



## Review

# Scrotal Elevation and Postoperative Scrotal Haematoma in Children Undergoing Surgery for Inguinoscrotal Swellings: A Narrative Review

<sup>1</sup>Isaac Sunday Chukwu, <sup>1</sup>Chukwuemeka Theophilus Ezeonwumelu, <sup>2</sup>Ikenna Stanley Ilo, <sup>2</sup>Doris Ifeyinwa Ilo, <sup>3</sup>Chioma Rita Uzoma Uchendu, <sup>4</sup>Amarachukwu Faith Okafor, <sup>1</sup>Paul Eberechukwu Ngwu, <sup>1</sup>Chidi Samuel Ekpemo

<sup>1</sup>Department of Surgery, Federal Medical Centre, Umuahia

<sup>2</sup>Department of Anaesthesia, Federal Medical Centre, Umuahia

<sup>3</sup>Department of Ophthalmology, Federal Medical Centre, Umuahia

<sup>4</sup>Department of Paediatrics, Federal Medical Centre, Umuahia

**Corresponding author:** *Isaac Chukwu*, Department of Community Medicine, University of Port Harcourt Teaching Hospital, Port Harcourt, Rivers State, Nigeria. [Isaacchukwu8@gmail.com](mailto:Isaacchukwu8@gmail.com); +2348138270270

Article history: Received 31 March 2026, Reviewed 11 April 2026, Accepted for publication 20 June 2026

## ABSTRACT

**Background:** Surgery for inguinoscrotal swellings in children is one of the commonest operations performed by paediatric surgeons. Postoperative scrotal haematoma remains a frequent complication despite advances in surgical technique. Scrotal elevation has been proposed as a simple measure to reduce postoperative morbidity.

**Objective:** To review the available evidence on the effect of scrotal elevation on the incidence, severity and duration of postoperative scrotal haematoma in children undergoing surgery for inguinoscrotal swellings.

**Methods:** A narrative review was conducted using PubMed, Google Scholar and Scopus. Articles published from database from January 1986 to December 2025 were searched using combinations of the terms ‘scrotal elevation’, ‘scrotal support’, ‘scrotal haematoma’, ‘inguinal hernia’, ‘hydrocele’, ‘postoperative care’ and ‘children’. Studies evaluating scrotal elevation or support in patients undergoing surgery for inguinoscrotal swellings were considered. As this was a narrative review, a formal PRISMA-based study selection process was not undertaken. However, search databases, search terms, eligibility criteria and limitations of the available evidence were described to improve transparency.

**Results:** Available evidence suggests that scrotal elevation may decrease the incidence, severity and duration of postoperative scrotal haematoma in children. Techniques described include scrotal hitching, adhesive tape support, scrotal suspension sutures and supportive garments. However, the evidence is limited by methodological heterogeneity and a paucity of paediatric-specific comparative studies.

**Conclusion:** Scrotal elevation is a simple, low-cost adjunct that may reduce the incidence, severity and duration of postoperative scrotal haematoma in children undergoing surgery for inguinoscrotal swellings.

**Keywords:** Herniotomy; Postoperative complications; Inguinoscrotal swellings; postoperative scrotal haematoma, scrotal elevation; paediatric surgery.



This is an open access journal and articles are distributed under the terms of the Creative Commons Attribution License (Attribution, Non-Commercial, ShareAlike” 4.0) - (CC BY-NC-SA 4.0) that allows others to share the work with an acknowledgement of the work's authorship and initial publication in this journal.

## How to cite this article

Chukwu IS, Ezeonwumelu CT, Ilo IS, Ilo DI, Uchendu CRU, Okafor AF, Ngwu PE, Ekpemo CS. Scrotal Elevation and Postoperative Scrotal Haematoma in Children Undergoing Surgery for Inguinoscrotal Swellings: A Narrative Review. The Nigerian Health Journal 2026; 26(2):893 – 901. <https://doi.org/10.71637/tnhj.v26i2.1407>



## INTRODUCTION

Surgery for inguinoscrotal swellings is very common in Paediatric surgical practice. <sup>1-5</sup> Inguinoscrotal hernia and communicating hydrocele are the commonest inguinoscrotal swellings in children. <sup>3,6,7</sup> They share a common pathogenesis – the patent processus vaginalis. <sup>6,7</sup> The inguinoscrotal hernia increases in size over time and may become complicated (incarceration, obstruction, strangulation), hence, require early surgery. Some cases of hydrocele may resolve without operative intervention. <sup>7</sup> The treatment for these pathologies is herniotomy which may be open or laparoscopic. Open herniotomy is commoner in our environment. <sup>8</sup> This is usually undertaken as day case. <sup>9,10,11</sup>

Herniotomy is not without complications. <sup>12</sup> The early postoperative complications— scrotal haematoma, scrotal edema and wound infection are more common. <sup>3,5,13</sup> Some authors have challenged the need for routine postoperative surveillance after day case herniotomy in children. <sup>14,15,16</sup>

Meanwhile, postoperative scrotal haematoma has been noted to be common following surgery for inguinoscrotal swellings in children. <sup>1,3,4,6,7</sup> This is despite recent advances and improvement in the surgical technique over the years in paediatric surgical practice. Most postoperative scrotal haematoma are mild and can be managed conservatively. <sup>17</sup> A few may be massive, causing functional impairment and may need drainage. <sup>18,19</sup> There may be prolonged hospitalization or re-hospitalization with discomfort, slow resolution and infection. <sup>19</sup> This is more common in patients with bleeding disorders. <sup>20,21</sup> Several attempts have been made in the past to prevent scrotal haematoma in surgery for inguinoscrotal swellings. These may include ensuring meticulous tissue dissection and haemostasis <sup>19</sup>, laparoscopic herniotomy <sup>22</sup>, not ligating the hernia/hydrocele sac <sup>23,24</sup>, scrotal approach to communicating hydrocele <sup>25</sup>, closure of spermatic fascia <sup>1</sup>, not excising the distal sac <sup>26,27</sup>, leaving a scrotal drain <sup>28</sup>, scrotal bandaging <sup>29</sup> and scrotal elevation. <sup>30,31,32,33</sup>

In adults, scrotal elevation has been noted to eliminate gravity, clasp the lax scrotum and avoid stretching of the spermatic cord and testis, thereby decreasing the chances of formation of scrotal haematoma. <sup>32,33</sup> Different techniques have been employed in scrotal elevation – scrotal hitching. <sup>31,32</sup>, antigravity adhesive tape scrotal support <sup>30</sup>, scrotal suspensory bandage, use of facemask <sup>33</sup>, gauze bandage scrotal support and tight underwear scrotal support. <sup>28</sup> Scrotal elevations to

prevent post herniotomy scrotal haematoma has not been explored in children in Nigeria.

Although, surgery for inguinoscrotal swellings in children is common, there is a dearth of reviews assessing the effect of scrotal elevation on the incidence of scrotal haematoma. The effect of scrotal elevation on the severity and duration of postoperative scrotal haematoma in children is not clear. <sup>34</sup> This review broadens the scope on prevention of postoperative morbidity in children. This review aims to clarify the current evidence on scrotal elevation and provide a practical synthesis to guide postoperative care and future research in children undergoing surgery for inguinoscrotal swellings.

## METHODS

A narrative review was conducted to evaluate the effect of scrotal elevation to evaluate the effect of scrotal elevation on postoperative scrotal haematoma in children undergoing surgery for inguinoscrotal swellings. The review was structured using a PICO framework: Population (paediatric patients undergoing surgery for inguinoscrotal swellings), Intervention (scrotal elevation or scrotal support techniques), Comparator (no elevation or alternative postoperative care) and Outcomes (incidence, severity and duration of scrotal haematoma).

Literature searches were performed in PubMed, Scopus, and Google Scholar was included to broaden capture of relevant surgical and low-resource setting literature; however, its limitations as a non-curated database with variable indexing quality were acknowledged. Search terms included combinations of ‘scrotal elevation’, ‘scrotal support’, ‘scrotal haematoma’, ‘inguinal hernia’, ‘hydrocele’, ‘herniotomy’, ‘postoperative complications’, and ‘children’. Grey literature and trial registries were not systematically searched.

Eligible studies included those reporting scrotal elevation or support in patients undergoing inguinoscrotal surgery. Adult studies were included where paediatric-specific data were limited and this was explicitly considered during interpretation. Non-surgical studies and articles without relevant postoperative outcomes were excluded.

As this is a narrative review, a formal PRISMA-based screening was not undertaken. <sup>35</sup> Nevertheless, the search strategy, databases used, eligibility criteria and limitations of the evidence base have been described to enhance transparency and reproducibility. No

quantitative reporting synthesis was performed due to heterogeneity in study design and outcome.

#### **Overview of inguinoscrotal swellings in children**

Inguinoscrotal swellings are those which extend from the groin onto the scrotum.<sup>6,7</sup> They occur mostly when abdominal cavity contents protrude through the inguinal area to the scrotum. Infants, children, and adolescents with inguinoscrotal pathology comprise a significant proportion of hospital visits.<sup>4</sup> The commonest cause of an inguinoscrotal swelling in children is patent processus vaginalis, which may present in form of an indirect hernia or hydrocele.<sup>6,7,36,37,38</sup> Congenital hernias are almost always indirect.<sup>38</sup> The indirect hernia is classified as inguinal or inguinoscrotal (complete).<sup>39</sup> Hydroceles contain peritoneal fluid and can be communicating or non-communicating. Non-communicating hydrocele may be infantile, encysted hydrocele of the cord or vaginal.<sup>36,37,39</sup>

#### **Embryology**

The processus vaginalis is first identifiable in the third month of intrauterine life.<sup>37, 41</sup> It is an embryonic outpouching of the parietal peritoneum. It represents a natural connection between the abdomen and scrotum in boys, and labia majora in girls. It is situated anterior to the developing testis and gubernaculum.<sup>37</sup> The gubernaculum is attached to the lower pole of the testis and assists its descent into the normal position in the scrotum.<sup>41</sup> While the processus vaginalis is formed, it is gradually covered by extensions of the abdominal wall which contributes to the final formation of the scrotum in the seventh to ninth month intrauterine life.<sup>41,42</sup> Hormonal stimuli acting unilaterally in a paracrine fashion causes the testes to descend from the abdominal cavity to the scrotum through the inguinal canal and along the processus vaginalis, which is pushed anteriorly. Processus vaginalis starts regressing after testicular descent.<sup>43</sup> This is completed in three (3) steps. The first step involves the closure of the deep ring, then the part of the processus vaginalis superior to the testis is obliterated.<sup>42</sup> The remaining cavity between the two obliterates last. After this, the portion of the processus vaginalis covering the testis forms the tunica vaginalis. The testis is almost covered by the tunica vaginalis except for a small part in the posterior surface next to the mediastinum testis, where the vas deferens and testicular blood vessels can be found.<sup>43</sup>

When obliteration of the processus vaginalis does not occur, congenital abnormalities are seen which may

include communicating hydrocele or inguinoscrotal hernia. Failure of closure of the processus vaginalis has been noted to be common on preterm neonates, hip dysplasia, cystic fibrosis and Ehlers-Danlos syndrome.<sup>36</sup>

#### **Relevant surgical anatomy**

The inguinal canal is the oblique passage in the groin between the deep and superficial inguinal rings. It transmits the spermatic cord in the male, the round ligament in the female, and the ilioinguinal nerve in both sexes.<sup>44</sup> Taghavies et al, in their systematic review of inguinal canal anatomy in children, noted that some studies showed rapid growth velocity of the length of the inguinal canal up to 2 years of age (with height and growth of the bony pelvis) before plateauing while others suggested no increase in canal length prior to 10 years of age.<sup>45</sup> The internal ring has been noted to be medial to the midpoint of the inguinal ligament throughout childhood<sup>44</sup>. Moreover, children have been noted to have a measurable inguinal canal against the belief that the superficial inguinal ring frequently overlaps the deep inguinal ring.<sup>4, 6</sup>

The scrotum houses the testes suspended by the spermatic cords. The scrotal skin is lax and shiny. It can become folded with transverse rugae, depending on the tone of the dartos smooth muscle which is continuous with the colles, scarpa and dartos fascia of the penis.<sup>47</sup> Other parts of the scrotal wall include the components of the spermatic fascia.<sup>1</sup> In accordance with their origin, the spermatic fasciae have a blood supply (cremasteric, vasal, testicular arteries) separate from that of the scrotal wall which is mainly from the external pudendal and perineal vessels<sup>47</sup>.

#### **Evaluation**

Presentation of inguinoscrotal swelling may be elective or emergent. Emergent presentation of inguinoscrotal hernia is usually when it is complicated (incarceration, obstruction, strangulation).<sup>38</sup> However, inguinoscrotal swellings are usually described by caregivers as intermittent scrotal bulge. One cannot get above an inguinoscrotal swelling. A hydrocele is soft, fluctuant and transilluminates.<sup>37</sup> An inguinoscrotal hernia is felt different from testis and may transilluminate in children. Associated anomalies such as undescended testis and hypospadias are looked out for.<sup>37</sup> Ultrasound scan may be helpful when physical findings are equivocal and in examination for the presence of contralateral hernia. According to Ibrahim et al, colour doppler ultrasound scan has emerged as an investigation of choice for these swellings especially in ruling out testicular torsion.<sup>48</sup>

### **Surgery for inguinoscrotal swellings in children**

Inguinoscrotal swellings are among the commonest clinical conditions that require surgical intervention in children. This may be open or laparoscopic. Ibrahim et al, opined that laparoscopic repair have shorter operation time in bilateral hernia repair, lower rate of metachronous hernia, quicker recovery, lesser pain, lower complication and recurrence rates with an improvement in cosmetic outcome.<sup>22</sup> Open herniotomy is commonly done in our environment. However, whether open or laparoscopic repair is contemplated, the standard surgical treatment for hernias and hydroceles in children is high ligation of the sac (processus vaginalis). There is no uniform consensus on the repair of congenital hernia/hydrocele.<sup>1,12</sup> Some twist and double ligate the proximal sac, others do not. Moreover, studies support the conclusion that ligation of the hernia sac is not only unnecessary and time consuming but also leads to postoperative pain, and hernia recurrence rates are statistically unaffected by not ligating the sac.<sup>23,24,50</sup> Alp et al, in a study where they compared inguinal and scrotal approaches for the treatment of communicating hydrocele in children, noted that the scrotal approach for the treatment of communicating hydrocele is well-tolerated, simple, cosmetically appealing and has a shorter operating time compared to the standard inguinal approach.<sup>25</sup> Okoro and Gbobo in their study on the place of spermatic fascia closure during open herniotomy in male children concluded that there is no demonstrable advantage or disadvantage in closing the spermatic fascia at herniotomy.<sup>1</sup> Gahukamble and Khamage in a prospective randomized controlled study stated that the less extensive process of distal longitudinal splitting of the residual hernia sac or processus vaginalis can be preferred over complete excision of the distal sac in herniotomy in male patients.<sup>27</sup> However, it is pertinent to state that any chosen approach must meet or exceed a high standard with less expense to justify cost-conscious healthcare systems.<sup>12</sup>

### **Complications of surgery for inguinoscrotal swellings**

Complications may be encountered in surgery for inguinoscrotal swellings and several studies have emphasized that the incidence is low.<sup>14,15,16,28,29,37</sup> These complications may be intraoperative, early or late postoperative. Intraoperative complications are primary haemorrhage and damage to surrounding structures –

vas deferens, nerves, vessels, abdominal and pelvic viscera. These are related to massive hernias, complicated hernias or reoperations.<sup>39,40</sup> Hughes et al, in a review of infants aged 0-12 months undergoing inguinal herniotomy, noted that there is no significant difference in complication rates between premature and term infants.<sup>50</sup> Recurrence has been seen as the most important late complication. Grosfeld et al, examined the factors affecting recurrence in 62 children following herniotomy and found that postoperative wound infection, haematoma, injury to the floor of the inguinal canal and usage of inappropriate suture materials accounted for most.<sup>51</sup> Furthermore, early complications are more common – wound infection, scrotal edema, scrotal haematoma, wound dehiscence<sup>6,7,14,15,16</sup> Different studies noted scrotal haematoma as being more frequent.<sup>1,2,3,5,10,39</sup> These complications may also not be remote from the surgical technique.

### **Scrotal haematoma**

Scrotal haematoma is a solid swelling of clotted blood within the scrotum. It commonly occurs following groin/scrotal surgeries or trauma. It has been described in other conditions. Acute scrotal haematoma has been seen in children with Henoch-Schonlein purpura<sup>52</sup>, idiopathic thrombocytosis<sup>21</sup>, anticoagulant therapy<sup>18</sup>, spontaneous rupture of varicoceles and spermatic cord vessels.<sup>18</sup> It has also been noted after procedures such as extracorporeal shockwave lithotripsy for a renal calculus<sup>53</sup> and transfemoral cardiac catheterization.<sup>54</sup> Trauma to the penis, pelvis or perineum may lead to scrotal haematoma. It may be blunt or penetrating. Symptoms and signs are more rapidly progressive and may be accompanied by other injuries. Degree of scrotal haematoma does not correlate with severity of testicular injuries.<sup>55</sup>

### **Postoperative scrotal haematoma**

Postoperative scrotal haematoma is common. It is usually encountered in groin surgeries including that of scrotum and its contents. In children, this is commoner in surgery for inguinoscrotal swellings. This is due to injury to small vessels related to the scrotum and its contents with resultant bleeding.<sup>33</sup> The scrotum is also lax and cannot easily tamponade bleeding.<sup>46,55</sup> This is worse in those with bleeding disorder.<sup>20,21</sup> Elevated postoperative blood pressure may increase the likelihood of haematoma formation.<sup>60</sup> It is being suggested that excising the distal sac during herniotomy<sup>26,27</sup>, non-closure of the spermatic fascia<sup>1</sup> and ligating the

hernia/hydrocele sac<sup>23,49</sup> may increase the chances of haematoma formation.

#### **Severity of postoperative scrotal haematoma**

Scrotal haematoma may only be small enough to cause ecchymosis<sup>1</sup> or large enough to cause haemodynamic instability<sup>18</sup>, reoperation<sup>19</sup>, prolonged hospitalization<sup>20</sup>. However, a palpable scrotal swelling is common.<sup>2,3,4,5</sup> This can get infected.<sup>39</sup> Older children may complain of pain, uneasiness or dragging sensation. Severity of scrotal haematoma may increase in patients with bleeding tendencies<sup>20,21</sup> or who are on anticoagulation.<sup>18</sup> Scrotal haematoma may be graded as grade I (mild effusion or ecchymosis), grade 2 (large effusion leading to swelling) and grade 3 (if re-operation is required or hospitalization is prolonged).<sup>61</sup>

#### **Duration of postoperative scrotal haematoma**

Postoperative scrotal haematoma often resolves spontaneously in children<sup>15</sup>. The time it takes may depend on the size of the haematoma.<sup>18</sup> Resolution of scrotal haematoma may take several weeks.<sup>56</sup> Caglayan and colleagues noted that extratesticular haematoma has no effect on the histology and haemodynamics of the testis in the early period but spermatogenesis may be adversely affected later by thermoregulation alteration.<sup>34</sup>

#### **Treatment of postoperative scrotal haematoma**

Treatment is mainly conservative as most resolve without sequelae.<sup>17</sup> However, with increasing size, pain/restlessness and sometimes haemodynamic instability; scrotal exploration may be warranted. Isgar and Turner described the use of medicinal leeches in a huge scrotal haematoma.<sup>62</sup> They were applied to the scrotum until they were engorged with blood and released their suckers (about 20 minutes). This was done using six leeches daily over six days which resulted in considerable reduction in swelling and relieve.<sup>62</sup>

#### **Prevention of postoperative scrotal haematoma**

Postoperative scrotal haematoma is preventable.<sup>30,31,32,33</sup> Several attempts have been made in the past in this regard, mostly in adult patients. This may be in the modification of the surgical procedure (as stated earlier) and ensuring adequate haemostasis<sup>19</sup>, inserting a scrotal drain, scrotal bandaging or scrotal elevation.

For the adult patients, Sheshe et al, used corrugated drains for patients with giant hernias in an elective mass hernia repair in Kano, Nigeria. They noted scrotal haematoma in 6.7% of cases.<sup>28</sup> Scrotal drain works mainly by blood drainage and obliteration of dead space. However, the open channel may lead to infection spread.

Turgic and colleagues, in their study to emphasize the usefulness of elastic bandaging for the prevention of postoperative haematoma, had lesser number of this complication occurring in those with elastic bandaging.<sup>29</sup> This may be due to the compression of the scrotal layers. However, scrotal bandaging has the drawback of slippage following surgery especially when patient ambulates. Scrotal elevation in the surgery for inguinoscrotal swellings has been noted to not only prevent scrotal haematomas but also scrotal oedema.<sup>33</sup> It can be applied in several ways.

#### **Scrotal elevation**

Despite the modifications introduced in surgery for inguinoscrotal swellings, use of scrotal drains and bandage, scrotal haematoma still occur. Studies have suggested that the unsupported scrotum will have more scrotal haematoma.<sup>33,46</sup> This is due to the vessels and lymphatics which are inadvertently torn during surgery.<sup>33</sup> The scrotal rugae is gradually lost without a tamponading effect on the haematoma. Scrotal elevation eliminates gravity and hinders overstretching of venules.<sup>32,33</sup> Scrotal elevation also decreases the duration and severity of formed haematoma.<sup>32,33</sup> It has been noted to be convenient, non-invasive, simple and without a learning curve<sup>33</sup>. Different modes of scrotal elevation have been described.

Traditionally, a firm underwear is usually encouraged following inguinoscrotal surgery.<sup>63</sup> Several studies have described a method of scrotal elevation by suturing the scrotal skin to the lower abdominal wall.<sup>31,32,64,65,66</sup> This may not be suitable in most children. Garg and Goyal described the use of facemask to suspend the scrotum following surgery for inguinoscrotal swellings.<sup>33</sup> They noted that in all cases, the incidence and severity of scrotal haematoma and oedema to be comparable to other types of scrotal elevation. Agarwal and Colleagues compared antigravity adhesive tape scrotal elevation with the conventional gauze bandage scrotal elevation and those without scrotal elevation.<sup>30</sup> The incidence of scrotal haematoma was noted to be less in patients in whom adhesive tape scrotal elevation was used as compared to those with no elevations or gauze bandaging.

## **DISCUSSION**

The apparent consistency in reported benefit of scrotal elevation across much of the included literature must be interpreted cautiously, as closer appraisal reveals substantial variability in study design, intervention

fidelity and outcome definition. While several studies report reduced postoperative scrotal oedema and a reduction in clinically apparent scrotal haematoma with elevation or support techniques, these findings are not uniform across all reports and should not be interpreted as definitive evidence of efficacy.

Importantly, studies demonstrating benefit are often limited by non-comparative designs, small sample sizes or absence of standardized outcome measures. In such contexts, improvements in postoperative appearance or swelling may reflect subjective clinical impression rather than objectively measured differences in haematoma incidence. Conversely, studies that report minimal or no measurable difference frequently differ in methodology, particularly in the use of less rigid elevation techniques or inconsistent application duration, making direct comparison inappropriate.

A key source of apparent contradiction between studies lies in outcome misclassification. Several authors do not clearly distinguish scrotal haematoma from postoperative oedema or ecchymosis, leading to potential overestimation of benefit in studies where 'reduced swelling' is interpreted as reduced haematoma formation. This diagnostic overlap significantly weakens cross-study comparability and explains much of the heterogeneity observed in reported outcomes.

Additionally, variation in patient population further contributes to inconsistent findings. Adult series tend to demonstrate more pronounced effects of scrotal elevation, likely due to greater scrotal dependency and postoperative dead space whereas paediatric patients may exhibit less pronounced anatomical susceptibility to dependent fluid accumulation. This biological difference limits direct extrapolation and must be considered when interpreting pooled narrative findings.

It is therefore inaccurate to interpret the literature as uniformly supportive of scrotal elevation as a preventive strategy for postoperative scrotal haematoma. Rather, the evidence supports a more cautious interpretation: scrotal elevation is a low-risk adjunct associated with probable reduction in postoperative scrotal swelling with uncertain and inconsistently demonstrated effects on true haematoma formation. The overall certainty of evidence remains low due to methodological limitations, heterogeneity and reliance on non-standardized outcome reporting.

This interpretation reconciles the conflicting findings across studies without overstating benefit and aligns the

conclusions with the actual strength of available evidence.

## CONCLUSION

Scrotal elevation is a simple adjunct that may reduce the incidence, severity and duration of postoperative scrotal haematoma in children undergoing surgery for inguinoscrotal swellings. However, its use currently is guided more by clinical experience than by robust evidence. The absence of standardized protocols, variability in practice and limited paediatric-specific data restrict definitive conclusions. Moreover, in the absence of high-quality paediatric data, clinicians may reasonably apply scrotal elevation based on adult evidence, with caution. Well-designed prospective studies are needed to clarify its role, establish optimal techniques and support the development of evidence-based guidelines for routine clinical use.

## Declarations

**Authors' contribution:** ISC led in conceptualization, study design, literature search, data extraction, and manuscript drafting; TCE contributed to study design, literature search and critical revision; ISI and DII handled data extraction, synthesis, interpretation, and drafting; CRUU and AFO provided methodological oversight and critical appraisal; while PEN and CSE contributed to data interpretation and editing, with all authors approving the final manuscript.

**Funding:** No funding was received

**Conflicts of Interest:** The authors declare no conflict of interest

**Disclosure in AI use:** No Generative AI was used in the development, conduct and reporting of the manuscript.

## REFERENCES

- 1) Okoro PE, Gbobo I. The place of spermatic fascia closure during open herniotomy in male children. *Niger J Surg.* 2013;19:23-5
- 2) Sarin YK, Wakhlu A, Agarwal LD, Sharma AK. Inguinal herniotomy in children: A decade's experience. *Indian Pediatr.* 1993;30:1363-6
- 3) Abatanga FA. Groin and scrotal swellings in children aged 5 years and below. A review of 535 cases. *Pediatr Surg Int.* 2003;19:446-50
- 4) Intikhab A, Musadiq K, Shaikat J, Mir NA. Clinicopathological study of inguino-scrotal swellings in children. *JK-Practitioner.* 2013;18(3-4):1-3

- 5) Obalum DC, Eyesan SU, Oge CN, Atoyebi OA. Day-case surgery for inguinal hernia: A multi-specialist private hospital experience in Nigeria. *Niger Q J Hosp Med* 2008;18:42-4
- 6) Ivy C, Kenneth W. Common urological problems in children: Inguinoscrotal pathologies. *Hong Kong Med J*. 2017;23(3):272-81
- 7) Guerra L, Leonard M. Inguinoscrotal pathologies. *Can Urol Assoc J*. 2017;11:41-46
- 8) Ojo E, Okoi E, Umoiyoho AJ, Nnamonu M. Surgical outreach program in poor rural Nigerian communities. *Rural Remote Health*. 2013;13(1):2200
- 9) Olatoregun FBO, Mukoro DG. Review of inguinal hernia surgeries performed in Nigerian children. *IOSR Journal of Dental and Medical Sciences*. 2014;13:21-23
- 10) Usang UE, Sowande OA, Adejuyigbe O, Bakare T, Ademuyiwa OA. Day case inguinal hernia surgery in Nigerian children: Prospective study. *Afr J Paediatr Surg*. 2008;5:76-8
- 11) Ibrahim M, Getso KI, Mohammad MA. Burden of congenital inguinal hernia and hydrocele in northern and southern Nigeria: An opportunity for awareness creation. *Afr J Paediatr Surg*. 2014;11:312-6
- 12) Ibrahim M, Ladan MA, Abdussalam US, Getso KI, Mohammad MA, Chukwuemeka AL, et al. Open inguinal herniotomy: Analysis of variations. *Afr J Paediatr Surg*. 2015;12:131-135
- 13) Taqvi SR, Akhtar J, Batool T, Tabassum R, Mirza F. Complications of inguinal surgery in children. *J Coll Physicians Surg Pak*. 2006;16:532-5
- 14) Shah JN, Pokhrel Y, Hassan K, Thapa G, Manandhar K, Maharjan SB. Is routine hospital visit after Day Case inguinal hernia surgery in children necessary? *J Nepal Health Res Counc*. 2013;11:35-9
- 15) Morecroft JA, Stringer MD, Higgins M, Holmes SJ, Capps SN. Follow up after inguinal herniotomy in boys. *BJS*. 1993;80:1613-4
- 16) Powell SF, Brown RA, Millar AJ, Dewet PM, Rode H. Is there a need for post operative surveillance after day case groin surgery in children? *S Afr J Surg*. 2002;40:91-4
- 17) Osifo O, Amusan TI. Outcomes of giant inguinoscrotal repair with local lidocaine anaesthesia. *Saudi Med J*. 2010;31:53-8
- 18) Burnand K, Viswanath S, Kumar V, Chitale S. Acute spontaneous scrotal haematoma presenting with haemorrhagic shock: a case report. *Ann R Coll Surg Engl*. 2012;94:1-2
- 19) Shah DK, Sagarz J. Massive penoscrotal haematoma following inguinal hernia repair: a case report. *J Med Case Reports*. 2008;2:357
- 20) Ekeke ON, Nwauche CA. An uncommon cause of penoscrotal haematoma. *Niger J Med*. 2004;13:64 - 66
- 21) Madan GB, Jairajpuri ZS, Hajini FF, Jetley S. Postoperative thrombocytosis: an unusual case report. *Int J Appl Basic Med Res*. 2015;5:225-227
- 22) Ibrahim M, Getso KI, Mohammad MA, Akhparov NN, Aipov RR. Herniotomy in resource-scarce environment: comparison of incisions and techniques. *Afr J Paediatr Surg*. 2015;12:45-50
- 23) Ochman I, Hady HA. Hernia sac of indirect hernia: invagination, excision or ligation? *Hernia*. 2014;18:199-204
- 24) Riquelme M, Aranda A, Riquelme QM. Laparoscopic pediatric inguinal hernia repair: no ligation, just resection. *Laparoscopic Adv Surg Tech A*. 2010; 20:77-80
- 25) Alp BF, Irkilata HC, Kibar Y, Zorba U, Sancaktutar AA et al. Comparison of the inguinal and scrotal approaches for the treatment of communicating hydrocele in children. *Kaohsiung J Med Sci*. 2014;30:200-5
- 26) Savoie PH, Abdalla S, Bordes J, Laroche J, Fournier R, Pons F et al. Surgical repair of giant inguinoscrotal hernias in an austere environment: leaving the distal sac limits early complications. *Hernia*. 2014;18:113-8
- 27) Gahukamble DB, Khamage AS. Prospective randomized controlled study of excision versus distal splitting of hernia sac and processus vaginalis in the repair of inguinal hernias and communicating hydroceles. *J Pediatr Surg*. 1995;30:625-629
- 28) Sheshe AA. Feasibility of elective mass hernia repair in Kano state, northern Nigeria. *Niger J Basic Clin Sci*. 2014;11:30-35
- 29) Turcic J, Vuckovic B, Cvitanovic B, Ivanusic M, Bilic A. Prevention of early postoperative haematoma with the use of elastic bandages. Its ultrasonic diagnosis and control. *Acta Chir lugosl*. 1990;37:101-108
- 30) Agarwal G, Roy Mk, Gupta SK, Khana NN. Simple and effective method of scrotal support following inguinal hernia surgery. *Indian Journal of Surgery*. 1999;61:246-248
- 31) Oesterling JE. Scrotal surgery: a reliable method for the prevention of postoperative haematoma and edema. *J Urol*. 1990;143:1201 - 1202
- 32) Kosternoy A, Bayumi EK. Effect of scrotal hitching in reducing scrotal edema after

- inguinoscrotal hernia repair. *IOSR Journal of Dental and Medical Sciences*. 2015;14:41-44
- 33) Garg G, Goyal S. Facemask as a scrotal support to reduce incidence of scrotal oedema(post inguinoscrotal surgery). *Innovative Journal of Medical and Health Science*. 2013;3:291-293
- 34) Caglayan F, Cakmak M, Karadeniz Y, Atasoy P, Eroglu E, Apan A. Effect of extratesticular hematoma on testicular blood flow and the histology of the testis and dartos fascia. An experimental study. *Urol Int*. 2004;72:229-32
- 35) Green BN, Johnson CD, Adams A. Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. *J Chiropr Med*. 2006; 5(3): 101 – 117.
- 36) Rafailidis V, Varelas S, Apostolopoulou F, Rafailidis D. Nonobliteration of the processus vaginalis: sonography of related abnormalities in children. *J Ultrasound Med*. 2016;35:805-818
- 37) Palmer LS. Hernias and hydroceles. *Pediatr Rev*. 2013;34(10):457-64
- 38) Bonnard A, Aigrain Y. Inguinal hernias in children. *Rev Prat*. 2003;53(15): 1667-70
- 39) Skoog SJ, Conlin MJ. Pediatric hernias and hydroceles. The urologist's perspective. *Urol Clin North Am*. 1995;22:119-30
- 40) Kombo BB, Allison AB. Giant inguinoscrotal hernias seen at the University of Port Harcourt Teaching Hospital. *Niger J Med*. 2013;22:317-318
- 41) Martin LC, Share JC, Peters C, Atala A. Hydrocele of the spermatic cord: embryology and ultrasonographic appearance. *Pediatr Radiol*. 1996;26:528-530
- 42) Lao OB, Fitzgibbons RJ Jr, Cusick RA. Pediatric inguinal hernias, hydroceles, and undescended testicles. *Surg Clin North Am*. 2012; 92(3): 487-504
- 43) Parnis SJ, Roberts JP, Hutson JM. Anatomic landmarks of the inguinal canal in prepubescent children. *Aust N Z J Surg*. 1997;67:335-7
- 44) Taghavi K, Genetav P, Mirjalili SA. The pediatric inguinal canal: systematic review of the embryology and surface anatomy. *Clin Anat*. 2016;29:204-10
- 45) Osuoji RI, Bankole MA. Do infants and children have measurable inguinal canals? *J Nepal Paediatr Soc*. 2013;33:182-185
- 46) Patel A. Anatomy and physiology of chronic scrotal pain. *Transl Androl Urol*. 2017;6:51-56
- 47) Ibrahim MZ, Tabari AM, Igashi JB, Lawal S, Ahmed M. Scrotal Doppler ultrasound evaluation in Zaria, Nigeria. *Niger Basic Clin Sci*. 2016;13:89-93
- 48) Sowande OA, Olajide TA. Using methylene blue for perioperative localization of the hydrocele sac in boys. *Ann Afr Med*. 2011;10:38-40
- 49) Rafei 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
- 50) Hughes K, Horwood JF, Clements C, Leyland D, Corbett HJ. Complications of inguinal herniotomy are comparable in term and premature infants. *Hernia*. 2016;20:565-9
- 51) Grosfeld JL, Minnick K, Shedd F, West KW, Rescorla FJ, Vane DW. Inguinal hernia in children: factors affecting recurrence in 62 cases. *J Pediatr Surg*. 1991;26:283-7
- 52) Ranero PP, Amat CM, Rafie MW, Merenciano CFJ. Acute scrotal haematoma in Schonlein-Henoch purpura. Infrequent urologic manifestation. *Actas Urol Esp*. 1997;21:489-93
- 53) Raja D, Darren JK, Lachian JD. Scrotal hematoma resulting from extracorporeal shockwave lithotripsy for a renal calculus: a sign of retroperitoneal hemorrhage. *Cent European J Urol*. 2011;64:262-263
- 54) Thomas AA, Hedgepeth R, Sarac TP, Vasavada SP. Massive scrotal hematoma following transfemoral cardiac catheterization. *Can J Urol*. 2008;15:4020-3
- 55) Meka SR, Kalyanpur A. Sonography of scrotal trauma. *Indian J Radiol Imaging*. 2012;22:293-297
- 56) Bioku MJ, Eziechila BC, Adewumi OA, Igwilo CI, Maduka O, Aiyekomogbon, JO. Idiopathic scrotal hematoma in neonate: a case report and review of literature. *Case Rep Urol*. 2014;2014:212914
- 57) Llan O, Arun OE, Pekcevik Y, Alkan OS, Akbay S, Memur S. Scrotal hematoma as a sign of subcapsular liver hematoma in a preterm infant. *Pediatr Neonatol*. 2017;58:95-96
- 58) Adorisio O, Mattei R, Ciardini E, Centonze N, Nocchioli B. Neonatal adrenal haemorrhage mimicking an acute scrotum. *J Perinatol*. 2007;27:130-2
- 59) Diamond DA, Borer JG, Peters CA, Cilento BG Jr, Sorcini A, Kaefer M et al. Neonatal scrotal haematoma: mimicker of neonatal testicular torsion. *BJU Int*. 2003;91:675-7
- 60) Farkas JP, Kenkel JM, Hatef DA, Davies G, Truong T, Rohrich RJ, et al. The effect of blood pressure on hematoma formation with perioperative Lovenox in excisional body contouring surgery. *Aesthet Surg J*. 2007; 27:589-93



- 61) Sensi DE, Miracapillo G, Cresti A, Severi S, Airaksinen KE. Pocket hematoma: a call for definition. *Pacing Clin Electrophysiology*. 2015;38:909-13
- 62) Isgar B, Turner AG. Large scrotal haematoma treated with medicinal leeches. *BJU Int*. 1989;64:549-550
- 63) Al-Abed YA, Carr TW. Tight swimming trunks to prevent post scrotal surgery: an experimental justification. *Urol J*. 2013;10:898-902
- 64) Wilms MC, Hellmold P. Avoiding scrotal haematoma after repair of extensive scrotal hernias by postoperative scrotal hernias by scrotal-abdominal skin suture. *Trop Doct*. 2012;42:86-7
- 65) Griffin JH, Canning JR. The scrotal hitch for hemostasis and edema. *Urology*. 1996;47:918-9
- 66) Arrizabalaga M, Extramiana J, Mora M, Navarro J, Manas A, Gonzalez P et al. Scrotal suspension with hypogastric suture. Hemostatic technique in intrascrotal surgery. *Actas Urol Esp*. 1992;16:691-4