

©Copyright: the Author(s), 2026
Licensee PAGEPress, Italy

Patent processus vaginalis in pediatric communicating hydroceles: to ligate or not to ligate

Emmanuel Nwangwu, Obinna Anikwe, Vincent Enemu, Sebastian Ekenze, Uchechukwu Ezomike, Elochukwu Nwankwo

Department of Pediatric Surgery, College of Medicine, University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu, Nigeria

Abstract

High ligation of the Patent Processus Vaginalis (PPV) is conventionally performed for communicating hydroceles, as it is believed to decrease the likelihood of recurrence. The objective of this study was to compare complication rates in children who had excision and ligation of PPV and those who had excision without ligation of PPV during surgery for communicating hydrocele. The study was a prospective randomized study of children with communicating hydroceles. Participants were randomized into two groups: ligation and non-ligation. Post-operative complications were systematically documented. Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) (IBM Corp.; Armonk, USA) version 21. Results were presented as percentages and in tabular form. Student's t-test was applied for comparisons of quantitative variables, while the chi-square test was used for qualitative variables. A p-value of less than 0.05 was considered statistically significant. Sixty-eight patients (65 males) with 70 communicating hydroceles (two bilateral hydroceles) aged 1 to 15 years were included. Three patients had scrotal hematoma (4.3%). Of these, 2 (2.9%) occurred in the non-ligation group and 1 (1.4%) in the ligation group ($p=0.56$). The scrotal hematoma resolved over 14-21 days. The mean duration of surgery for the non-ligation group was 32.8 ± 5.1 minutes; for the ligation group, it was 34.4 ± 9.8 minutes, and they were comparable ($p=0.394$). There was no recurrence and no development of an inguinal hernia. There is no significant difference in complication rates between the ligation and non-ligation of a patent processus vaginalis in pediatric communicating hydroceles.

Key words: communicating hydrocele, non-ligation, ligation, patent processus vaginalis; pediatric.

Correspondence: Elochukwu Nwankwo, Department of Pediatric Surgery, College of Medicine, University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu, Nigeria. E-mail: elochukwu.nwankwo@unn.edu.ng

Introduction

Surgical treatment of communicating hydroceles is one of the common procedures performed by pediatric surgeons.¹⁻⁴ The underlying embryological abnormality is the persistent patency of the processus vaginalis after birth. Traditionally, one of the essential components of surgical treatment for pediatric communicating hydroceles has been high ligation of the patent processus vaginalis.^{5,6}

High ligation of the patent processus vaginalis is considered essential to prevent recurrence after surgery for communicating hydrocele and inguinal hernia.⁷ However, several studies suggest that ligation of the patent processus vaginalis may not be necessary in adults and may even contribute to increased post-operative wound pain.⁷⁻¹⁰

Some studies have found no significant difference in hernia recurrence rates between cases in which the patent processus vaginalis is simply transected without ligation and those in which ligation is performed.^{8,11,12} This is attributed to the rapid closure of peritoneal defects by the differentiation of *in situ* mesodermal cells.¹³

There is a paucity of publications on the effect of non-ligation of the patent processus vaginalis for herniotomy in our setting. The present study was undertaken to serve as a benchmark for further studies on the topic in our environment. We hypothesize that non-ligation of the patent processus vaginalis does not increase compli-

cation rates following surgery in children with communicating hydroceles. Therefore, this study aimed to compare the effect of non-ligation and ligation of the patent processus vaginalis on post-operative complications following surgery for communicating hydroceles.

Materials and Methods

A prospective randomized study was conducted at the University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu, Nigeria. The hospital is a 500-bedded tertiary facility located in South-Eastern Nigeria. The study lasted from September 1, 2016 to December 31, 2017, and participants were pediatric patients aged between 1 and 15 years who underwent surgery for communicating hydrocele. Ethical clearance was obtained from the University of Nigeria Teaching Hospital Research and Ethics Committee, with approval number NHREC/05/01/2008B-FWA00002458-1RB00002323. The purpose and nature of the research were explicitly explained to each parent or caregiver, both verbally and in writing, with opportunities to ask questions before they provided written informed consent. They were assured that they were free to withdraw from the study at any time. Participants who met the inclusion criteria were grouped into 3: 1 to 5 years, 6 to 10 years, and 11 to 15 years. Patients were consecutively enrolled in the study.

Sampling and randomization

The required sample size was calculated using the formula for determining the sample size for two independent means:¹⁴

$$n=2[(Z\alpha + Z\beta)\delta/d]^2$$

where: n= estimated sample size for each group; Zα= the probability of making a type I error, =5% (that is, 95% confidence level) =1.96; Zβ= the probability of making a type II error, =20% (that is, power of 80%) =0.84; d= estimated significant difference to be detected between the two means =5; δ= standard deviation =7 (from pilot study); $n=2[(1.96+0.84(7/5)]^2=30.7=31$ (approx)

With 10% attrition rate being 3.1= 3 (approx)
 $n=31+3=34$
Hence, the total sample size, 2n=68

Participants who met the study criteria were recruited consecutively. A research assistant conducted simple random sampling using a double-blind approach. Sixty-eight sealed envelopes were prepared: 34 containing folded papers labeled A and 34 containing folded papers labeled B. Group A (the study group) consisted of patients who underwent surgery without ligation of the patent processus vaginalis; Group B (the control group) included those who had ligation of the patent processus vaginalis. The envelopes were mixed thoroughly in a bag before a participant picked one, and the process was repeated for every patient to maintain randomization. After it was picked, the envelope was not returned to the bag.

In the study group, the sac was transected at the level of the internal ring without ligation; in the control group, ligation followed transection of the PPV. The duration of surgery (from skin incision to completion of skin closure) was recorded. Patients were followed up at one week, one month, three-month, and six-month intervals post-operatively. At the first visit, patients were assessed for early wound complications (hematoma and surgical site infection); in subsequent visits, assessment for recurrent hydrocele and inguinal hernia was performed. Diagnosis of recurrent hydrocele and inguinal hernia was based on history and physical examination. Participants who were unable to return to the outpatient clinics were contacted by telephone and assessed. If complications were suspected or reported, hospital visits were advised.

Information regarding age, sex, parent or guardian’s phone number, duration of surgery, and post-operative wound complications was recorded. Data were entered into and analyzed using the Statistical Package for Social Sciences (SPSS) (IBM Corp.; Armonk, USA) version 21.0. Means and standard deviations for both participants’ age and surgery duration were calculated for each group. To determine whether there were significant differences between the groups, Student’s t-test was used to compare the mean age and mean duration of surgery. The normality of the data distribution was assessed beforehand to ensure the validity of the

t-test results. The chi-square test was used to evaluate the relationship between the surgical approach to the hydrocele sac and the occurrence of postoperative complications in the two groups. Before applying the chi-square test, expected cell counts were checked to confirm the suitability of the test. For all statistical analyses, a p-value of less than 0.05 was considered significant.

This study adhered to the CONSORT guidelines for Randomized Controlled Trials (RCTs) to ensure completeness, transparency, and methodological rigor in reporting.

Results

A total of 68 pediatric patients were included in the study, with 70 cases of communicating hydroceles, as two patients had bilateral involvement. Three patients (4.4%) were female, and 65 patients (95.6%) were male. The overall mean age of the participants was 5.0±3.6 years, range 1-15 years. The mean ages of the participants in group A (non-ligation group) and group B (ligation group) were 5.0±3.7 years (range: 1-15 years) and 4.9±3.7 years (range: 1-14 years), respectively. The majority of participants in both groups were between 1 and 5 years, accounting for 62.9% (group A) and 60.0% (group B). The largest proportion of participants in both the non-ligation and ligation groups fell within the 1-5 years age range, accounting for 62.9% and 60.0% of each group, respectively. In contrast, the smallest proportion in both groups was observed in the 11-15 year age category (Table 1).

The overall mean duration of surgery was 33.8±7.8 minutes. The mean duration of surgery for the non-ligation group was 32.8±5.1, and 34.4±9.8 minutes for the ligation group; however, this difference in means was not statistically significant (p=0.394).

Post-operative complications were observed in 3 (4.3%) patients within the first post-operative week and all were scrotal hematomas. Two cases (2.9%) of post-operative hematomas occurred in the non-ligation group, and one (1.4%) in the ligation group (p=0.56). All hematomas resolved spontaneously within four weeks (Table 2).

Discussion

This study was designed to compare the outcomes among children who had ligation and excision of patent processus vaginalis and those who had excision without ligation of patent processus vaginalis during surgery for communicating hydrocele. The duration of surgery in each group was also assessed.

The finding that there were more patients within the age range of 1 and 5 years corresponds with those of Tyler *et al.*,¹⁵ Parveen *et al.*,¹⁶ and Koranga *et al.*¹⁷ The predominance of males corresponds with published literature indicating that pathologies associated with patent processus vaginalis are more common in males.^{18,19}

Table 1. Age distribution of the patients between the two groups.

Age (years)	Ligation (n=35; %)	Non-ligation (n=35; %)	p
1-5	22; 62.9	21; 60	0.96
6-10	9; 25.7	10; 28.6	
11-15	4; 11.4	4; 11.4	
Mean age ± SD	5.03±3.7	4.9±3.7	0.97

SD, Standard deviation.

The majority of the patients in this study had right-sided hydroceles, which resonates with earlier reports on children with hydroceles.²⁰⁻²² The later descent of the right testis during development is thought to contribute to this. The non-ligation group had a shorter mean duration of surgery and aligns with the observations of Pant *et al.*²³ and Rafiei *et al.*²⁴ that non-ligation of patent processus vaginalis reduces the operation time, hence, the duration under general anesthesia. In a retrospective study involving 3208 orchidopexies, Salimi *et al.*²⁵ discovered that non-ligation of patent processus vaginalis resulted in a significant reduction in operation time.

Scrotal hematoma was the only complication observed in this study. This suggests that non-ligation of the hydrocele sac does not increase the risk of hematoma or surgical site infection. A similar finding was reported by Omid *et al.*,¹⁸ Tabrizan *et al.*,¹² Mohta *et al.*,²⁶ and Kishwar *et al.*²⁷ In a prospective study of 104 cases of groin surgeries, Rafiei *et al.*²⁴ reported three cases of scrotal hematoma in the non-ligation group and two cases of hematoma in the ligation group, similar to the pattern observed in the present study. Mohta *et al.*²⁶ found that of 50 pediatric groin surgeries, no postoperative scrotal hematoma was recorded, supporting the argument that the transected processus vaginalis does not predispose patients to scrotal hematoma if it is not ligated.

The finding that there was no post-operative inguinal hernia or recurrent hydroceles in both groups contrasts with Omid *et al.*¹⁸ and Slamini *et al.*²⁵ Omid *et al.* noted a 5.0% incidence of post-operative hydrocele in their non-ligation group and 4.0% in the ligation group. In the same study, there was no incidence of inguinal hernia in the non-ligation group; but there was a 0.5% rate of inguinal hernia in the group that had ligation of the processus vaginalis. Slamini *et al.* reported five cases of post-operative hydrocele, two in the non-ligation group and three in the ligation group, following 2,659 herniotomies in patients with undescended testes. Their finding, however, was not statistically significant.

Kishwar *et al.*²⁷ reported that a post-herniotomy inguinal hernia can occur within 30 days of operation. This study, with a follow-up period of 6 months, agrees with Cecanti *et al.*²⁸ and Kumar *et al.*,¹³ and found no incidence of inguinal hernia or postoperative hydrocele. Likewise, Omid *et al.*¹⁸ and Tabrizan *et al.*¹² reported no incidence of inguinal hernia with non-ligation of PPV after 1 year and 1-3 years of follow-up. One explanation for this could be the fact that a defect created on the peritoneum (in this case, pro-

cessus vaginalis) would close through migration of *in situ* mesodermal cells.¹³

The study is limited by the relatively small sample size and the fact that parts of some of the patients' follow-up were conducted via audio telephone conversations, which might not be as accurate as physical examination during clinic visits. We suggest that further studies involving multiple pediatric surgery centres be conducted with a consequently larger sample size and a possible longer duration of follow-up to confirm the results of this study in our sub-region. From the foregoing, we recommend that non-ligation of the processus vaginalis is a viable alternative, especially when a remnant of the sac inadvertently slips after transection at the level of the deep ring.

Conclusions

No statistically significant differences in clinical outcomes were noted between patients who underwent ligation of the patent processus vaginalis and those who did not. Throughout the follow-up period, neither group experienced surgical site infections, recurrent hydroceles, nor the development of inguinal hernias, indicating comparable safety and efficacy for both surgical approaches. Therefore, ligation of the sac can be safely skipped in pediatric hydrocelectomies.

References

- Musa I, Mu'azu AL, Umar SA, et al. Open inguinal herniotomy: analysis of variations. *Afr J Paediatr Surg* 2015;12:131-5.
- Lau ST, Lee YH, Caty MG. Current management of hernias and hydroceles. *Semin Pediatr Surg* 2007;16:50-7.
- Bonnard A, Aigrain Y. Inguinal hernias in children. *Rev Prat* 2003;53:1667-70.
- Kapur P, Caty MG, Glick PL. Pediatric hernias and hydroceles. *Pediatr Clin North Am* 1998;45:777-89.
- Evan AA, David KO. Selected disorders of genitourinary system. In: Taylor RB (Ed.), "Family medicine: principles and practice". Sixth edition. Springer-Verlog; New York, USA; 2003.
- Kogan BA. Communicating hydrocele/hernia repair in children. *BJU International* 2007;100:703-13.
- Shulman AG, Amid PK, Lichtenstein IL. Ligation of hernia sac. A needless step in adult hernioplasty. *Int Surg* 1993;78:152-3.
- Smedberg SG, Broome AE, Gullmo A. Ligation of hernia sac? *Surg Clin North Am* 1984;64:299-306.
- Othman I, Hady HA. Hernia sac of indirect inguinal hernia: invagination, excision, or ligation? *Hernia* 2014;18:199-204.
- Delikoukos S, Lavant L, Hlias G, et al. The role of hernia sac ligation in post-operative pain in patients with elective tension-free indirect inguinal hernia repair: a prospective randomized

Table 2. Diagnosis of the patients.

Diagnosis	Frequency
Right hydrocele	41
Left hydrocele	25
Bilateral hydrocele	2

Table 3. Outcomes of the study.

Outcome	Ligation (n=35; %)	Non-ligation (n=35; %)	p
Scrotal hematoma	2	1	0.56
Surgical site infection	-	-	-
Hydrocele	-	-	-
Hernia	-	-	-
Mean duration of surgery (minutes)	32.8	34.4	0.39

- study. *Hernia* 2007;11:425-8.
11. Riquelme M, Aranda A, Riquelme QM. Laparoscopic pediatric inguinal hernia repair: no ligation, just resection. *J Laparoendosc Adv Surg Tech* 2010;20:77-80.
12. Tabrizian F, Raisolsadat SM, Houshmand B, Yaghubi MA. Assessment of necessity of sac high ligation in inguinal hernia open surgery among children. *J Pediatr Surg* 2013;48:547-9.
13. Kumari V, Biswas N, Mitra N, et al. Is ligation of hernia sac during orchidopexy mandatory? *J Indian Assoc Pediatr Surg* 2009;14:66-7.
14. Frieman LM, Furberg CD, Demets DL. Sample size. In: "Fundamentals of clinical trials". Springer Sciences; New York, USA; 2010.
15. Tyler C, Patrick CC, Catherine D, Brent WS. New onset hydroceles in boys over 1 year of age. *Int J Urol* 2006;13:1425-7.
16. Parveen Z, Khan S, Sultana S, et al. Pattern of children presenting with inguinal hernia and hydrocele – Experience in a tertiary level hospital. *JAFMC Bangladesh* 2017;3:46-50.
17. Koranga H, Chandrasekaran R. A study of clinical evaluation and management of inguinoscrotal swelling in paediatric age group. *Int J Surg* 2018;5:2097-102.
18. Omid A, Diana ND, Vahid M. New technique for herniotomy in children: a clinical trial. *Advances in Surgical Sciences* 2014;2:1-4.
19. Natasha F, Behrouz B. Pediatric hydrocele: a comprehensive review. *Clin Surg* 2017;2:1448.
20. Prabakaran S, Kasthuri TK. Persistent processus vaginalis presenting as hydrocele and hernia. *Int J Contemp Pediatr* 2018;5:1819-23.
21. Akkrapol M. Complications of hydrocele and results of hydrocelectomy in children more than 2years of age. *J Med Assoc Thai* 2017;100:105-8.
22. Thorat SL, Sambhus DP. Survey of presence of hernia and hydrocele among school children in Nasik. *J Cint Med Dent* 2016;4:41-4.
23. Pant N, Aggarwal SK, Ratan SK. Laparoscopic repair of hernia in children: comparison between ligation and non-ligation of sac. *J Indian Assoc Pediatr Surg* 2014;19:76-9.
24. Rafiei MH, Jazini A. Is the ligation of hernia sac necessary in herniotomy for children? A randomized controlled trial of evaluating surgical complications and duration. *Adv Biomed Res* 2015;4:97.
25. Salimi A, Shahmoradi S, Rashidi NS, Eftekhari SS. Beneficial impression of san-ligation over high-ligation during orchidopexy: a cross-sectional study of 2659 patients. *Int J Pediatr* 2017;5:5145-52.
26. Mohta A, Jain N, Irniraya KP, et al. Non-ligation of the hernia sac during herniotomy: a prospective study. *Pediatr Surg Int* 2003;19:451-2.
27. Kishwar A, Haider K, Irfan UK, Humera L. Non-ligation of indirect hernia sac in children. *J Ayud Med Coll Abbottabad* 2015;27:180-2.
28. Ceccanti S, Zani A, Mele E, Cozzi DA. Orchidopexy without ligation of the processus vaginalis is not associated with an increased risk of inguinal hernia. *Hernia* 2014;18:339-42.

Received: 18 May 2026; Accepted: 21 July 2026.

Contributions: EIN, SOE, and EPN conceptualized the study; EIN, UOE, and EPN were involved in data acquisition and analysis; EPN, VCE, ONA, and UOE were involved in the initial critical review of the manuscript for intellectual content. All the authors have read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of interest: the authors declare no potential conflict of interest.

Funding: none.

Ethics approval and consent to participate: ethical clearance was obtained from the University of Nigeria Teaching Hospital Research and Ethics Committee, with approval number: NHREC/05/01/2008B-FWA00002458-1RB00002323.

Informed consent: written informed consent was obtained from the patients' parents or guardians before enrolment in the study.

Patient's consent for publication: the patients' guardians gave their written consent to use their personal data for publication of this paper and any accompanying images.

Availability of data and materials: the research data are available upon request through the corresponding author.

Acknowledgments: the authors are grateful to the staff and management of the Department of Surgery and the main theatre, University of Nigeria Teaching Hospital, for their support during this work. They also thank their patients and their guardians for their cooperation during the course of the study.

Publisher's note: all claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article or claim that may be made by its manufacturer is not guaranteed or endorsed by the publisher.

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0).