary Table 21](#)).

Belgian urologists were least likely to perform aspiration, whereas Finnish urologists were most likely to perform it ([Table 3](#)). Urologists' age and position were not associated with performing aspiration, but male urologists were more likely to perform aspiration than female urologists.

3.3. Aspiration

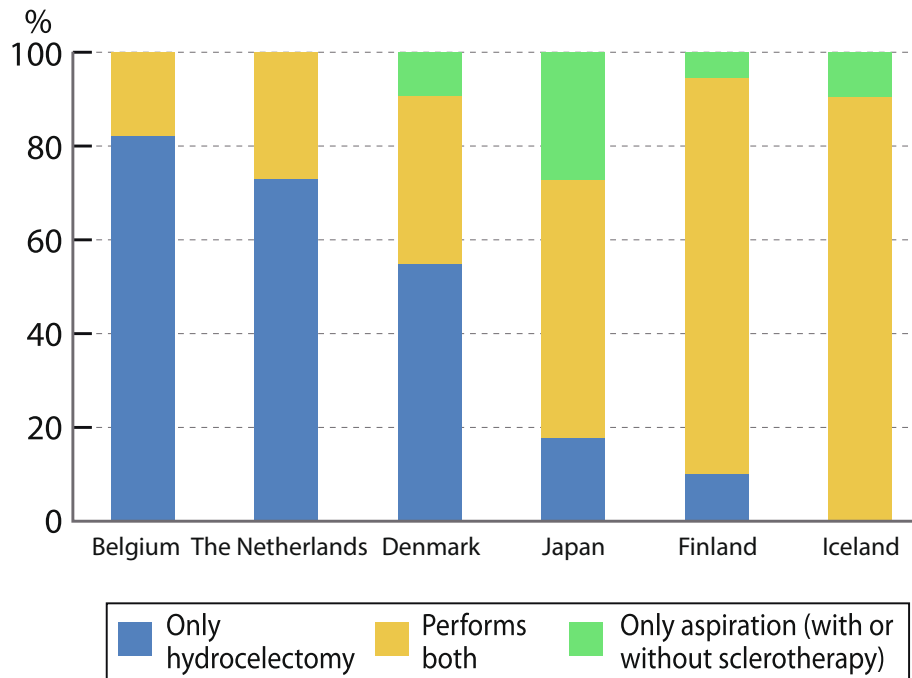
In countries other than Japan, 77.8% (95% CI 70.8–83.8) of urologists who performed aspiration also performed sclerotherapy in at least 50% of the cases ([Supplementary Table 2](#)); this was only 2.7% (95% CI 0.3–9.4%) in Japan. The most used sclerosant was lauromacrogol/polidocanol (Aethoxyskerol; 65.5%, 95% CI 57.7–72.7; [Supplementary material](#); data heavily influenced by Finnish urologists' responses). Of the urologists, 58.3% (95% CI 51.8–64.6) did not routinely follow up with patients after aspiration, 26.7% (95% CI 21.2–32.7) never repeated aspiration before performing surgery, and 38.8% (95% CI 32.6–45.2) repeated aspiration once ([Supplementary Tables 5 and 6](#)).

3.4. Hydrocelectomy

Of the urologists, 47.9% (170/355, 95% CI 42.6–53.2) did not typically follow up with patients after hydrocelectomy. Follow-up through appointment was most common in Bel-

Table 2 – Baseline characteristics of the respondents by country (in percentages)

| | Age (yr) | | | | Male (vs female) (%) | Consultant (vs resident) (%) | Response rate (%) |
|-----------------|----------|-----------|-----------|---------|-------------------------|---------------------------------|----------------------|
| | <30 (%) | 30–49 (%) | 50–69 (%) | ≥70 (%) | | | |
| Belgium | 7 | 59 | 33 | 2 | 78 | 91 | 29 |
| Denmark | 5 | 68 | 25 | 2 | 56 | 54 | 45 |
| Finland | 0 | 64 | 36 | 1 | 75 | 81 | 72 |
| Iceland | 0 | 36 | 45 | 18 | 100 | 100 | 79 |
| Japan | 3 | 44 | 47 | 6 | 91 | 92 | 59 |
| The Netherlands | 0 | 68 | 32 | 0 | 56 | 83 | 45 |
| Total | 2 | 59 | 36 | 3 | 73 | 82 | 51 |

**Fig. 1 – Methods urologists use to treat adult male hydroceles.****Table 3 – Logistic regression model to predict whether a urologist performs aspiration**

| Variable | Odds ratio | 95% confidence intervals | | p value |
|--|------------|--------------------------|-------|---------|
| | | Lower | Upper | |
| Gender (reference: female) | | | | |
| Male | 2.40 | 1.31 | 4.41 | 0.005 |
| Position (reference: resident/in training) | | | | |
| Consultant/staff | 1.73 | 0.83 | 3.51 | 0.144 |
| Age (reference: ≥50) | | | | |
| <50 | 0.68 | 0.37 | 1.24 | 0.204 |
| Country (reference: Denmark) ^a | | | | |
| Belgium | 0.15 | 0.06 | 0.42 | <0.001 |
| Finland | 8.50 | 3.73 | 19.37 | <0.001 |
| Japan | 3.35 | 1.47 | 7.67 | 0.004 |
| Netherlands | 0.34 | 0.15 | 0.75 | 0.008 |

^a Iceland was excluded from the regression analysis due to small sample size.

gium (97.8%, 95% CI 88.5–100.0%); no urologist reported follow-up via appointment in Finland ([Supplementary material](#)). Winkelmann's (Jaboulay's/eversion) technique was the most popular (66.4%, 95% CI 61.2–71.3) surgical method ([Supplementary Tables 10 and 11](#)).

3.5. Antibiotic prophylaxis

Finland and Japan were the only countries with significant use of prophylactic antibiotics with aspiration ([Supplementary material](#)). There were considerable differences between

countries in the use of antibiotic prophylaxis with surgery: 98.5% (95% CI 91.7–100.0) of Japanese urologists typically prescribed antibiotics before or after the surgery, or both, compared with only 1.4% (95% CI 0.0–7.5%) in the Netherlands (Supplementary Tables 4 and 9).

3.6. Decision-making and outcomes

Overall, urologists favored hydrocelectomy for large hydroceles (78.8% vs 37.5% for small), younger patients (66.0% for patients <50 yr vs 41.2% for ≥ 70 yr), patients with few or no comorbidities (62.3% vs 23.1% for those with multiple comorbidities), and patients without antithrombotic agents (53.5% vs 36.5% for patients with antithrombotic agents; Fig. 2). Urologists preferred aspiration for patients with multiple comorbidities (64.3% vs 12.0% without multiple comorbidities; Fig. 2 and Supplementary Tables 12–15). Chance cannot easily explain any of these differences (all $p < 0.01$).

Urologists were more likely to prefer different treatment methods based on patient characteristics in countries where a higher proportion of urologists performed both aspiration and surgery. The most notable change in urologists' treatment preferences was associated with the existence of comorbidities: preference for aspiration in the case of no comorbidities proved 12.0% (95% CI 8.9–15.7), compared with 63.8% (95% CI 58.8–68.7) for patients with comorbidities (Supplementary Tables 14 and 15).

Approximately half of the urologists (53.8%, 95% CI 48.6–58.9) considered patients to be more satisfied after hydrocelectomy, whereas only 10.0% (95% CI 7.1–13.5) believed that satisfaction is higher after aspiration (Fig. 3 and Supplementary Table 16).

Urologists thought that hydrocelectomy is more likely to cause complications: 77.8% (95% CI 73.3–81.9) believed that hematoma is more likely after surgery, while 8.8% (95% CI 6.2–12.2) believed that it is more common after aspiration. Corresponding figures for the likelihood of infection were 44.5% (95% CI 39.4–49.7) for surgery and 18.5% (95% CI 14.7–22.8) for aspiration (Supplementary Tables 17 and 18). Most urologists (91.7%, 95% CI 88.4–94.3) thought that recurrence is more common after aspiration than after hydrocelectomy, with very little variation between countries (Supplementary Table 19). Urologists who performed both operations were more likely to be indifferent regarding which method leads to higher patient satisfaction than the urologists who performed hydrocelectomies only (45.8% vs 19.9%; Fig. 3 and Supplementary Table 21).

4. Discussion

This large-scale multinational survey identified large practice variation in the treatment of hydroceles. Approximately half of the urologists reported that they performed both hydrocelectomies and aspiration; 39% reported performing

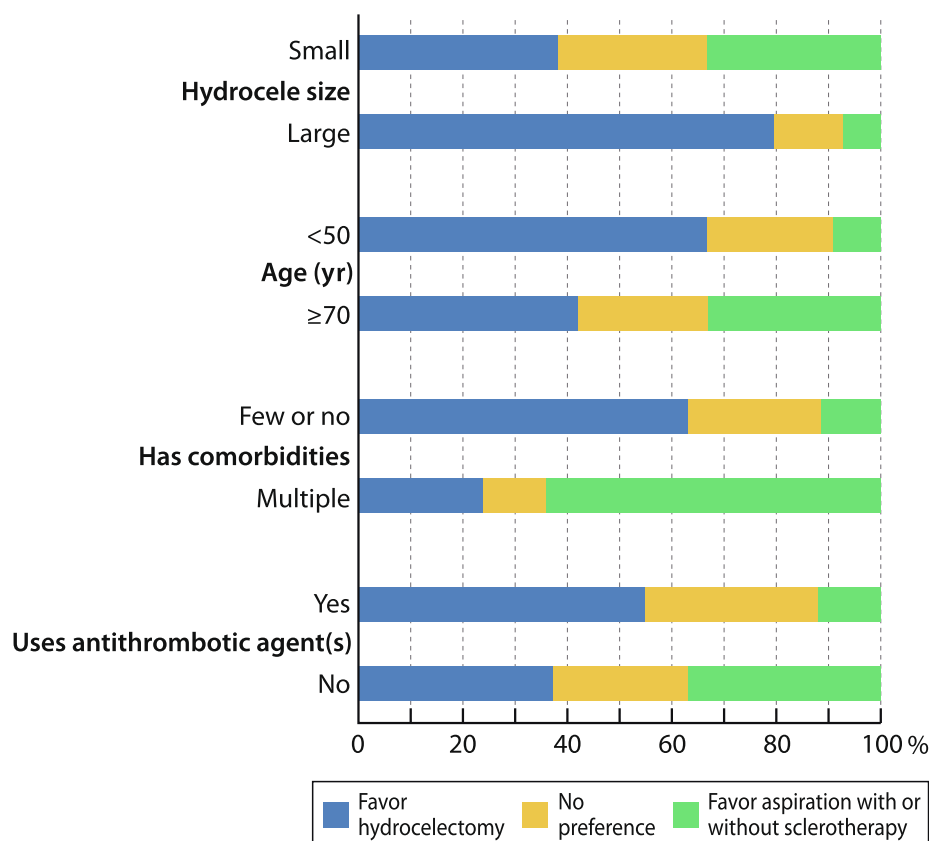


Fig. 2 – Treatment preferences with different patient characteristics.

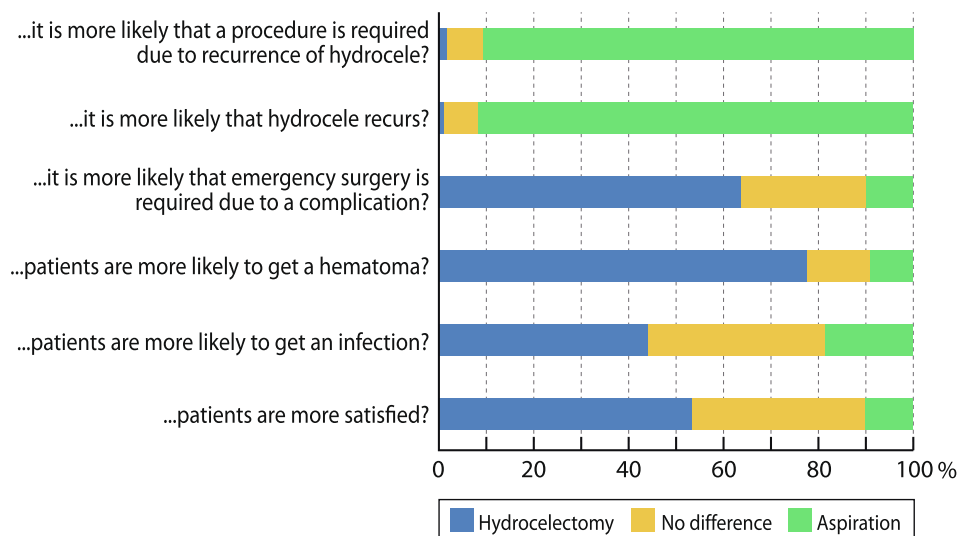


Fig. 3 – Urologists' beliefs over outcomes after hydrocelectomy/aspiration.

only hydrocelectomies, and 8% only aspiration. In Belgium (83%), the Netherlands (75%), and Denmark (55%), urologists primarily performed hydrocelectomies only, whereas in Finland (84%), Japan (61%), and Iceland (91%), most respondents performed both hydrocelectomies and aspiration. We also found large variation in the practices of antibiotic prophylaxis, postintervention follow-ups, as well as technical aspects of both surgery and aspiration sclerotherapy. Finally, urologists' management decisions by patient characteristics and urologists' beliefs regarding treatment outcomes varied widely.

4.1. Comparison with other studies

We are not aware of any previous studies surveying adult hydrocele treatment practices internationally or previous studies examining urologists' beliefs regarding comparative effectiveness of different treatment options. Evidence regarding treatment options' risks and benefits is also limited [6].

4.2. Strengths and limitations

The strengths of our survey include our enrolling a representative cohort of urologists, randomly identified from the registries of national urologic societies of Belgium, Finland, Iceland, Japan, and the Netherlands. We carefully prepared the survey with several pilots with a variety of stakeholders, were comprehensive in the questions related with management of the hydroceles that we asked, and achieved satisfactory (51%) and very high completeness of questionnaire responses. Furthermore, responses were largely similar by response round, suggesting limited if any selection bias.

Our study also has limitations. First, how urologists practice in a real-life setting might differ from their responses to our study. Second, generalization to jurisdictions beyond the six that we included remains uncertain. In particular, all the countries that participated in the survey are high-

income countries (from Europe and Asia; none from Africa, Americas, or Oceania), potentially limiting the applicability of the results to lower-income countries. Additionally, we lack knowledge regarding whether treatment decisions are influenced by the distinction between public and private treatment contexts. Finally, we do not have detailed insights regarding potential confounding factors of clinical decision-making, including different reimbursement strategies and availability of operating theaters.

4.3. Implications of findings

The survey showed hydrocelectomy to be more popular than aspiration in treating adult male hydroceles. We identified, however, a considerable variation within and between countries. Indeed, the country of residence was a significant predictor for whether a urologist performs aspiration. Practices also varied regarding (1) how aspiration and hydrocelectomy were conducted, (2) whether sclerotherapy is used with aspiration, (3) how many times aspiration is repeated, (4) whether antibiotics are used and when, as well as (5) how the patients are followed up.

The paucity of prior research and lack of clear guidelines could explain the large variation in treatment. Establishing optimal approaches to practice will require future prospective trials, studies on values and preferences, as well as systematic reviews and clinical practice guidelines.

Urologists' beliefs over outcomes were correlated with their treatment preference. This could mean that the favored clinical tradition in a country was supported by positive beliefs about the treatment method. Overall, we found a very large variation in several steps of management of adult hydroceles within and between countries. To delineate optimal practice, future studies, including randomized trials, and studies on patients' values and preferences (not the focus of current study), as well as systematic reviews and guidelines will be necessary. Additionally, we support the Cochrane review's recommendation that cost effectiveness studies should be conducted [6]. Earlier studies

showed that aspiration sclerotherapy is cheaper than surgery in the short term [2–4]. However, the paucity of studies with long-term follow-up hinders the optimal assessment of cost effectiveness.

5. Conclusions

We conducted an international survey among urologists to characterize practice variation in the treatment of adult hydroceles. The survey showed hydrocelectomy to be more popular than aspiration. There was considerable variation between countries in treatment practices. Practices also varied regarding how aspiration and hydrocelectomy were conducted, use of sclerotherapy, use of antibiotic prophylaxis, and postintervention follow-up of patients. The lack of research on adult hydrocele management and paucity of guidelines may explain varying practices.

Author contributions: Mikko Forss and Kari A. O. Tikkinen had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Forss, Bolsunovskiy, Lee, Kilpeläinen, Guyatt, Tikkinen.

Acquisition of data: Forss, Bolsunovskiy, Aoki, Gudjonsson, Hervé, Miyazawa, Sander, Witte, Tikkinen.

Analysis and interpretation of data: All authors.

Drafting of the manuscript: Forss, Kilpeläinen, Tikkinen.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Forss, Guyatt, Tikkinen.

Obtaining funding: Tikkinen.

Administrative, technical, or material support: Forss, Tikkinen.

Supervision: Kilpeläinen, Guyatt, Tikkinen.

Other: None.

Financial disclosures: Mikko Forss and Kari A.O. Tikkinen certify that all conflicts of interest, including specific financial interests and relationships and affiliations relevant to the subject matter or materials discussed in the manuscript (eg, employment/affiliation, grants or funding, consultancies, honoraria, stock ownership or options, expert testimony, royalties, or patents filed, received, or pending), are the following: François Hervé received speaker honoraria; is a company consultant for Astellas, Coloplast, Hollister, Medtronic, and Ferring; and received research grants from Astellas. Petrus Järvinen is a shareholder of Osgenic. Mikko Forss, Kostiantyn Bolsunovskiy, Yung Lee, Tuomas P. Kilpeläinen, Yoshitaka Aoki, Sigurdur Gudjonsson, Sachin Malde, Katsuhito Miyazawa, Jukka Sairanen, Lotte Sander, Philippe D. Violette, Lambertus P.W. Witte, Gordon H. Guyatt and Kari A.O. Tikkinen declare no financial conflict of interest.

Funding/Support and role of the sponsor: This work was supported by the Competitive Research Funding of the Helsinki University Hospital (TYH2020248; TYH2022330) and Sigrid Jusélius Foundation. Open access funded by Helsinki University Library. The sponsors had no role in the

analysis and interpretation of the data or the manuscript preparation, review, or approval.

Acknowledgments: We would like to thank the Finnish Urological Association, the French-speaking Urological Association of Belgium, the Dutch Urological Association, the Icelandic Urological Association, the Japanese Urological Association, as well as the seven Danish urology departments that participated in the survey (Supplementary material). We would also like to thank research nurses Katja Kiianlinna, Merja Rignell, and Paula Saari for their support in conducting the survey and recording the data.

Ethics statement: In Japan, the ethics committee (The Research Ethics Committee of University of Fukui, #20200133) gave approval for conducting the survey. In all other countries, the survey was exempted from an ethical review.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.euro.2023.09.005>.

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