OUTCOME ANALYSIS OF PEDIATRIC INGUINAL HERNIA REPAIR BY OPEN VS LAPAROSCOPIC TECHNIQUE- AN OBSERVATIONAL STUDY

BY

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DISSERTATION

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LIST OF ABBREVIATIONS

APSA - AMERICAN PAEDIATRIC SURGICAL ASSOCIATION

EUPSA - EUROPEAN ASSOCIATION OF PAEDIATRIC SURGEONS

IIH - INCARCERATED INGUINAL HERNIAS

LS - LAPAROSCOPIC SURGERY

OS - OPEN SURGERY

POD - POSTOPERATIVE DAY

LPEC - LAPAROSCOPIC PERCUTANEOUS EXTRAPERITONEAL CLOSURE

MH - METACHRONOUS HERNIA

OHR - OPEN HERNIORRHAPHY

LH - LAPAROSCOPIC HERNIORRHAPHY

HERNIORRHAPHY - SURGICAL OPERATION TO REPAIR A HERNIA

LPEC - LAPAROSCOPIC PERCUTANEOUS EXTRAPERITONEAL CLOSURE

MRI - MAGNETIC RESONANCE IMAGING

SSI - SURGICAL SITE INFECTION

VAS - VISUAL ANALOG SCALE (FOR PAIN)

APGAR - APPEARANCE, PULSE, GRIMACE, ACTIVITY, RESPIRATION (A SCORING SYSTEM FOR NEWBORNS)

NSIADS - NON-STEROIDAL ANTI-INFLAMMATORY DRUGS

SPSS - STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES

PDS - PAEDIATRIC SURGERY DEPARTMENT

ABSTRACT

Background: Paediatric inguinal hernia repair is a common surgical procedure with open and laparoscopic techniques being the primary approaches. While both methods are widely used, there is limited data comparing their outcomes in terms of complications, recovery time, and patient satisfaction. This observational study aims to compare the outcomes and complications associated with open versus laparoscopic repair of paediatric inguinal hernias.

Methods: This observational study was conducted at KLE Prabhakar Kore Hospital and Medical Research Centre, Belagavi from March 2023 to February 2024. A total of 40 paediatric patients aged 1–12 years with inguinal hernias were enrolled. The patients were divided into two groups based on the surgical technique: 20 underwent open inguinal hernia repair and 20 underwent laparoscopic repair. Outcome measured include duration of surgery, hospital stay, complications like scrotal edema, hydrocele, infection were analysed using SPSS software.

Results: Laparoscopic surgeries had significantly longer operative times (mean 57.25 minutes) compared to open surgeries (mean 24.35 minutes). Hospital stay was longer in the laparoscopic group (3-5 days) compared to the open group (2-3 days). Scrotal edema was observed exclusively in the laparoscopic group. There were no significant differences in intraoperative and postoperative complication rates. Hernia type and preoperative ultrasound findings influenced the choice of surgical technique

Conclusion: Both open and laparoscopic inguinal hernia repairs are safe and effective in paediatric patients. Laparoscopic surgery though the operative time is more is preferred in cases of simple hernia types while open surgery may be offered in complex or difficult hernia. Surgical technique choice should be based on hernia characteristics and surgeon expertise.

Keywords: Paediatric inguinal hernia, open surgery, laparoscopic surgery, postoperative outcomes, complications

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INTRODUCTION

Inguinal hernia repair in the paediatric population remains a critical focus in surgical practice due to its high prevalence and potential complications if left untreated [1]. The condition arises from the incomplete closure of the processus vaginalis, leading to the protrusion of abdominal contents through the inguinal canal [2]. Affecting approximately 1-5% of full-term infants and a higher proportion of preterm neonates, inguinal hernias are more common in males, with a male-to-female ratio of about 6:1 [3]. The universally accepted management is surgical repair, aimed at preventing complications like incarceration or strangulation of herniated tissue [4].

Historically, the open technique has been the standard care for repairing paediatric inguinal hernias. This approach involves a small incision in the groin through which the hernia sac is dissected and ligated [5]. Known for its simplicity and direct access to the defect, the open technique has shown favourable outcomes in terms of low recurrence rates and minimal morbidity [6]. But it is not without limitations, including the risk of complications like surgical site infections, recurrence, contralateral hernia occurrence, and the need for a relatively longer recovery period [7].

Over the past decades, laparoscopic inguinal hernia repair has gained popularity as a minimally invasive alternative. Utilizing small ports and a camera, this technique allows surgeons to repair the hernia with enhanced visualization and precision [8]. The laparoscopic approach offers distinct advantages, including smaller scars, reduced postoperative pain, and the ability to evaluate and address contralateral inguinal hernias during the same procedure [9].

However, concerns about longer operative times and the learning curve associated with laparoscopic techniques and higher costs continue to influence its use in clinical practice [10].

Comparative studies between open and laparoscopic techniques have yielded mixed findings, with some highlighting the superior cosmetic outcomes and shorter hospital stays associated with laparoscopy, while others emphasize the reliability and long-term success of the open approach [9]. This variation necessitates the need for further research to comprehensively evaluate the relative benefits and risks of each technique. [7].

This observational study aims to compare the outcomes and complications of open and laparoscopic repair of paediatric inguinal hernias. By examining parameters such as operative time, hospital stay and the incidence of complications, this study seeks to provide evidence-based insights into the relative efficacy of the two approaches [4]. Ultimately, the findings of this study will contribute to guiding surgical decision-making and addressing gaps in the existing literature on paediatric inguinal hernia repair techniques [6].

OBJECTIVES

Study to compare between the outcomes and complications of the conventional open hernia repair and the laparoscopic repair for pediatric inguinal hernia.

REVIEW OF LITERATURE

ANATOMY OF INGUINAL REGION

The inguinal region, located in the lower anterior abdominal wall plays a pivotal role in various physiological and pathological processes particularly in the context of inguinal hernias. A comprehensive understanding of the inguinal anatomy is essential for surgeons when comparing open and laparoscopic hernia repair techniques. This section deals with the detailed anatomy of the inguinal region.

1. Overview of the Inguinal Region -

The inguinal region is situated on both sides of the lower abdomen, extending from the anterior superior iliac spine (ASIS) to the pubic tubercle. It serves as a critical passageway for various structures, including nerves, blood vessels, and the spermatic cord in males or the round ligament in females. The complex interplay of these structures within the inguinal canal makes the region susceptible to herniation, particularly inguinal hernias, which are classified as direct or indirect based on their anatomical pathways [2,3].

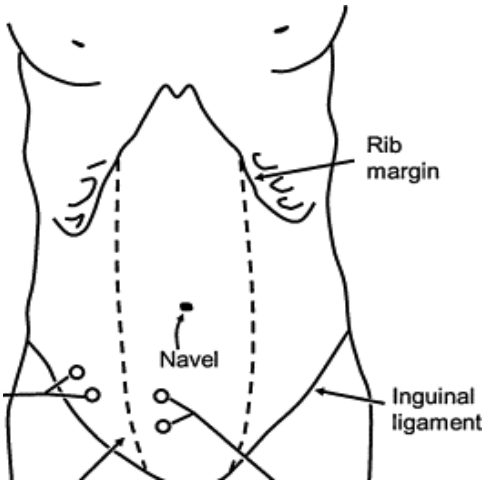


Figure 1: Diagram of the anterior abdominal wall.

2. Boundaries of the Inguinal Region -

Understanding the boundaries of the inguinal region is fundamental for identifying potential sites of herniation and for surgical navigation during hernia repair procedures.

- **Superior Boundary:** The superior boundary of the inguinal region is demarcated by the anterior superior iliac spine (ASIS) of the ilium and extends medially to the pubic tubercle.
- **Inferior Boundary:** The inferior boundary is defined by the inguinal ligament, which runs from the ASIS to the pubic tubercle. The inguinal ligament forms the base of the inguinal canal and is a modification of the lower fibres of external oblique aponeurosis.
- **Medial Boundary:** Medially, the inguinal region is bordered by the pubic tubercle, which serves as an attachment point for the inguinal ligament and marks the site where the inferior epigastric vessels cross the inguinal ligament.
- **Lateral Boundary:** The lateral boundary is formed by the lateral edge of the rectus abdominis muscle and the inguinal ligament. This lateral aspect houses the deep inguinal ring, an important anatomical feature in indirect hernias.

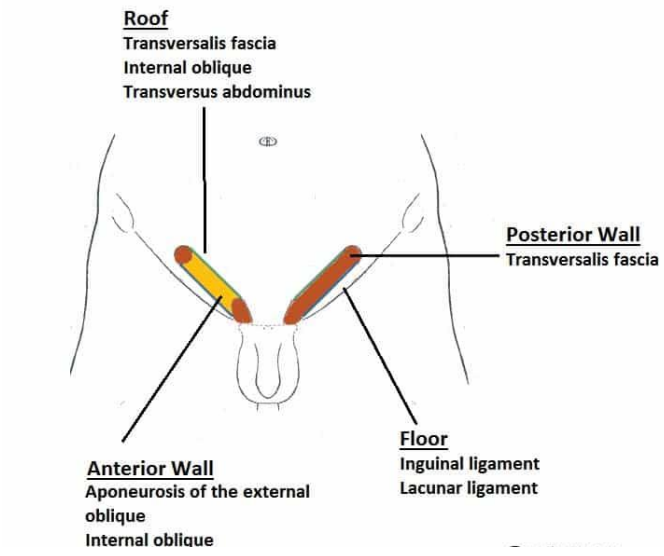


Figure 2: Anatomical boundaries of the inguinal region.

3. Anatomical Components of the Inguinal Canal -

The inguinal canal is a narrow passage in the lower anterior abdominal wall, approximately 4 cm in length. It comprises of the superficial inguinal ring and the deep inguinal ring.

- **Superficial Inguinal Ring:** Located just above the pubic tubercle, the superficial inguinal ring is an opening in the external oblique aponeurosis. It serves as the exit point of the inguinal canal.
- **Deep Inguinal Ring:** Situated approximately halfway between the ASIS and the pubic symphysis, the deep inguinal ring is an internal opening in the transversalis fascia. It is the entry point for indirect inguinal hernias.

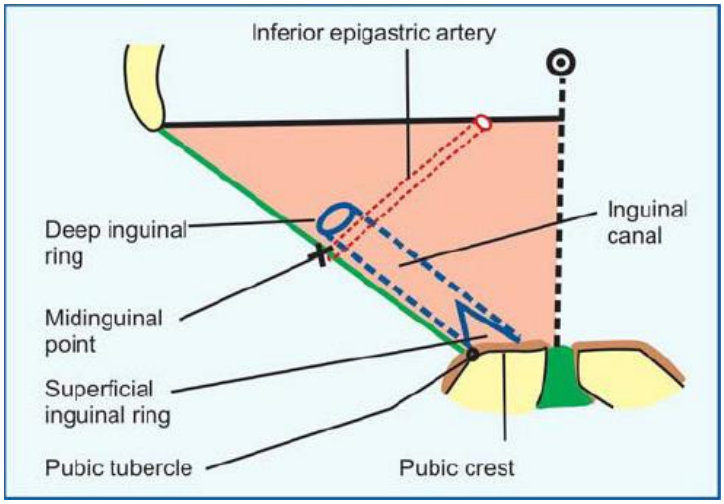


Figure 3: Cross-sectional view of the inguinal canal highlighting the superficial and deep inguinal rings.

4. Layers of the Anterior Abdominal Wall in the Inguinal Region -

The anterior abdominal wall comprises several layers, each contributing to the structural integrity and function of the inguinal region.

1. **Skin and Subcutaneous Tissue:** The outermost layers providing protection and insulation.

2. **External Oblique Muscle and Aponeurosis:** The external oblique Fibers run downward and medially, forming the inguinal ligament as they transition into the aponeurosis.

3. **Internal Oblique Muscle and Aponeurosis:** Positioned beneath the external oblique, the internal oblique Fibers run upward and medially, contributing to the formation of the conjoint tendon.

4. **Transversus Abdominis Muscle and Transversalis Fascia:** The deepest muscle layer, with the transversalis fascia providing a supportive layer for the inguinal canal.

5. **Extraperitoneal Fat and Peritoneum:** The innermost layers encapsulating the abdominal organs.

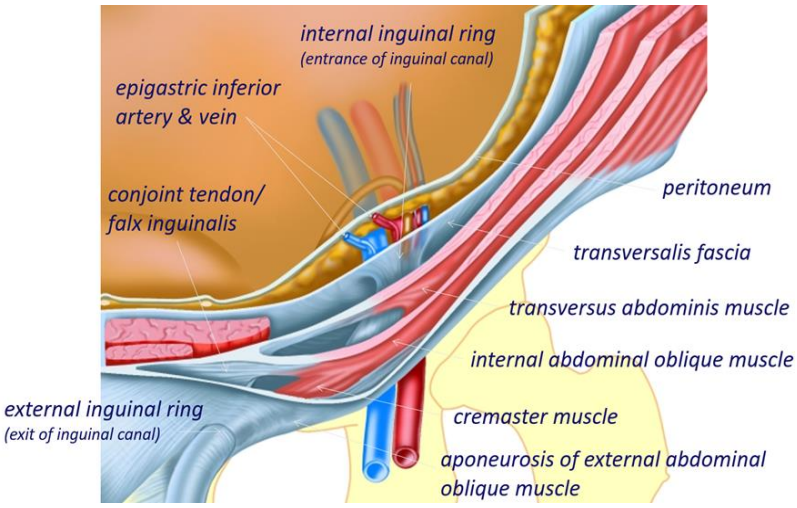


Figure 4: Layers of the anterior abdominal wall in the inguinal region.

5. Important Anatomical Structures within the Inguinal Canal -

Several critical structures traverse the inguinal canal, each with distinct anatomical and functional significance.

- **Spermatic Cord (in Males):** Enclosed within the inguinal canal, the spermatic cord comprises the vas deferens, testicular artery, pampiniform plexus, nerves, and lymphatics. It plays a vital role in the transport of sperm and blood supply to the testes.
- **Round Ligament (in Females):** The round ligament of the uterus runs through the inguinal canal, providing structural support to the uterus by anchoring it to the pelvic wall.
- **Ilioinguinal Nerve:** Originating from the L1 spinal nerve, this nerve provides sensory innervation to the groin and medial thigh. It also contributes to the motor function of the internal oblique and transversus abdominis muscles.
- **Genital Branch of the Genitofemoral Nerve:** Supplies motor Fibers to the cremaster muscle and sensory Fibers to the skin of the scrotum or labia majora.

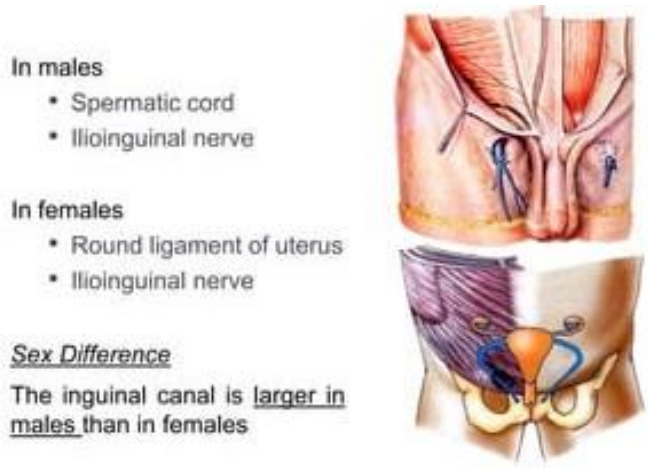


Figure 5: Structures within the inguinal canal in males and females.

6. Anatomical Relations of the Inguinal Region -

The inguinal region's anatomical relations are complex, with several key structures in close proximity, influencing both the presentation and management of inguinal hernias.

- **Superiorly:** The inguinal ligament and the anterior superior iliac spine (ASIS) are prominent landmarks. The iliohypogastric nerve runs superior to the inguinal ligament, providing sensory innervation to the lower anterior abdominal wall.
- **Inferiorly:** The pubic symphysis and pubic tubercle lie below the inguinal ligament. The inferior epigastric vessels, arising from the external iliac vessels, course upwards and medially towards the rectus abdominis sheath.
- **Medially:** The internal inguinal ring is located near the lateral edge of the rectus abdominis muscle. The lacunar ligament, a thickened band of the inguinal ligament, lies medially and forms part of the femoral sheath.
- **Laterally:** The external inguinal ring is situated lateral to the inferior epigastric vessels. The femoral artery and vein lie beneath the inguinal ligament, entering the femoral sheath.

7. Vascular Supply and Innervation -

The vascular and nervous supply to the inguinal region is integral to its function and has implications for surgical interventions.

- **Vascular Supply:**
    - **Superior Epigastric Artery:** A branch of the internal thoracic artery, supplying the lower anterior abdominal wall.
    - **Inferior Epigastric Artery:** Branching from the external iliac artery, it ascends medially towards the rectus sheath.
    - **Testicular/ Ovarian Artery:** The testicular artery supplies the testes, while the ovarian artery supplies the ovaries in females.

- **Innervation:**
    - **Iliohypogastric Nerve:** Provides sensory innervation to the lower anterior abdominal wall and motor innervation to the internal oblique and transversus abdominis muscles.
    - **Ilioinguinal Nerve:** Supplies the groin area and contributes to the cremasteric reflex in males.
    - **Genital Branch of the Genitofemoral Nerve:** Innervates the cremaster muscle and provides sensory input to the genital region.

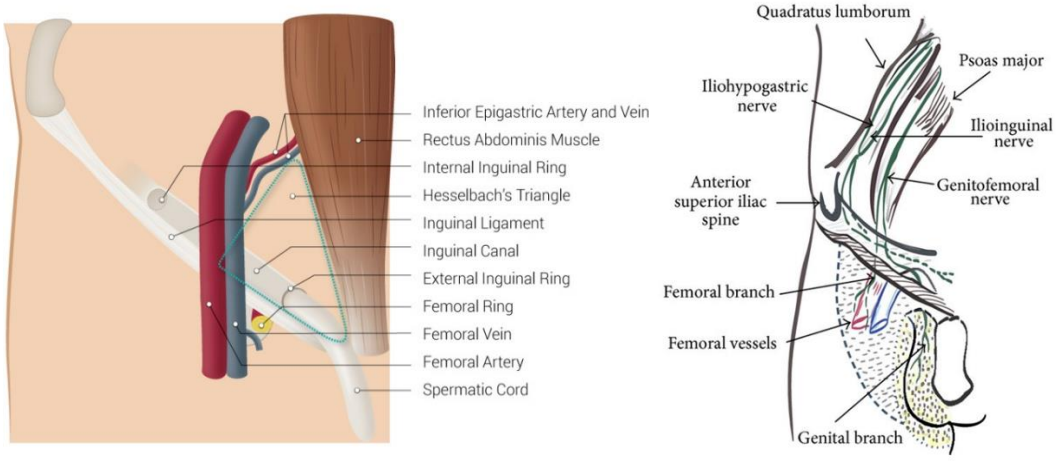


Figure 6: Vascular and nervous structures in the inguinal region.

8. Clinical Significance in Herniation -

The intricate anatomy of the inguinal region predisposes it to herniation, where abdominal contents protrude through weak points in the abdominal wall.

- **Indirect Inguinal Hernia:** Occurs when abdominal contents protrude through the deep inguinal ring, following the path of the spermatic cord in males or the round ligament in females. This type is congenital, resulting from the incomplete closure of the processus vaginalis.

- **Direct Inguinal Hernia:** Arises when abdominal contents push directly through a weak spot in the posterior wall of the inguinal canal, area known as Hesselbach's triangle. This type is acquired and more common in older adults.
- **Femoral Hernia:** While not strictly inguinal, femoral hernias occur just below the inguinal ligament, through the femoral canal. They are more prevalent in women and carry a higher risk of incarceration.

9. Hesselbach's Triangle -

Hesselbach's triangle is a key anatomical landmark in the inguinal region, crucial for differentiating between direct and indirect inguinal hernias.

- **Boundaries of Hesselbach's Triangle:**
  - **Medial Boundary:** Lateral border of the rectus abdominis muscle.
  - **Lateral Boundary:** Inferior epigastric vessels.
  - **Base:** Inguinal ligament.
- **Clinical Relevance:** Direct inguinal hernias protrude through Hesselbach's triangle, whereas indirect hernias follow the path of the deep inguinal ring, bypassing the triangle.

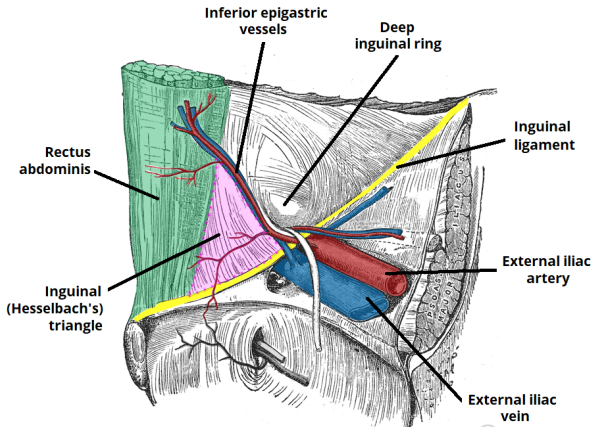


Figure 7: Hesselbach's triangle with boundaries and hernia types.

10. Processus Vaginalis -

The processus vaginalis is an embryonic developmental outpouching of the peritoneum that precedes the descent of the testes in males or the round ligament in females.

- **Function in Development:** Facilitates the descent of the testes from the abdominal cavity into the scrotum. In females, it accompanies the round ligament of the uterus.
- **Clinical Implications:** Incomplete closure or obliteration of the processus vaginalis postnatally can lead to indirect inguinal hernias or hydroceles. Persistent processus vaginalis is a common etiological factor in congenital inguinal hernias.

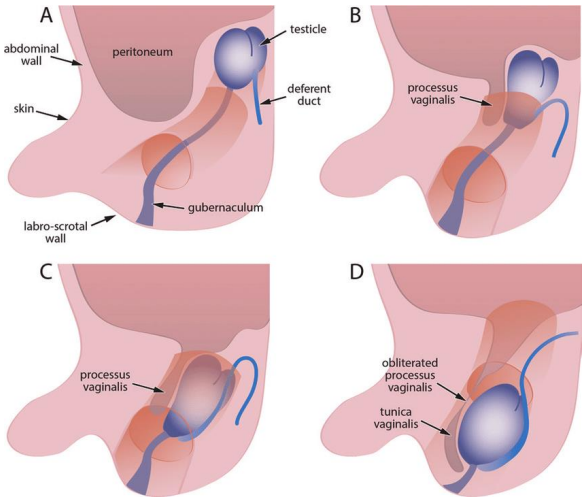


Figure 8: Embryological development of the processus vaginalis.

11. Lymphatic Drainage -

- **Superficial Lymph Nodes:** Drain to the superficial inguinal lymph nodes.
- **Deep Lymph Nodes:** Drain to the deep inguinal lymph nodes, which then communicate with the external iliac lymph nodes.

❖ Epidemiology and Etiology of Pediatric Inguinal Hernia

Paediatric inguinal hernia is one of the most common surgical conditions affecting children, with a global prevalence ranging from 1% to 5% in full-term neonates and significantly higher rates in preterm infants [11]. The condition predominantly affects males, with a male-to-female ratio of approximately 6:1, attributed to the anatomical differences in the processus vaginalis and inguinal canal [12]. In males, the processus vaginalis accompanies the descent of the testes through the inguinal canal, a critical step in normal testicular development. Failure of this processus to obliterate results in a pathway through which abdominal contents can protrude, leading to the formation of a hernia [13]. In females, the persistent processus vaginalis can allow herniation of the ovary or fallopian tube, though this is less common.

The etiological basis of paediatric inguinal hernia is multifactorial with both genetic and environmental factors playing critical roles.

Additional causes
1.Cystic fibrosis
2.Ehlers-Danlos syndrome
3.Trisomy 21
4.Preterm delivery
5.Family history -1st degree [15]

Figure 9: Typical appearance of an infant with a large right indirect inguinal hernia containing palpable loops of bowel and fluid

Paediatric inguinal hernia is also associated with increased intra-abdominal pressure, which can exacerbate the protrusion of abdominal contents. Conditions such as chronic cough, constipation or ascites contributes to sustained pressure against the weakened area of the inguinal canal promoting hernia formation [16]. In neonates and infants, the developing abdominal musculature and incomplete maturation of the inguinal canal add to the risk making early childhood the most common period for diagnosis. Interestingly, the right side is more frequently affected than the left, likely due to the delayed descent of the right testis compared to the left, a phenomenon supported by embryological evidence [17].

If left untreated, inguinal hernia in children is marked by a significant risk of complications like incarceration and strangulation. Incarceration occurs when the herniated contents become trapped and cannot be reduced back into the abdominal cavity. If left untreated, this can progress to strangulation where compromised blood supply leads to ischemia and necrosis of the content [18] which are reported to be as high as 30% emphasizing the need for timely diagnosis and intervention

For diagnosis, paediatric inguinal hernia is primarily a clinical diagnosis with physical examination being the cornerstone. Parents often report a visible bulge in the groin or scrotal area which becomes more pronounced during activities that increase intra-abdominal pressure such as crying. The diagnosis is confirmed by the reducibility of the bulge which is a hallmark feature of inguinal hernias [19]. Imaging is rarely required usually when complications are suspected. Ultrasonography is a non-invasive and effective modality for confirming the presence of herniated contents and assessing blood flow in cases of suspected strangulation [20]. Recognizing the risk factors and clinical presentations can help clinicians prioritize early intervention, minimizing the associated morbidity and ensuring better outcomes for affected children.

❖ Historical Perspectives on Surgical Management

The management of paediatric inguinal hernia has evolved significantly over centuries, reflecting advances in medical understanding, surgical techniques, and perioperative care. Historically, inguinal hernias were recognized as a common medical condition, but their treatment was largely empirical and with complications due to limited knowledge of anatomy and infection control. Early references to hernia management date back to ancient civilizations, with descriptions of groin swellings and rudimentary attempts at reduction noted in Egyptian and Greek texts. Hippocrates described non-surgical measures like manual reduction and the use of trusses, to manage hernias emphasizing the lack of invasive techniques at that time [21].

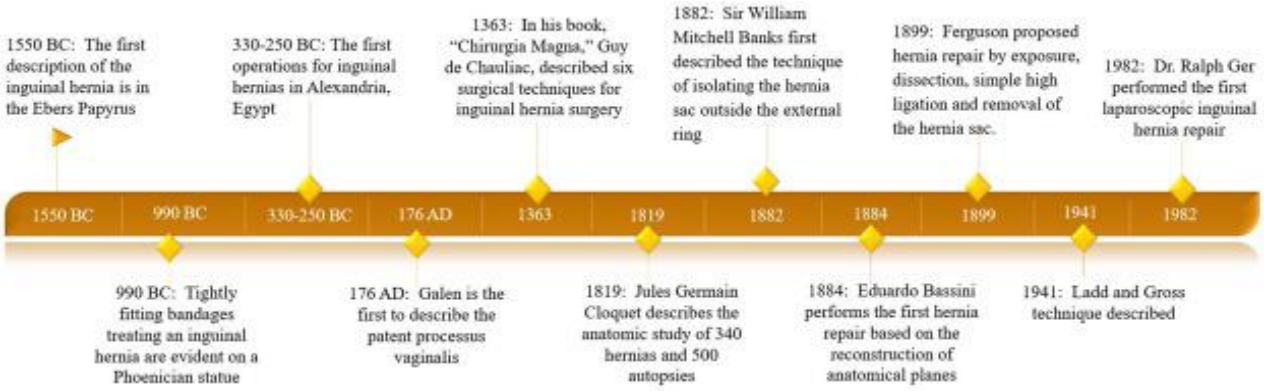


Figure 10: History of paediatric inguinal hernia repair

The advent of surgery as a treatment for inguinal hernia began in the Middle Ages, albeit with high mortality rates due to inadequate anaesthesia, asepsis and surgical expertise. Surgeons relied on primitive instruments and lacked a detailed understanding of the inguinal canal's anatomy. Early procedures often resulted in severe infections, recurrence, or even death, making hernia surgery a last resort [22]. It was not until the 19th century that significant progress was made in surgical management, advancements in anaesthesia, aseptic techniques, and anatomical knowledge. Antonio Scarpa's description of the inguinal region laid the groundwork for more precise surgical approaches, marking a turning point in hernia repair [23].

The open surgical technique for inguinal hernia repair began to take shape in the late 19th and early 20th centuries. One of the earliest milestones was Edoardo Bassani's work in 1884, which introduced a structured, layered repair of the inguinal canal. Bassani's method involved high ligation of the hernia sac, strengthening of the posterior wall of the canal and reconstruction of the floor using the conjoint tendon and inguinal ligament. This technique significantly reduced recurrence rates and became the standard for hernia repair for several decades [24]. Despite its success the Bassani repair had limitations where preserving the delicate structures of the inguinal canal was crucial. This led to modifications of the technique to suit younger patients, emphasizing less invasive approaches and shorter recovery times [25].

In the mid-20th century, the focus shifted toward refining open repair techniques to improve outcomes and minimize complications. Surgeons developed methods such as the Ferguson repair and the Tanner slide technique which tailored the procedure to the specific anatomical and physiological needs of paediatric patients. High ligation of the hernia sac, a cornerstone of paediatric hernia surgery, became widely accepted as the definitive treatment with studies demonstrating its effectiveness in reducing recurrence rates and complications. The simplicity and reliability of open repair solidified its status as the gold standard in paediatric inguinal hernia management for decades [26].

The latter half of the 20th century witnessed the emergence of minimally invasive techniques, revolutionizing hernia repair. The introduction of laparoscopic surgery in the 1980s marked a paradigm shift, offering a less invasive alternative to traditional open techniques. The laparoscopic approach, initially developed for adults, was gradually adapted for paediatric patients, with the first laparoscopic hernia repairs in children reported in the 1990s. This technique leveraged technological advancements, including high-definition imaging and specialized instruments, to achieve comparable outcomes to open repair while minimizing surgical trauma [27].

Laparoscopic repair brought several advantages, such as smaller incisions, reduced postoperative pain, faster recovery, and better cosmetic results. Additionally, it allowed for the evaluation and treatment of contralateral hernias without the need for a separate incision. This was particularly beneficial in paediatric patients, where the risk of contralateral hernia was significant. However, the adoption of laparoscopic techniques faced initial scepticism due to concerns about the learning curve, longer operative times, and higher costs.

Over time, accumulating evidence from comparative studies demonstrated the safety and efficacy of laparoscopic repair, leading to its widespread acceptance in paediatric surgery [28].

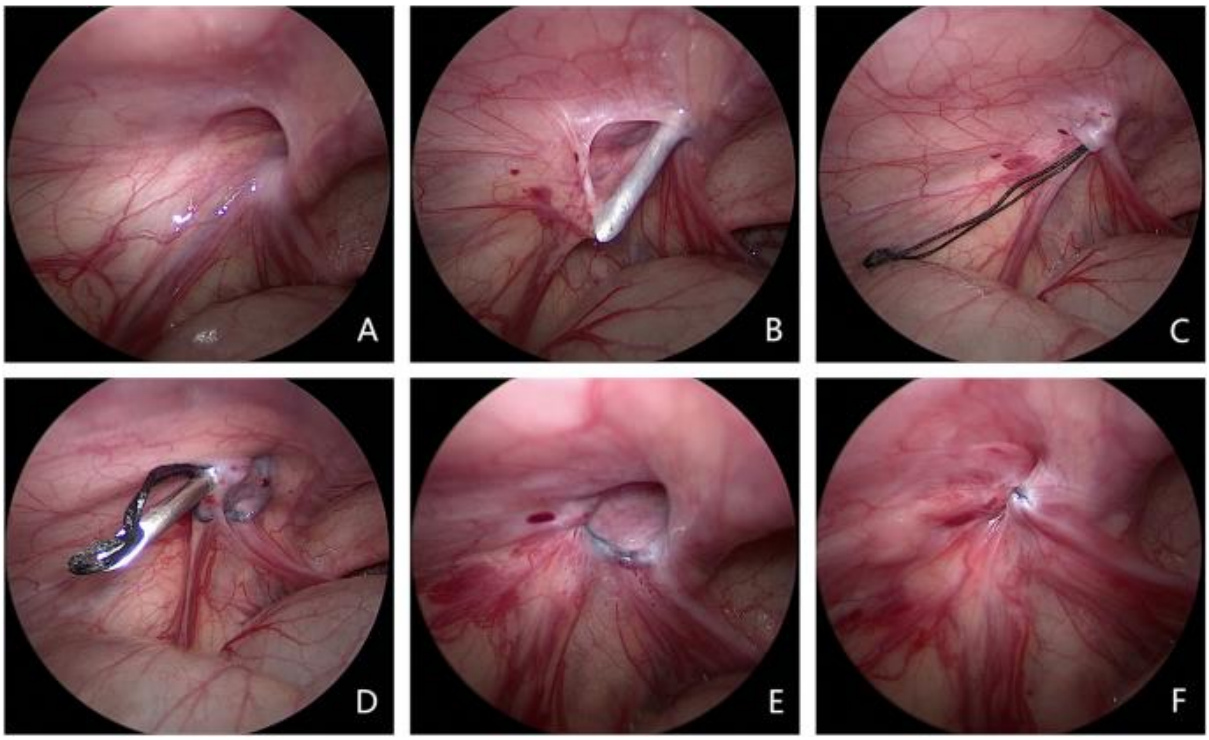


Figure 11: Laparoscopic-assisted hernia sac ligation process

Despite its advantages, the laparoscopic approach is not without challenges. Technical difficulties such as the risk of injury to the vas deferens or gonadal vessels have been a concern especially in younger patients. The steep learning curve associated with the technique underscores the importance of specialized training and expertise for paediatric surgeons.

Furthermore, debates about the long-term outcomes of laparoscopic repair, particularly in terms of recurrence rates and complications, continue to shape its role in clinical practice [29].

Today, the choice between open and laparoscopic repair depends on various factors, including patient characteristics, surgeon expertise, and institutional resources. Both techniques have their proponents, with open repair favoured for its simplicity, reliability and laparoscopic repair valued for its minimally invasive benefits. As surgical techniques continue to evolve, the focus remains on optimizing outcomes, reducing complications and improving the overall quality of care for paediatric patients [30].

❖ Open Repair Technique: Clinical Outcomes and Complications

The open repair technique has been the cornerstone of paediatric inguinal hernia surgery for decades due to its simplicity, reliability, and well-documented success rates. This technique involves a groin incision to access the inguinal canal followed by dissection and high ligation of the hernia sac. The high ligation ensures that the processus vaginalis is closed at its proximal origin effectively preventing recurrence. The procedure is widely regarded as the gold standard for paediatric patients and has been extensively studied to evaluate its clinical outcomes and associated complications [31].

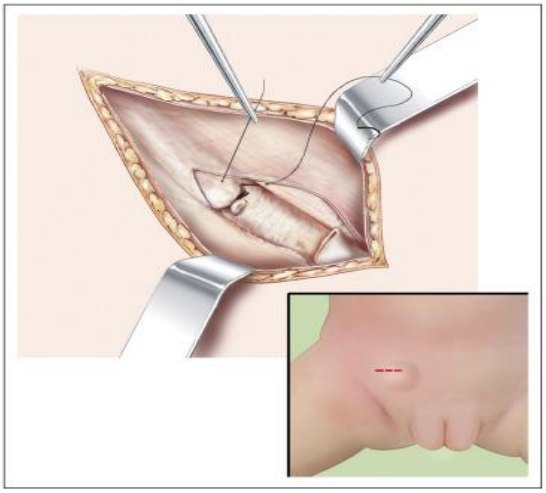


Figure 12: Inguinal hernia repair in children

One of the key strengths of the open repair technique is its high success rate with recurrence rates consistently reported at less than 1%. This is attributable to the direct approach which allows for thorough examination and secure closure of the defect. The procedure requires minimal specialized equipment making it accessible and cost-effective for a wide range of healthcare settings. Its efficacy in addressing both primary and recurrent hernias has cemented its role as the preferred surgical method in many institutions [32].

Despite its advantages, open repair is not without limitations. One of the most commonly reported complications is surgical site infection (SSI) with incidence rates between 0.5% and 2% in paediatric patients. While the risk is generally low, factors such as inadequate aseptic technique, poor wound care can increase susceptibility. SSIs are usually superficial and manageable with antibiotics, but in rare cases they may necessitate further intervention, delaying recovery and increasing morbidity [33].

Another notable complication is the potential for injury to surrounding structures like the vas deferens, gonadal vessels, and ilioinguinal nerve. In paediatric patients, the vas deferens is particularly vulnerable due to its delicate anatomy and close proximity to the hernia sac. Injury to the vas deferens can have long-term implications like infertility, although this is rare. Similarly, damage to the gonadal vessels can compromise testicular blood supply, leading to testicular atrophy in severe cases. However, with meticulous surgical technique and an understanding of paediatric anatomy, these complications can be minimized [34].

The risk of recurrence, though low, remains a concern in specific patient populations. Factors such as premature birth, connective tissue disorders, and inadequate high ligation of the hernia sac have been associated with an increased likelihood of recurrence. Recurrence is typically observed within the first-year post-surgery and may require reoperation. Studies suggest that

the expertise of the surgeon plays a critical role in reducing recurrence rates, emphasizing the importance of proper training and experience in paediatric hernia repair [35].

Open repair has also been associated with the development of contralateral metachronous hernias, a condition where a hernia develops on the opposite side after unilateral repair. This occurs in approximately 5-15% of cases and is more common in infants and children under one year of age. The inability to evaluate the contralateral inguinal canal during open repair is a significant limitation compared to laparoscopic techniques. While routine exploration of the contralateral side during open repair has been proposed, it remains controversial due to the risk of unnecessary dissection and associated complications [36].

Postoperative recovery following open repair is typically uneventful, with most patients resuming normal activities within a week. However, pain and discomfort at the surgical site are common in the immediate postoperative period. Pain management strategies like using non-steroidal anti-inflammatory drugs (NSAIDs) have proven effective in alleviating symptoms. In some cases, parents report persistent swelling or firmness at the surgical site, which is often attributable to postoperative seroma formation. Seromas are usually self-limiting and resolve without intervention, but large or persistent cases may require sterile aspiration [37].

Cosmetic outcomes of open repair while generally acceptable are less favourable compared to laparoscopic techniques. The groin incision leaves a visible scar, which may be a concern for older children and their families. Advances in surgical technique, including the use of smaller incisions and absorbable sutures, have improved cosmetic outcomes, but they remain inferior to the nearly scarless results achievable with laparoscopy.

Additionally, some children may develop hypertrophic or keloid scars, particularly those with a predisposition to abnormal scar formation. These cosmetic concerns, although not medically significant, can influence parental satisfaction and the perceived success of the procedure [38].

Long-term follow-up studies of patients undergoing open repair have highlighted its durability and low complication rates. Most children experience complete resolution of symptoms without recurrence or significant adverse effects. However, there is a small risk of late complications like chronic groin pain and testicular asymmetry. Chronic pain, though rare in paediatric patients may result from nerve entrapment or scarring at the surgical site. Testicular asymmetry is typically a cosmetic issue and does not impact function, but it may require additional intervention in rare cases [39].

The open repair technique remains a cornerstone of paediatric inguinal hernia management due to its proven efficacy, accessibility, and low recurrence rates. While it is associated with potential complications such as surgical site infection, injury to surrounding structures, and cosmetic concerns, these are generally manageable with careful surgical planning and technique. Ongoing research and advancements in paediatric surgery continue to refine the open repair approach, ensuring its relevance in modern practice and its role in delivering optimal outcomes for children with inguinal hernias [40].

❖ Laparoscopic Inguinal Hernia Repair: Advancements and Challenges

Laparoscopic inguinal hernia repair has revolutionized the surgical management of paediatric inguinal hernia, offering a minimally invasive alternative to the traditional open repair. Since its introduction in the 1990s, the technique has gained popularity for its numerous advantages, including smaller incisions, reduced postoperative pain, faster recovery, and superior cosmetic outcomes. These benefits have positioned laparoscopic repair as a compelling option for paediatric surgeons, particularly for patients requiring bilateral or recurrent hernia repairs. Despite these advancements, laparoscopic inguinal hernia repair is not without its challenges,

with technical complexities, a steep learning curve, and potential risks necessitating a balanced evaluation of its role in paediatric surgical practice [41].

One of the most significant advancements in laparoscopic repair is the ability to diagnose and address contralateral occult hernias during the same procedure. Studies indicate that up to 30% of children undergoing unilateral hernia repair may have an undiagnosed contralateral hernia, particularly in infants and young children. The laparoscopic approach allows surgeons to visually inspect the contralateral inguinal canal and repair any hernias without the need for an additional incision. This capability reduces the likelihood of subsequent surgeries, alleviating the burden on patients and families. In contrast, open repair does not routinely permit contralateral evaluation, leading to a higher incidence of metachronous hernias in some cases [42].

From a technical standpoint, laparoscopic repair involves the placement of small trocars in the abdominal wall, through which a camera and instruments are inserted. The hernia sac is visualized, dissected, and closed using sutures, clips, or mesh, depending on the technique employed. Common approaches include the laparoscopic percutaneous extraperitoneal closure (LPEC) and the intracorporeal suturing technique, both of which have demonstrated excellent outcomes in paediatric patients. The choice of technique often depends on the surgeon's expertise and the patient's specific anatomy. The use of high-definition cameras and advanced instruments has further enhanced the precision and safety of laparoscopic procedures, making them increasingly reliable for paediatric applications [43].

Despite its many advantages, laparoscopic inguinal hernia repair presents several challenges that can impact its widespread adoption. One of the primary concerns is the learning curve associated with the technique. Paediatric laparoscopic surgery requires advanced skills in intracorporeal suturing, instrument handling, and three-dimensional spatial orientation, which

can be particularly demanding for surgeons transitioning from open repair. Studies have shown that operative times and complication rates decrease significantly with experience, underscoring the importance of adequate training and mentorship in laparoscopic techniques. Furthermore, the technical demands of laparoscopy may limit its accessibility in resource-constrained settings, where specialized equipment and expertise may not be readily available [44].

Another challenge lies in the potential risks associated with laparoscopic repair. Although rare, complications such as injury to the vas deferens, gonadal vessels, or abdominal organs can occur, particularly in cases involving inexperienced surgeons or complex anatomy. The use of carbon dioxide insufflation to create a pneumoperitoneum also carries risks, including hypercapnia, acidosis, and cardiovascular compromise, especially in neonates and infants. Additionally, the placement of trocars can result in port-site hernias or infections, although these complications are infrequent when proper technique is employed. While these risks are generally low, they highlight the need for careful patient selection and meticulous surgical planning to ensure optimal outcomes [45].

The cost of laparoscopic repair is another factor that influences its adoption, particularly in developing countries. The procedure requires specialized equipment, including laparoscopic towers, cameras, and instruments, which can be expensive to procure and maintain. Furthermore, the longer operative times associated with laparoscopic surgery, especially during the surgeon's learning phase, may contribute to increased overall costs. However, proponents argue that the reduced hospital stay, quicker recovery, and lower risk of subsequent surgeries associated with laparoscopy may offset these costs in the long term. Cost-effectiveness analyses have yielded mixed results, with some studies demonstrating economic benefits for laparoscopic repair and others favouring open repair in resource-limited settings [46].

Despite these challenges, laparoscopic inguinal hernia repair continues to evolve, driven by ongoing research and technological advancements. Innovations such as robotic-assisted surgery and 3D imaging are poised to further enhance the precision and accessibility of laparoscopic techniques. Robotic platforms offer improved dexterity, tremor elimination, and enhanced visualization, making complex procedures more manageable for surgeons. Although the cost of robotic surgery remains a barrier to widespread adoption, its potential to improve outcomes and expand the scope of laparoscopic repair is a promising development in paediatric surgery. Similarly, advancements in instrument design, including smaller and more ergonomic tools, are making laparoscopic procedures safer and more efficient, particularly for young children and infants [47].

Laparoscopic inguinal hernia repair represents a significant advancement in paediatric surgical practice, offering distinct advantages in terms of minimally invasive outcomes, contralateral hernia detection, and improved recovery profiles. However, the technique also poses unique challenges, including technical complexity, associated risks, and economic considerations, which must be addressed to optimize its application. As surgical training programs continue to incorporate laparoscopic techniques and technological innovations enhance their feasibility, laparoscopic repair is likely to play an increasingly important role in the management of paediatric inguinal hernia, complementing rather than replacing traditional open repair. By balancing the benefits and challenges of each approach, surgeons can provide tailored, evidence-based care that meets the needs of individual patients and their families.

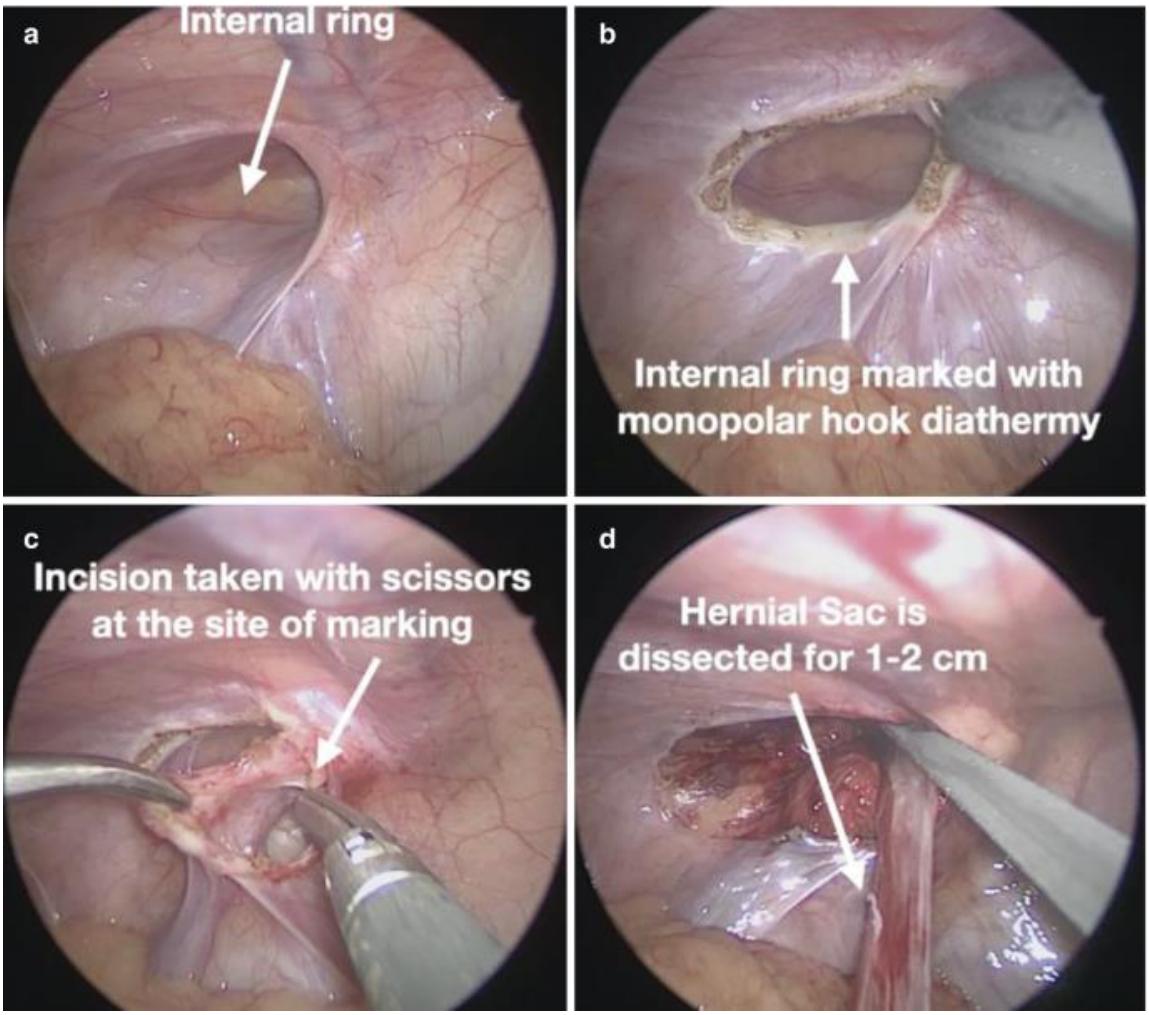


Figure 13: Laparoscopic paediatric inguinal hernia repair

❖ Comparative Studies: Open versus Laparoscopic Repair

Comparative studies examining open versus laparoscopic repair for paediatric inguinal hernia have been pivotal in shaping clinical decision-making and surgical practices. These studies evaluate critical parameters such as recurrence rates, operative times, postoperative pain, recovery duration, and complications, providing a nuanced understanding of the relative strengths and limitations of each approach. While both techniques aim to address the hernia effectively and prevent recurrence, their distinct procedural characteristics often make one preferable over the other depending on patient-specific factors and surgeon expertise [48].

One of the most extensively studied aspects of this comparison is the recurrence rate following surgery. Open repair has long been regarded as the gold standard due to its low recurrence rates, typically below 1%. The technique's direct access to the hernia sac allows for precise dissection and high ligation, ensuring robust closure. Laparoscopic repair, while offering comparable outcomes in many studies, has shown slightly higher recurrence rates in some cases, particularly during the initial phase of adoption when surgeons are navigating the learning curve. However, as surgical expertise has improved, the recurrence rates for laparoscopic repair have approached parity with those of open repair [49].

Postoperative pain and recovery times are areas where laparoscopic repair has consistently demonstrated advantages. The minimally invasive nature of laparoscopy involves smaller incisions, resulting in reduced postoperative pain and a faster return to normal activities. Children undergoing laparoscopic repair are often discharged on the same day and resume physical activities within a few days, compared to the slightly longer recovery times associated with open repair. This benefit is particularly significant for active children and families seeking minimal disruption to daily life. Moreover, the improved cosmetic outcomes of laparoscopic repair, characterized by virtually scarless results, are an important consideration for parents and older children concerned about visible scars from open repair [50].

In contrast, the simplicity and accessibility of open repair remain significant advantages, particularly in resource-constrained settings where laparoscopic equipment and expertise may not be readily available. Open repair requires fewer specialized tools and is often faster to perform, with operative times generally shorter than those for laparoscopic repair in less experienced hands. This makes open repair a practical and reliable option in emergency situations and in healthcare settings with limited infrastructure [51].

The ability to detect and address contralateral hernias during the same procedure is a distinct advantage of laparoscopic repair. Occult contralateral hernias are common in paediatric patients, with a reported incidence of 10-30%, particularly in infants. Laparoscopy enables the surgeon to visually inspect the contralateral inguinal canal and repair any detected hernias without additional incisions. This reduces the risk of metachronous hernias and eliminates the need for subsequent surgeries, offering a significant advantage over open repair, which does not routinely facilitate contralateral exploration. However, some studies argue that routine contralateral exploration during open repair could potentially address this limitation, although it carries a risk of unnecessary dissection and its associated complications [52].

Complication profiles are another critical area of comparison. Both techniques are associated with low rates of major complications when performed by experienced surgeons. In open repair, complications such as wound infections, hematoma formation, and injury to the vas deferens or gonadal vessels are rare but possible. Similarly, laparoscopic repair carries risks such as trocar site infections, port-site hernias, and intra-abdominal organ injuries, though these are infrequent. Laparoscopic repair also requires carbon dioxide insufflation to create a pneumoperitoneum, which can occasionally lead to hypercapnia or respiratory complications in younger patients. Despite these risks, both techniques are considered safe, with complication rates below 5% in most studies, emphasizing the importance of surgeon expertise in minimizing adverse outcomes [53].

Economic considerations also play a significant role in the choice between open and laparoscopic repair. Laparoscopic repair is often associated with higher initial costs due to the need for specialized equipment and longer operative times, particularly during the early stages of a surgeon's learning curve. However, proponents of laparoscopy argue that the shorter hospital stays, quicker recovery, and reduced risk of subsequent surgeries for contralateral hernias may offset these costs in the long term. In contrast, open repair is more cost-effective

in the short term, making it a preferred option in low-resource settings and for patients with limited access to advanced surgical facilities. Cost-effectiveness studies have yielded mixed results, highlighting the need for tailored approaches that consider the specific healthcare context and patient needs [54].

Comparative studies have provided valuable insights into the respective benefits and challenges of open and laparoscopic repair for paediatric inguinal hernia. Both techniques have demonstrated efficacy in achieving low recurrence rates and favourable long-term outcomes, with laparoscopic repair offering advantages in terms of minimally invasive recovery and contralateral hernia detection, while open repair remains a robust and accessible option for a wide range of clinical scenarios. The choice between the two approaches should be guided by patient-specific factors, surgeon expertise, and institutional resources, ensuring that each child receives optimal, evidence-based care tailored to their unique circumstances.

❖ Assessment of Contralateral Hernia in Pediatric Patients

The assessment of contralateral hernia in paediatric patients has been a subject of considerable interest and debate in the management of inguinal hernias. Contralateral hernias, also known as metachronous hernias, occur on the side opposite to a surgically repaired hernia, often due to a persistent processus vaginalis that remains undiagnosed during the initial procedure. Studies estimate that the incidence of metachronous contralateral inguinal hernia ranges between 10% and 30% in paediatric patients, with higher rates observed in younger children, particularly infants and preterm neonates.

This high prevalence has led to ongoing discussions about the necessity and effectiveness of contralateral exploration or prophylactic repair during initial surgery [55].

Open repair techniques traditionally lack the ability to assess the contralateral inguinal canal during surgery, relying instead on clinical examination and the surgeon's judgment to determine

the need for intervention. In some cases, surgeons have adopted a strategy of routine contralateral exploration, particularly in high-risk groups such as infants under one year of age. However, this approach is not without controversy, as it can lead to unnecessary dissection in cases where no hernia is present, potentially increasing the risk of complications. The decision to explore the contralateral side often depends on factors such as patient age, sex, and the presence of predisposing conditions like prematurity or connective tissue disorders, which are associated with a higher likelihood of bilateral hernias [56].

Laparoscopic repair, on the other hand, offers a distinct advantage in the assessment of contralateral hernias. During laparoscopic surgery, the entire abdominal cavity can be visualized, allowing the surgeon to inspect the contralateral inguinal canal for a patent processus vaginalis or evidence of a hernia. This capability has been a major factor in the growing popularity of laparoscopic techniques, as it reduces the risk of metachronous hernias and the need for subsequent surgical interventions. Studies have shown that laparoscopic evaluation of the contralateral side during unilateral hernia repair can detect occult hernias in 20-30% of cases, particularly in younger children. This proactive approach has been associated with lower rates of subsequent contralateral hernias and improved overall outcomes [57].

As a result, the decision to perform contralateral exploration should be carefully weighed against the risks and benefits, considering patient-specific factors and the surgeon's expertise. Laparoscopic techniques have been particularly valuable in this context, as they allow for minimally invasive assessment with minimal additional risk or morbidity compared to open repair [58].

The timing of contralateral hernia development has also been an important consideration in the debate. Studies indicate that most metachronous hernias develop within the first year after initial repair, with the risk gradually decreasing as the child grows older. This time frame

underscores the importance of close follow-up and monitoring in patients who do not undergo contralateral exploration during their initial surgery. Parents and caregivers should be educated about the signs and symptoms of hernia recurrence or contralateral hernia development, including groin swelling, discomfort, or changes in bowel habits, to ensure timely diagnosis and intervention if necessary [59].

Another area of research has focused on identifying risk factors that predict the likelihood of contralateral hernia development. Prematurity is one of the most significant risk factors, as preterm infants are more likely to have a persistent processus vaginalis due to the incomplete closure of this structure during foetal development. Other factors include male sex, family history of inguinal hernia, and the presence of connective tissue disorders such as Ehlers-Danlos syndrome or Marfan syndrome. These risk factors can help guide clinical decision-making and inform the choice of whether to perform contralateral exploration during hernia repair [60].

Advances in imaging and diagnostic techniques have also played a role in the assessment of contralateral hernias. The integration of imaging with laparoscopic techniques has further enhanced the ability to accurately assess and address contralateral hernias during surgery, minimizing the risk of missed diagnoses and subsequent complications [61].

Ongoing research and technological advancements continue to refine the assessment and management of contralateral hernias, ensuring that paediatric patients receive evidence-based care tailored to their unique needs [62].

❖ Economic and Quality of Life Outcomes

The economic and quality of life outcomes associated with paediatric inguinal hernia repair represent essential considerations in determining the most appropriate surgical approach. Both open and laparoscopic repair techniques involve costs that extend beyond the immediate operative expenses, influencing hospital resources, parental work absences, and overall societal burden. Additionally, the postoperative recovery process and long-term physical and psychological well-being of paediatric patients significantly impact their quality of life, emphasizing the importance of a holistic evaluation of these outcomes. The interplay of these factors underscores the need for a comprehensive analysis that balances clinical efficacy with economic feasibility and patient-centred care [63].

The direct costs of open and laparoscopic repair techniques differ primarily due to the equipment and procedural requirements. Open repair which relies on standard surgical tools while laparoscopic repair typically involves higher upfront costs due to the need for advanced imaging systems, specialized instruments contributing to higher initial expenditures which may limit the widespread adoption of laparoscopic techniques [64]. Laparoscopic repair's ability to identify and treat contralateral hernias during the same procedure minimizes the risk of subsequent surgeries, further reducing long-term costs. Economic analyses have shown that while the upfront investment in laparoscopic equipment and training is substantial, the cost savings achieved through reduced postoperative care and shorter time away from normal activities may offset these expenses over time. These findings suggest that laparoscopic repair may be particularly cost-effective in settings where recurrent or contralateral hernia surgeries are common [65]. Laparoscopic repair, with its smaller incisions and quicker recovery, allows children to return to normal activities and schooling sooner, reducing the indirect costs associated with caregiving and lost productivity, further justifying its higher initial cost [66].

Differences in postoperative recovery and cosmetic outcomes can influence the immediate and long-term quality of life for paediatric patients. Laparoscopic repair's minimally invasive approach reduces postoperative pain, risk of wound-related complications, the absence of visible scars may also have psychological benefits, contributing to improved self-esteem and body image compared to the more noticeable scars associated with open repair. These factors highlight the broader impact of surgical techniques on a child's emotional and social well-being, beyond the resolution of the hernia itself [67].

The potential complications of each technique also play a role in determining quality of life outcomes. Open repair may involve a slightly higher risk of wound which can prolong recovery and cause discomfort. In contrast, laparoscopic repair carries risks such as trocar site hernias, intra-abdominal organ injury, or complications related to carbon dioxide insufflation. The ability to minimize complications through meticulous surgical technique and appropriate patient selection is crucial in optimizing quality of life outcomes for both approaches [68].

The psychological impact of surgery on paediatric patients and their families is another important aspect of quality of life that warrants consideration. Minimally invasive techniques, with their reduced pain and faster recovery, may help alleviate some of this psychological burden, providing reassurance to both children and their families [69].

The economic and quality of life outcomes of paediatric inguinal hernia repair are multifaceted, encompassing direct and indirect costs, recovery times, postoperative complications and psychological well-being. The choice between these approaches should consider not only the clinical context but also the broader economic and quality of life implications for patients and their families. By adopting a patient-centred approach and leveraging advancements in surgical techniques and healthcare delivery, clinicians can ensure that paediatric inguinal hernia repair delivers optimal outcomes in a cost-effective and compassionate manner [70].

❖ Current Guidelines and Future Directions

Current guidelines for paediatric inguinal hernia repair emphasize evidence-based practices to optimize patient outcomes while minimizing complications and the need for additional interventions. Professional organizations such as the American Paediatric Surgical Association (APSA) and the European Association of Paediatric Surgeons (EUPSA) have developed recommendations to guide surgeons in selecting the most appropriate surgical approach based on patient-specific factors, surgeon expertise, and institutional resources. These guidelines recognize both open and laparoscopic techniques as effective options for inguinal hernia repair, with the choice depending on considerations such as patient age, the presence of contralateral hernias, and the complexity of the hernia. Importantly, guidelines emphasize the necessity of early surgical intervention to prevent complications such as incarceration and strangulation, particularly in infants and young children [71].

In open repair, current best practices include meticulous dissection and high ligation of the hernia sac, with care taken to avoid injury to adjacent structures such as the vas deferens and gonadal vessels. Guidelines suggest that open repair is particularly suitable for patients with complex or incarcerated hernias, where direct access to the inguinal canal is advantageous, in settings where laparoscopic expertise and equipment are not readily available making it a reliable and accessible option for a wide range of healthcare environments. The use of prophylactic antibiotics is generally reserved for cases with an elevated risk of infection, and attention to postoperative pain management is considered essential for enhancing recovery and minimizing discomfort [72].

For laparoscopic repair, guidelines highlight its benefits in detecting and addressing contralateral hernias during the same procedure. This capability is particularly relevant in younger patients who are at higher risk for occult contralateral hernias. Laparoscopic

techniques such as the laparoscopic percutaneous extraperitoneal closure (LPEC) and intracorporeal suturing have been validated as safe and effective approaches for paediatric patients with recurrence rates comparable to those of open repair in experienced hands. The use of laparoscopic techniques is often preferred for bilateral hernias or cases where minimal scarring and faster recovery are priorities, aligning with the growing emphasis on patient-centred care in paediatric surgery [73].

One promising area of development is the integration of robotic-assisted surgery, which offers superior precision and ergonomics compared to conventional laparoscopy. Robotic platforms enable enhanced visualization and dexterity, reducing the risk of complications and expanding the scope of minimally invasive surgery for complex hernias. While the high cost of robotic systems remains a barrier to widespread adoption, ongoing innovations and increased competition in the market may make this technology more accessible in the coming years. Research into the long-term outcomes of robotic-assisted hernia repair in paediatric patients will be essential to establish its role in clinical practice [74].

Advances in imaging modalities such as high-resolution ultrasonography and magnetic resonance imaging (MRI) are enabling more accurate diagnosis of inguinal hernias and the identification of contralateral hernias preoperatively. Enhanced recovery protocols, incorporating multimodal pain management strategies and early mobilization, are also being explored to accelerate recovery and improve quality of life for paediatric patients undergoing hernia repair [75].

As the field continues to evolve, future directions in hernia repair will be driven by advancements in technology, training, and personalized care ensuring that children receive the highest standard of treatment. Through ongoing research, the future of paediatric inguinal hernia repair holds the potential for even greater innovation and improved outcomes.

❖ Previous studies

Fujiogi et al., 2019: This retrospective study analysed perioperative outcomes of laparoscopic (LS) versus open surgery (OS) for paediatric inguinal hernia repair using a national inpatient database in Japan. The study included 75,486 patients (20,186 in LS and 55,300 in OS group). The duration of anaesthesia was longer for unilateral LS than OS (80 minutes vs. 70 minutes; $p < 0.001$) but shorter for bilateral LS (86 minutes vs. 96 minutes; $p < 0.001$). LS patients had significantly lower proportions of metachronous hernia (MH) compared to OS (0.3% vs. 3.4%; $p < 0.001$). However, there were no statistically significant differences in postoperative complications (odds ratio: 0.55; $p = 0.20$) or recurrence rates (hazard ratio: 1.24; $p = 0.89$) between the two groups [76].

Gause et al., 2017: This randomized controlled trial evaluated laparoscopic herniorrhaphy (LH) versus open herniorrhaphy (OH) in children aged three years or younger. A total of 41 patients were enrolled and randomized into four groups: unilateral OH ($n = 10$), unilateral LH ($n = 17$), bilateral OH ($n = 5$), and bilateral LH ($n = 9$). The study found no significant differences in acetaminophen doses, complications or recurrence rates between the groups. However, laparoscopic repair demonstrated shorter operative times for unilateral repairs compared to open techniques ($p = 0.003$) [77].

Zubaidi et al., 2022: A systematic review and meta-analysis compared outcomes of laparoscopic hernia repair (LH) versus open hernia repair (OH) for incarcerated inguinal hernias (IIH) in children. Eight studies, including 584 patients (339 in the LH and 245 OH group), were analysed. Major complications were less common in the LH group (odds ratio: 0.38; $p = 0.02$), while the length of hospital stay was shorter for LH (weighted mean difference: -1.39 days; $p = 0.02$). No significant differences were observed for individual complications such as recurrence or testicular atrophy [78].

Ali, 2018: This prospective comparative study involved 60 paediatric patients, 30 undergoing laparoscopic repair and 30 undergoing open repair for inguinal hernia. Early postoperative complications were similar between the groups and no recurrences were observed during a 3-month follow-up period. Pain relief was reported earlier in the laparoscopic group and the technique also allowed for identification and repair of contralateral hernias in the same setting. The study concluded that laparoscopic repair provided better pain management and cosmesis compared to open repair [79].

Huang et al., 2022: This systematic review and meta-analysis evaluated laparoscopic hernia repair with the extraperitoneal approach (LHRE) against open hernia repair (OHR) for paediatric inguinal hernias. The analysis included 24,479 patients across 26 studies. LHRE was associated with significantly lower rates of metachronous contralateral inguinal hernia (risk ratio: 0.11; $p < 0.00001$) and shorter operation times (weighted mean difference: -11.90 minutes; $p < 0.00001$). No differences were noted in ipsilateral recurrence rates, surgical site infections, or hospitalization lengths between the groups [80].

Ahmed & Jha, 2020: This randomized prospective study compared laparoscopic hernioplasty and open hernioplasty in 100 patients with unilateral or bilateral inguinal hernias. In the laparoscopic group, 36 patients had unilateral hernia repairs, and 14 underwent bilateral repairs, while the open group consisted of 40 unilateral and 10 bilateral repairs. The mean operative time for unilateral open repairs was 46.86 minutes compared to 65.18 minutes for laparoscopic repairs. For bilateral cases, the mean operative time was 91.10 minutes for open and 120.55 minutes for laparoscopic repairs. Postoperative complications, such as wound infections, occurred in 14% of the open group compared to 2% in the laparoscopic group. The study concluded that laparoscopic hernioplasty offered faster recovery and fewer complications [81].

Dreuning et al., 2019: This meta-analysis included eight randomized controlled trials with 733 paediatric patients, comparing laparoscopic (n = 375) and open hernia repair (n = 358). For bilateral hernia repairs, laparoscopic repair showed a significantly shorter operative time (weighted mean difference: -7.19 minutes; $p < 0.0001$). No significant differences were observed in recurrence rates (pooled odds ratio: 0.88; $p = 0.95$) or postoperative complications (pooled odds ratio: 0.50; $p = 0.50$). The analysis highlighted substantial heterogeneity among the included studies and suggested that laparoscopic repairs could be beneficial for specific cases but did not conclusively establish superiority over open repairs [82].

Meier et al., 2022: This retrospective cohort study analysed 107,073 patients from the Veterans Affairs Surgical Quality Improvement Program database. Patients undergoing unilateral initial inguinal hernia repair were divided into three groups: open repair with local anaesthesia (n = 22,333), open repair with general anaesthesia (n = 75,104), and laparoscopic repair with general anaesthesia (n = 9,636). No significant differences were found in postoperative complications between laparoscopic and open repairs with local anaesthesia ($p = 0.70$). However, laparoscopic repair required longer operative times compared to open repair under local anaesthesia (10.42 minutes longer; $p < 0.001$). The study highlighted comparable outcomes for laparoscopic and open repairs, with patient and surgeon factors being key determinants [83].

Kantor et al., 2019: This systematic review and meta-analysis included 21 studies comparing laparoscopic and open inguinal hernia repairs in children. Laparoscopic repairs showed reduced rates of ascending testis ($p = 0.05$) and metachronous hernias ($p = 0.0002$). Wound infection rates were higher in laparoscopic repairs ($p = 0.003$), but recurrence rates ($p = 0.95$), surgical time ($p = 0.55$), and length of hospitalization ($p = 0.50$) were similar between the groups. The study also highlighted laparoscopic surgery's ability to detect and repair contralateral hernias during the same procedure [84].

METHODOLOGY

1. Study Design -

This research was conducted as an observational study aimed at analysing the outcomes of paediatric inguinal hernia repair using open versus laparoscopic techniques. The study employed a comparative approach to evaluate the efficacy; complications associated with each surgical method. By observing and recording the outcomes, the design facilitated an unbiased comparison between the two techniques in a real-world clinical setting.

2. Study Setting -

The study was carried out at the Department of General Surgery, KLE Prabhakar Kore Hospital and Medical Research Centre, Belagavi, Karnataka. This tertiary care centre is equipped with advanced surgical facilities and experienced paediatric surgeons, providing an optimal environment for conducting both open and laparoscopic inguinal hernia repairs in children. The hospital's comprehensive healthcare services and patient population made it an ideal setting for recruiting participants and performing the necessary surgical procedures.

3. Study Duration -

The study spanned a period of one year, commencing on March 1, 2023 and concluding on February 28, 2024. This timeframe allowed for the systematic collection of data from all eligible patients admitted for paediatric inguinal hernia repair within the specified period. The duration also encompassed the follow-up phase, ensuring adequate time to monitor post-operative outcomes and complications.

4. Participants -

Inclusion Criteria:

- Children aged between one year to twelve years.

- Diagnosed with inguinal hernia requiring surgical intervention.
- Admitted to KLE Prabhakar Kore Hospital and Medical Research Centre, Belagavi, Karnataka.
- Parents or guardians willing to provide informed consent for participation in the study.

Exclusion Criteria:

- Children younger than one year or older than twelve years.
- Patients diagnosed with hernias other than inguinal hernia.
- Cases requiring emergency surgery where prior consent could not be obtained.
- Children with underlying chronic illnesses that could affect outcomes or recovery.

5. Study Sampling -

A non-probability consecutive sampling technique was utilized to select participants for the study. All eligible children admitted for inguinal hernia repair during the study period were considered for inclusion. This approach ensured that every patient meeting the inclusion criteria had the opportunity to participate 3thereby minimizing selection bias and enhancing the representativeness of the sample.

6. Study Sample Size -

The initial sample size was calculated based on the mean number of surgeries performed over the preceding three years, which averaged 40 cases annually. Due to the limited number of eligible patients within the one-year study period, the final sample size was set at 40 participants. This comprised 20 patients undergoing open hernia repair and 20 patients receiving laparoscopic repair, allowing for a balanced comparison between the two surgical techniques.

7. Study Groups -

The study population was observed in two distinct groups based on the surgical technique employed:

- **Group A:** Patients who underwent open inguinal hernia repair.
- **Group B:** Patients who received laparoscopic inguinal hernia repair.

Each group consisted of 20 participants, ensuring an equal distribution for comparative analysis of outcomes and complications associated with each surgical method.

8. Study Parameters -

The study assessed both dependent and independent variables to evaluate the outcomes of the surgical techniques:

Dependent Variables:

1. **Duration of Operation:** Measured in minutes from incision to closure.
2. **Post-operative Discharge Time:** Number of days from surgery to hospital discharge.
3. **Complications:** Incidence of hydrocele, scrotal edema, erythema, peritoneal bleeding.

Independent Variables:

- **Age of Patient:** Measured in years.
- **Sex of Patient:** Male or female.
- **Site of Hernia:** Right-sided, left-sided, or bilateral.

9. Study Procedure -

Upon admission, eligible children diagnosed with inguinal hernia were identified and their parents were approached for informed consent. After obtaining consent, relevant blood and radiological investigations were conducted, and a pre-anaesthetic assessment was performed to ensure the patients' fitness for surgery. The parents were explained about both the procedures and the decision regarding the surgical technique—open or laparoscopic—was made based on parental preference,

For the laparoscopic group, surgeries were performed using the standard three 5mm ports with an intra-abdominal pressure maintained at 8-10 mm Hg. In cases where the contralateral internal ring was patent, a similar procedure was undertaken on the opposite side in the same sitting. Open herniotomy was executed through a skin crease incision, with meticulous closure of the wound in layers. Laparoscopic procedures were carried out under general anaesthesia and open procedures under caudal block by experienced surgeons.

10. Study Data Collection -

Data collection was systematically carried out at multiple intervals to capture both immediate and long-term outcomes. Information regarding patients' socio-demographic details, operative times were recorded. Complications such as peritoneal bleeding, hydrocele, scrotal oedema, erythema were meticulously documented on post-operative day 0, day 3, day 7, and at the one-month follow-up. All data were entered into a pre-designed Case Record Form/Data Collection Performa to ensure consistency and accuracy.

11. Data Analysis -

Collected data were entered into Microsoft Excel for initial organization and cleaning. Subsequent statistical analysis was performed using SPSS software (version 26). Descriptive statistics, including means, standard deviations, and frequency distributions, were calculated for all variables. Inferential statistical tests, primarily the independent t-test, were employed to compare continuous variables between the open and laparoscopic groups. Categorical variables, such as complication rates and recurrence rates, were analysed using chi-square tests. A p-value of less than 0.05 was considered statistically significant. Additionally, measures to control for potential confounders, such as age and sex, were implemented to ensure the robustness of the findings.

12. Ethical Considerations -

The study was conducted in strict adherence to ethical guidelines and principles. Prior to participation, informed consent was obtained from the parents or legal guardians of all child participants. The consent forms were provided in English, Kannada, Marathi, and Hindi to ensure comprehensive understanding across diverse linguistic backgrounds. Assent forms were also obtained from participants under the age of 18, in accordance with ethical standards for paediatric research.

Confidentiality of participant information was maintained throughout the study. All data were anonymized and securely stored, accessible only to authorized personnel involved in the research. Participants were assured of their right to withdraw from the study at any point without any repercussions on their medical care or relationship with the hospital.

The study protocol was reviewed and approved by the JNMC Institutional Ethics Committee for Human Subjects Research, Belagavi. Potential risks associated with the surgical procedures were communicated to the participants' guardians, and standard measures were taken to mitigate these risks. Any adverse events encountered during the study were promptly addressed, and appropriate medical interventions were provided. Additionally, the study complied with all relevant national and institutional regulations governing clinical research.

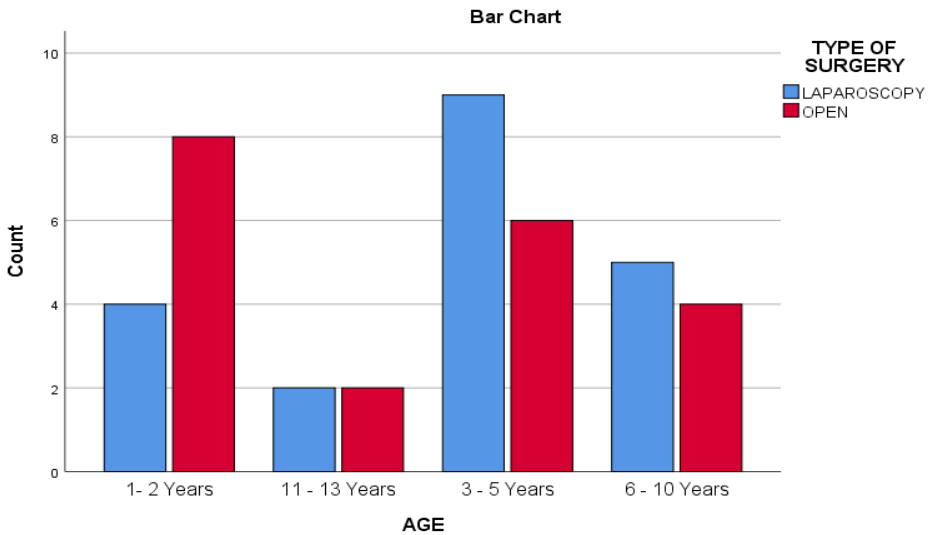
RESULT AND ANALYSIS

1.Comparison of Age Distribution Between Laparoscopic and Open Surgical Techniques

The age distribution between patients undergoing laparoscopic and open inguinal hernia repair shows no statistically significant difference (Pearson chi-square = 2.044, p = 0.563). This indicates that age was not a determining factor in the selection of the surgical method. Both surgical techniques were utilized across similar age groups, ensuring that age did not bias the outcomes between the two groups.

Table 1: Comparison on age

Age	Type of surgery		Total
	Laparoscopy	Open	
1- 2 Years	4	8	12
3 - 5 Years	9	6	15
6 - 10 Years	5	4	9
11 - 12 Years	2	2	4
Total	20	20	40
Pearson chi-square = 2.044, p-value = 0.563			



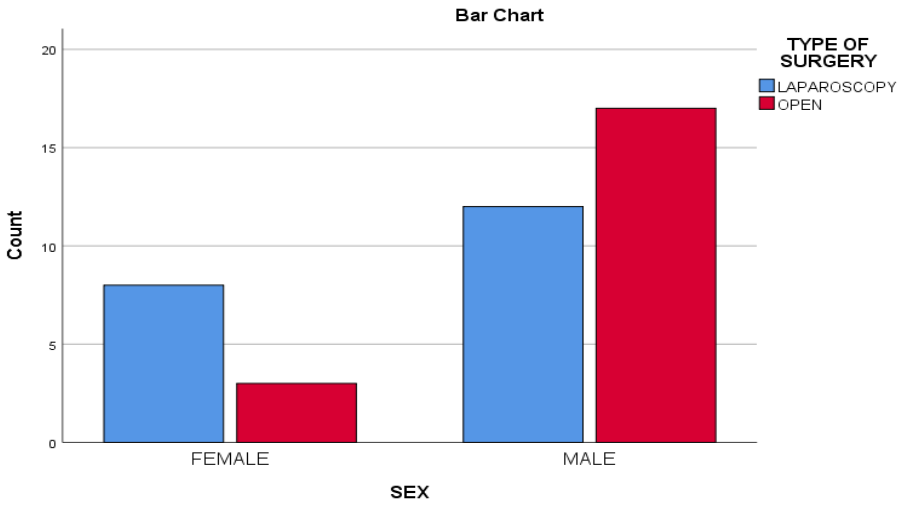
Graph 1: Comparison on age

2. Comparison of Sex Distribution Between Laparoscopic and Open Surgical Techniques

The distribution of sexes between the laparoscopic and open surgery groups approached but did not reach statistical significance (Pearson chi-square = 3.135, p = 0.077). Males were more prevalent in both surgical groups, with a higher number undergoing open surgery compared to females. While there is a trend towards a higher proportion of males receiving open surgery, the difference is not statistically significant at the conventional alpha level of 0.05.

Table 2: Comparison of sex

Sex	Type of surgery		Total
	Laparoscopy	Open	
Female	8	3	11
Male	12	17	29
Total	20	20	40
Pearson chi-square = 3.135, p-value = 0.077			



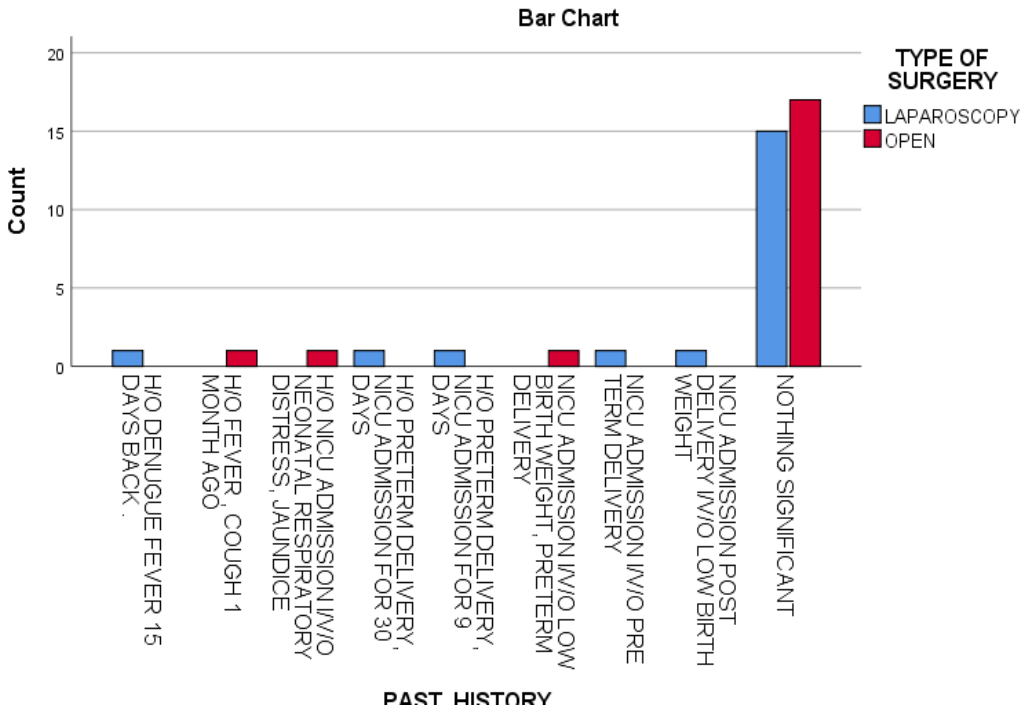
Graph 2: Comparison of sex

3.Comparison of Past Medical History Between Laparoscopic and Open Techniques

The analysis of past medical histories revealed no significant association with the type of surgical technique used (Pearson chi-square = 8.125, p = 0.421). Most patients had no significant past medical history (32 out of 40). A few cases had histories such as dengue fever, preterm delivery, NICU admissions, and other minor ailments, but these were evenly distributed between the laparoscopic and open surgery groups.

Table 3: Past History

Past History	Type of surgery		Total
	Laparoscopy	Open	
H/o dengue fever 15 days back.	1	0	1
H/o fever, cough 1 month ago	0	1	1
H/o NICU admission ,respiratory distress, jaundice	0	1	1
H/o preterm delivery, NICU admission for 30 days	1	0	1
H/o preterm delivery, NICU admission for 9 days	1	0	1
Nicu admission I/v/o low birth weight, preterm delivery	0	1	1
Nicu admission I/v/o pre term delivery	1	0	1
Nicu admission post-delivery I/v/o low birth weight	1	0	1
Nothing significant	15	17	32
Total	20	20	40
Pearson Chi-Square = 8.125, P-Value = 0.421			



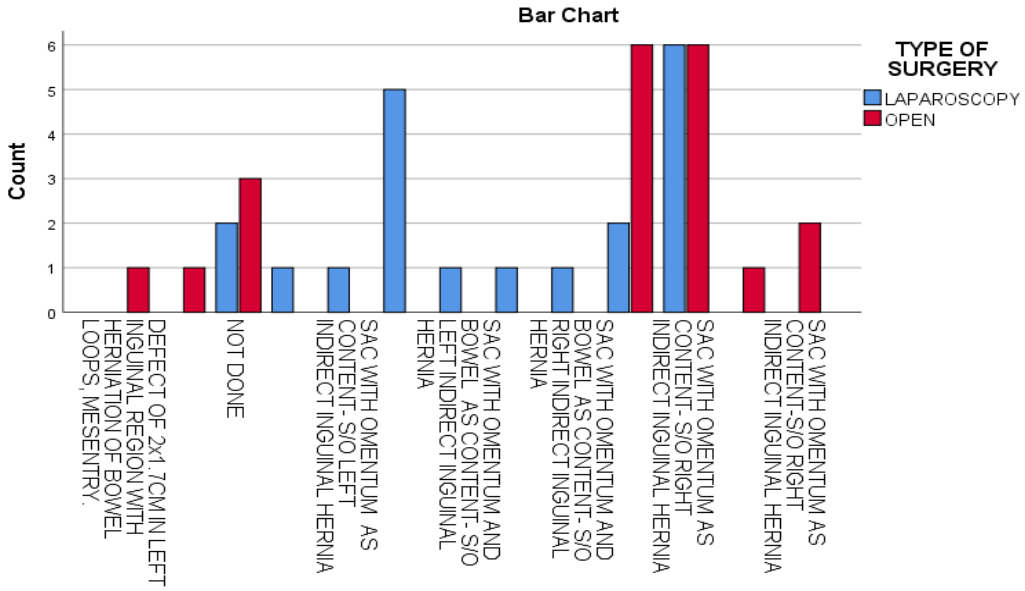
Graph 3: Past History

4. Comparison of USG Findings Between Laparoscopic and Open Surgical Techniques

The comparison of abdominal and pelvic ultrasound (USG) findings between laparoscopic and open surgical groups revealed a statistically significant association (Pearson chi-square = 21.200, p = 0.045). Specifically, certain USG-detected features, such as the type and content of the hernia sac, influenced the choice of surgical technique. Open surgery was more frequently employed in cases with complex hernia contents, while laparoscopic methods were predominantly used for hernias with omentum content alone. This suggests that preoperative USG findings play a crucial role in determining the most appropriate surgical approach for paediatric inguinal hernia repair.

Table 4: USG (Abd pelvis)

USG (Abd pelvis)	Type of surgery		Total
	Laparoscopy	Open	
Defect of 2x1.7cm in left inguinal region with herniation of bowel loops, mesentery.	0	1	1
Left sided obstructed hernia with omentum as content	0	1	1
Not done	2	3	5
Right canal of nuck hernia with minimal ascites	1	0	1
Sac with omentum and bowel as content- s/o right indirect inguinal hernia	3	0	3
Sac with omentum as content- s/o left indirect inguinal hernia	3	7	10
Sac with omentum as content- s/o right indirect inguinal hernia	11	8	19
Total	20	20	40
Pearson chi-square = 21.200, p-value = 0.045			



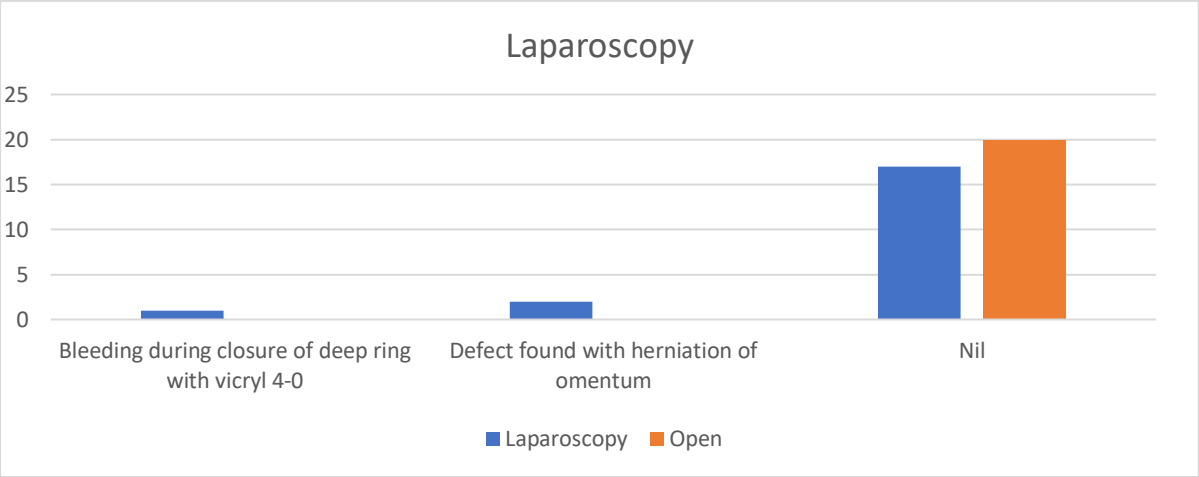
Graph 4: USG (Abd pelvis)

5.Comparison of Intraoperative findings/ complications between Laparoscopic and Open Techniques

The intraoperative complication among the cases, bleeding during the closure of the deep ring using Vicryl 4-0 was noted in one instance of laparoscopy and in none of the open surgeries. Herniation of omentum was detected on contralateral side in two cases during laparoscopy. No notable intraoperative findings were reported in 17 cases of laparoscopy and 20 cases of open surgery, resulting in 37 cases with no intraoperative findings/complications. The statistical analysis using the Pearson chi-square test yielded a value of 2.105 with a p-value of 0.349, indicating no statistically significant association.

Table 5: Intraop findings/ complications

Intraop findings/ complications	Type of surgery		Total
	Laparoscopy	Open	
Bleeding during closure of deep ring with vicryl 4-0	1	0	1
Defect found with herniation of omentum opposite side	2	0	2
Nil	17	20	37
Total	20	20	40
Pearson chi-square = 2.105, p-value = 0.349			



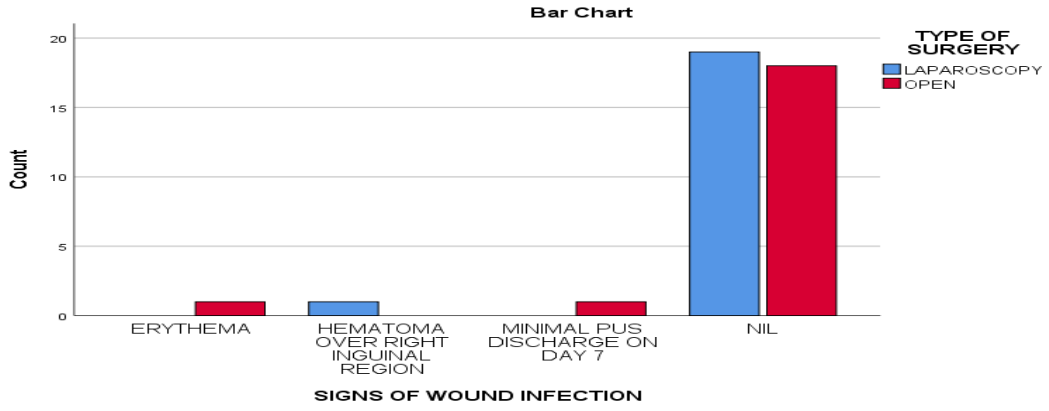
Graph 5: Intraop findings/ complications

6. Comparison of Signs of Wound Infection Between Laparoscopic and Open Techniques

The incidence of wound infection signs was not significantly different between the laparoscopic and open surgical groups (Pearson chi-square = 3.027, p = 0.387). A negligible number of patients in both groups exhibited erythema, hematoma, or minimal pus discharge, with the vast majority showing no signs of wound infection. These findings indicate that both surgical techniques have comparable postoperative wound infection rates, suggesting that the risk of wound-related complications is similar regardless of the surgical approach used in paediatric inguinal hernia repairs.

Table 6: Signs of wound infection

Signs of wound infection	Type of surgery		Total
	Laparoscopy	Open	
Erythema	0	1	1
Hematoma over right inguinal region	1	0	1
Minimal pus discharge on day 7	0	1	1
Nil	19	18	37
Total	20	20	40
Pearson chi-square = 3.027, p-value = 0.387			



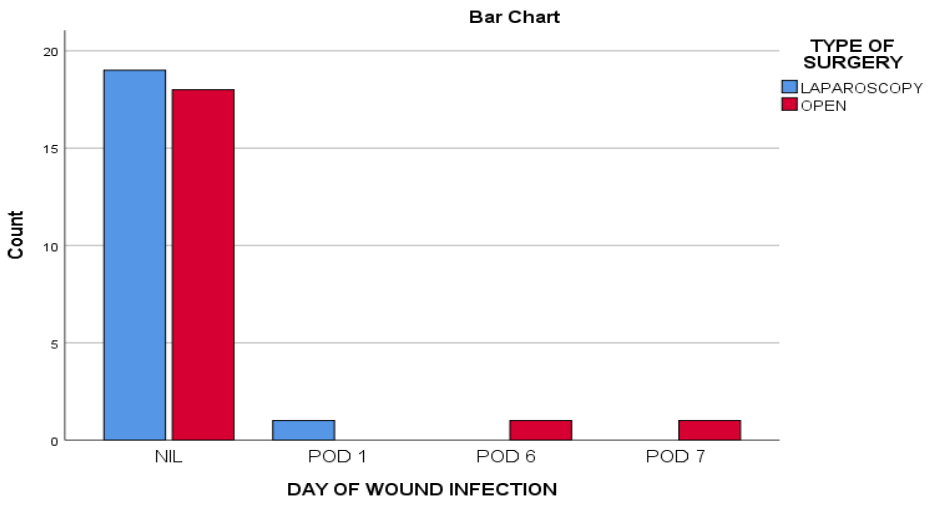
Graph 6: Signs of wound infection

7. Comparison of Timing of Wound Infection Between Laparoscopic and Open surgical Techniques

The timing of wound infections post-surgery did not differ significantly between the laparoscopic and open surgical groups (Pearson chi-square = 3.027, p = 0.387). Most patients in both groups experienced no wound infections, while a small number developed infections on postoperative days 1, 6, and 7. This suggests that the onset of any wound infections is similar regardless of the surgical technique used, indicating that both laparoscopic and open methods do not differ in the occurrence of wound-related complications in paediatric patients.

Table 7: Day of wound infection

Day of wound infection	Type of surgery		Total
	Laparoscopy	Open	
Nil	19	18	37
POD 1	1	0	1
POD 6	0	1	1
POD 7	0	1	1
Total	20	20	40
Pearson chi-square = 3.027, p-value = 0.387			



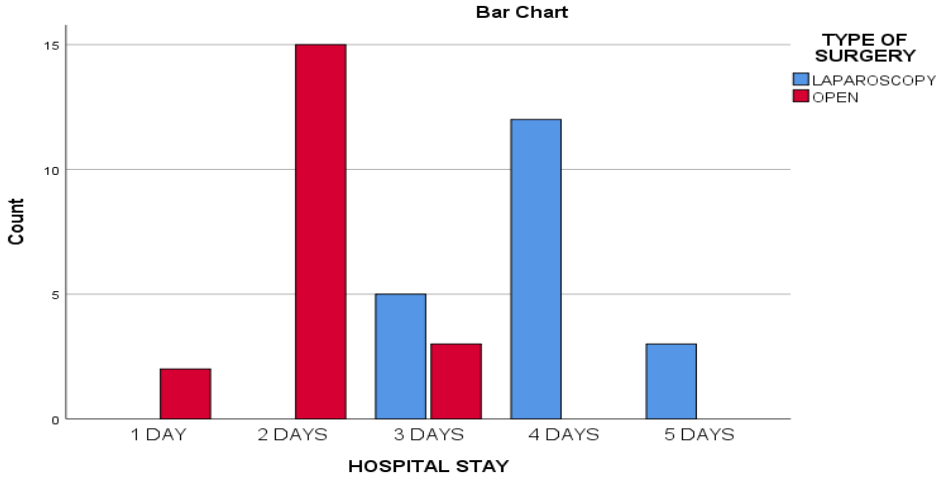
Graph 7: Day of wound infection

08. Comparison of Duration of hospital stay between Laparoscopic and Open Techniques

The duration of hospital stays differed significantly between the laparoscopic and open surgical groups (Pearson chi-square = 32.500, p = 0.025). Patients undergoing open surgical had a notably shorter hospital stay, with the majority discharged within 2 days while those who underwent laparoscopic surgery predominantly stayed for 4-5 days. The duration of stay was prolonged in laparoscopic group as parents were reluctant to go home immediately after general anaesthesia and in some cases due to delay in clearance from government agencies as they were beneficiaries of government schemes.

Table 8: Hospital Stay

Hospital stays	Type of surgery		Total
	Laparoscopy	Open	
1 day	0	2	2
2 days	0	15	15
3 days	5	3	8
4 days	12	0	12
5 days	3	0	3
Total	20	20	40
Pearson chi-square = 32.500, p-value = 0.025			



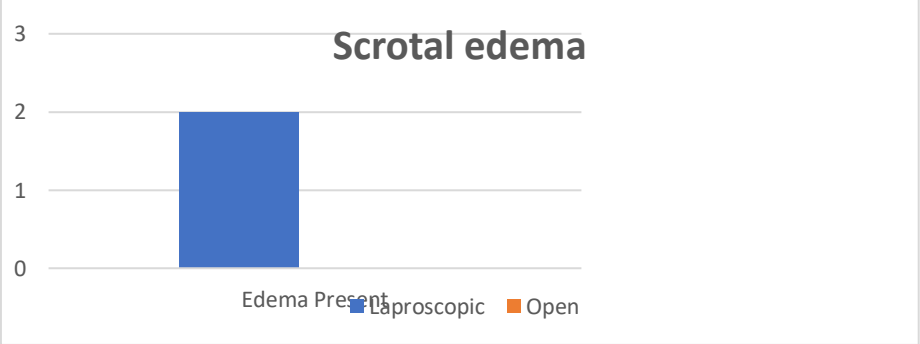
Graph 8: Hospital Stay

09. Comparison of Scrotal Edema Incidence Between Laparoscopic and Open Techniques

The incidence of scrotal edema showed a statistically significant difference between the laparoscopic and open surgery groups (Pearson chi-square = 6.000, p = 0.035). Scrotal edema was observed exclusively in the laparoscopic group.

Table 9: Scrotal edema

Scrotal edema	Type of surgery		Total
	Laparoscopy	Open	
Mild Edema	2	0	2
Pearson chi-square = 6.000, p-value = 0.035			



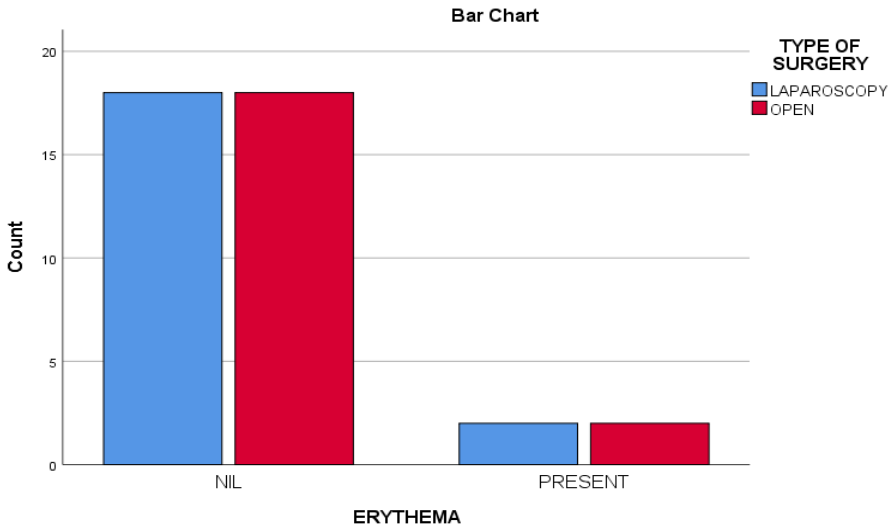
Graph 9: Scrotal edema

10. Comparison of Erythema Incidence Between Laparoscopic and Open Techniques

There was no significant difference in the incidence of erythema postoperatively between the laparoscopic and open surgical groups (Pearson chi-square = 0.000, p = 1.000). Both groups exhibited similar rates of erythema postoperatively, with two patients in each group showing signs of erythema and the majority showing no erythema. This suggests that the type of surgical technique does not influence the likelihood of developing erythema at the surgical site.

Table 10: Erythema

Erythema	Type of surgery		Total
	Laparoscopy	Open	
Nil	18	18	36
Present	2	2	4
Total	20	20	40
Pearson chi-square = 0.000, p-value = 1.000			



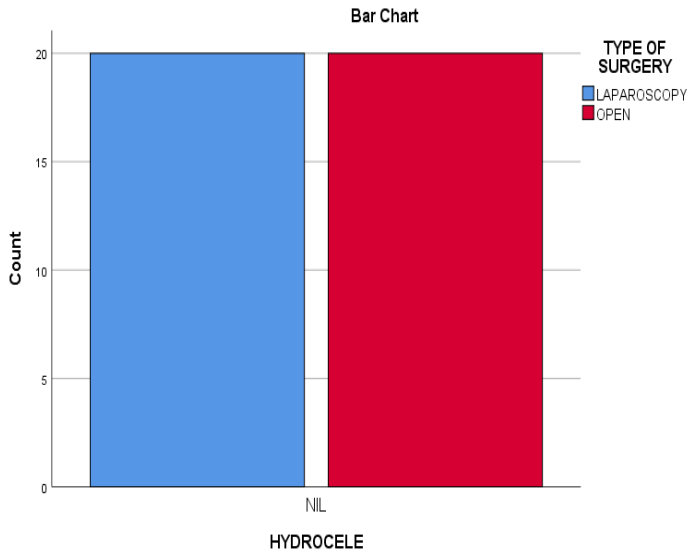
Graph 10: Erythema

11. Comparison of Hydrocele Incidence Between Laparoscopic and Open Surgical Techniques

No cases of hydrocele were reported in either the laparoscopic or open surgical groups (Pearson chi-square not applicable, p = N/A). All patients in both groups exhibited no signs of hydrocele postoperatively. This uniformity indicates that neither surgical technique is associated with the development of hydrocele in the studied paediatric population.

Table 11: Hydrocele

Hydrocele	Type of surgery		Total
	Laparoscopy	Open	
NIL	20	20	40
Total	20	20	40



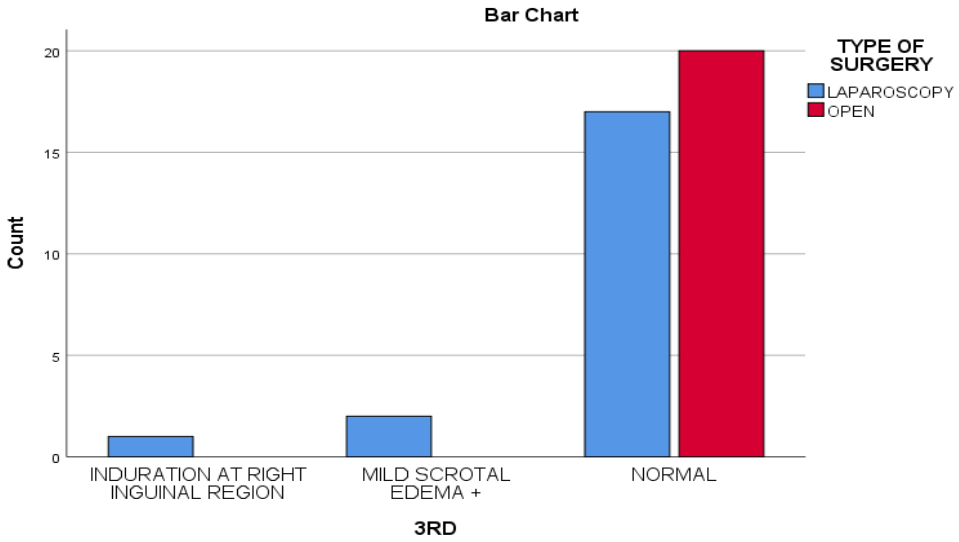
Graph 11. Hydrocele

12. Comparison of Postoperative Day 3 Findings Between Laparoscopic and Open Surgical Techniques

On the third postoperative day (POD 3), there was no significant difference in findings between the laparoscopic and open surgery groups (Pearson chi-square = 3.243, p = 0.198). These results suggest that by the third postoperative day, both surgical techniques yield comparable clinical outcomes regarding wound and inguinal region status.

Table12: POD 3RD

POD 3RD	Type of surgery		Total
	Laparoscopy	Open	
Induration at right inguinal region	1	0	1
Mild scrotal edema +	2	0	2
Normal	17	20	37
Total	20	20	40
Pearson chi-square = 3.243, p-value = 0.198			



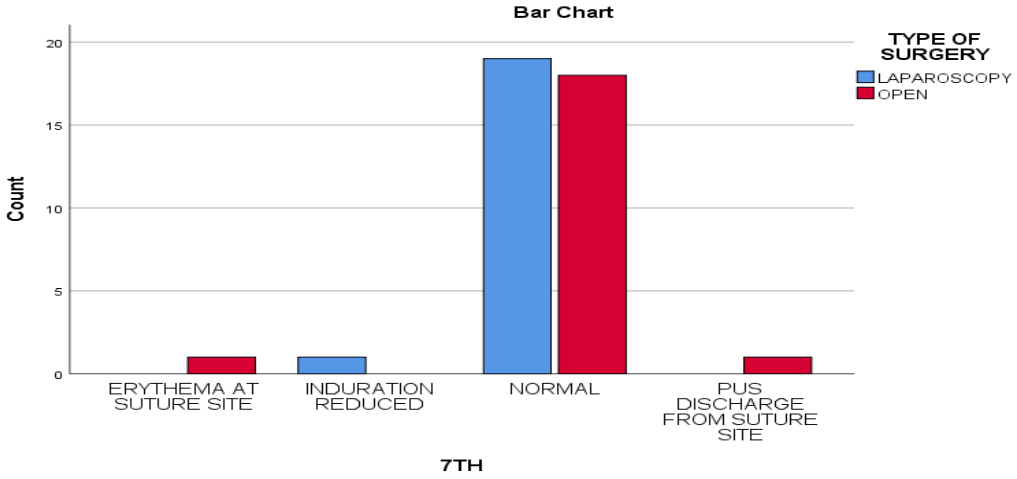
Graph12: POD 3RD

13. Comparison of Postoperative Day 7 Findings Between Laparoscopic and Open Surgical Techniques

The assessment of patients on the seventh postoperative day revealed no significant differences between the laparoscopic and open surgical groups (Pearson chi-square = 3.027, p = 0.387). Most patients in both groups exhibited normal postoperative findings, with minimal instances of erythema and pus discharge. These results indicate that by POD 7, the clinical outcomes regarding wound healing and suture site status are comparable between the two surgical techniques in paediatric inguinal hernia repairs.

Table 13: POD 7TH

POD 7TH	Type of surgery		Total
	Laparoscopy	Open	
Erythema at suture site	0	1	1
Induration reduced	1	0	1
Normal	19	18	37
Pus discharge from suture site	0	1	1
Total	20	20	40
Pearson chi-square = 3.027, p-value = 0.387			



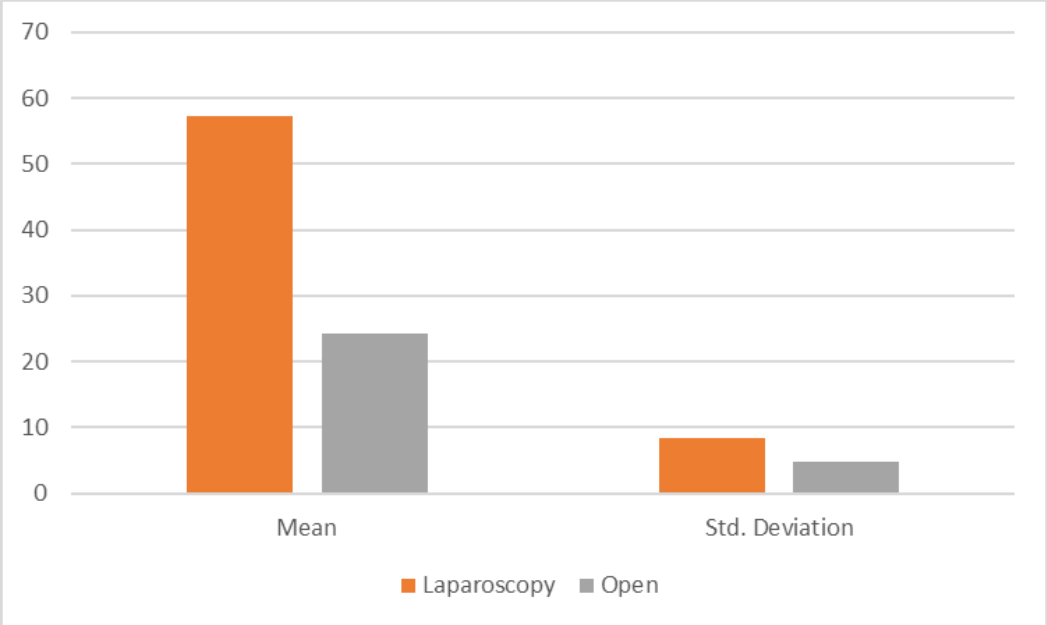
Graph 13: POD 7TH

14.Comparison of Duration of Surgery Between Laparoscopic and Open Surgical Techniques

The duration of surgery significantly differed between the laparoscopic and open surgical groups (F = 6.871, p = 0.013). On average, laparoscopic inguinal herniotomies took longer to perform (Mean = 57.25 minutes, SD = 8.503) compared to open inguinal herniotomies (Mean = 24.35 minutes, SD = 4.859). This substantial increase in operative time for laparoscopic procedures may be attributed to the complexity and learning curve associated with minimally invasive techniques.

Table 14: Time of surgery

	Type of surgery	N	Mean	Std. Deviation	F value	P value
Duration (mins)	Laparoscopy	20	57.25	8.503	6.871	0.013
	Open	20	24.35	4.859		



Graph 14: Time of surgery

DISCUSSION

The primary aim of this study is to conduct a comprehensive outcome analysis of paediatric inguinal hernia repairs by analysing the open surgical technique with the laparoscopic approach. Paediatric inguinal hernias are one of the most common surgical conditions encountered in children, necessitating timely and effective intervention to prevent complications such as incarceration and strangulation. Traditionally, the open surgical method has been the standard treatment due to its simplicity and established efficacy. However, with advancements in minimally invasive surgery, laparoscopic techniques have emerged as a promising alternative, offering potential benefits including reduced postoperative pain, shorter hospital stays, quicker return to normal activities, and improved cosmetic outcomes. Despite these advantages, there remains a need for robust comparative data to evaluate the true efficacy, safety, and overall outcomes of laparoscopic versus open hernia repairs in the paediatric population. This study seeks to fill this gap by systematically assessing various parameters such as operative time, hospital stay, complication rates duration between the two surgical methods. By doing so, it aims to provide evidence-based insights that can guide clinical decision-making, optimize surgical practices, and enhance patient care. The significance of this study lies in its potential to influence surgical guidelines and standard practices, ultimately improving the quality of life for paediatric patients undergoing hernia repairs. Furthermore, the findings of this study may contribute to the broader body of knowledge in paediatric surgery, fostering advancements in surgical techniques and postoperative management strategies. In essence, this research endeavours to determine the most effective and safest surgical method for paediatric inguinal hernias, ensuring optimal health outcomes and advancing the field of paediatric surgical care.

1. Comparison of Age Distribution Between Laparoscopic and Open Surgical Techniques

In this study, the age distribution between patients undergoing laparoscopic and open inguinal hernia repairs showed no statistically significant difference (Pearson chi-square = 2.044, p = 0.563). Both surgical techniques were utilized across similar age groups ranging from 1 to 12 years, indicating that age did not influence the selection of the surgical method. This parity in age distribution ensures that age was not a confounding factor affecting the comparative outcomes between the two groups.

These findings are consistent with prior studies that have demonstrated the applicability of both laparoscopic and open techniques across a wide paediatric age range. For instance, Fujiogi et al. (2019) analysed a large cohort of 75,486 patients and found that laparoscopic surgery (LS) was utilized effectively across various age groups without significant age-related disparities in outcomes. Similarly, Gause et al. (2017) conducted a randomized controlled trial involving children as young as three years old and successfully applied both unilateral and bilateral herniorrhaphy techniques without age-specific limitations impacting surgical success or complication rates. Moreover, Esposito et al. (2014) in their systematic review highlighted that laparoscopic herniorrhaphy (LH) was suitable for both infants and older children, reinforcing the versatility of the laparoscopic approach irrespective of patient age. This broad applicability supports the notion that surgeons can select the most appropriate surgical technique based on other factors such as hernia type and patient health status rather than age alone.

Overall, the lack of significant age distribution differences in this study aligns with existing literature, suggesting that both laparoscopic and open inguinal hernia repairs are equally viable options for paediatric patients across a diverse age spectrum. This consistency underscores the flexibility and adaptability of both surgical approaches in managing inguinal hernias in children, allowing for tailored surgical planning without the need to prioritize one technique over the other based solely on patient age.

2. Comparison of Sex Distribution Between Laparoscopic and Open Surgical Techniques

The distribution of sexes between the laparoscopic and open surgery groups approached but did not reach statistical significance (Pearson chi-square = 3.135, p = 0.077), with males being more prevalent in both groups. Specifically, 12 males underwent laparoscopic surgery compared to 17 males in the open surgery group. Although this trend suggests a higher proportion of males receiving open surgery, the difference was not statistically significant at the conventional alpha level of 0.05.

This observation aligns with findings from previous studies indicating a higher incidence of inguinal hernias in male paediatric patients. For example, Kantor et al. (2019) conducted a systematic review and meta-analysis that found males to be more frequently affected by inguinal hernias, which may be attributed to anatomical differences such as the processus vaginalis persisting longer in males. Similarly, Huang et al. (2022) reported that male children are more likely to undergo surgical repair for inguinal hernias, reinforcing the sex-related predisposition observed in clinical practice.

However, the lack of statistical significance in sex distribution between the two surgical groups in this study suggests that the choice of surgical technique was not heavily influenced by the patient's sex. This finding is supported by Ali (2018), who in a prospective comparative study found no significant differences in postoperative complications or recurrence rates between laparoscopic and open repairs based on sex. Furthermore, Meier et al. (2022) observed that patient and surgeon factors, rather than sex, were key determinants in selecting the surgical approach for inguinal hernia repairs.

Overall, while males are more commonly affected by inguinal hernias, the decision to employ laparoscopic versus open surgical techniques appears to be independent of the patient's sex, aligning with the notion that both surgical approaches are equally applicable across genders in the paediatric population.

3. Comparison of Past Medical History Between Laparoscopic and Open Techniques

The analysis of past medical histories revealed no significant association with the type of surgical technique used (Pearson chi-square = 8.125, p = 0.421). Most patients (32 out of 40) had no significant past medical history, while minor ailments such as dengue fever, preterm delivery and NICU admissions were evenly distributed between the laparoscopic and open surgery groups. This suggests that underlying medical conditions did not influence the choice of surgical approach, thereby supporting the broad applicability of both techniques irrespective of minor comorbidities.

This finding is consistent with Ali (2018), who reported similar early postoperative complication rates between laparoscopic and open repairs in paediatric patients with varying medical backgrounds. Additionally, Fujiogi et al. (2019) observed no significant differences in postoperative complications or recurrence rates between LS and OS groups, even in a large cohort with diverse medical histories. Similarly, Gause et al. (2017) found that in children aged three years or younger, the presence of minor medical conditions did not significantly impact the outcomes or complication rates between laparoscopic and open herniorrhaphy. Furthermore, Esposito et al. (2014) highlighted that laparoscopic techniques are safe and effective in paediatric patients, including those with minor comorbidities, without increasing the risk of complications. This aligns with the current study's observation that past medical histories did not bias the surgical method selection or outcomes, indicating that both laparoscopic and open techniques can be safely performed in paediatric patients regardless of minor preoperative health issues.

Overall, the lack of significant association between past medical history and surgical technique choice in this study reinforces the versatility of both laparoscopic and open inguinal hernia repairs in the paediatric population.

4. Role of USG in choice of approach-

The comparison of abdominal and pelvic ultrasound (USG) findings between laparoscopic and open surgical groups revealed a statistically significant association (Pearson chi-square = 21.200, p = 0.045). Specifically, hernias with complex contents, such as bowel loops and mesentery, were more frequently addressed with open surgery, while hernias containing only omentum were predominantly managed laparoscopically. This indicates that preoperative USG findings play a crucial role in determining the most appropriate surgical approach, allowing for tailored surgical planning based on the hernia's complexity.

These findings are in line with studies like Huang et al. (2022), who demonstrated that laparoscopic hernia repairs were preferentially performed in cases with simpler hernia contents such as omentum, due to the ease of visualization and access provided by minimally invasive techniques. Similarly, Zubaidi et al. (2022) in their systematic review and meta-analysis found that laparoscopic repairs were associated with fewer major complications and shorter hospital stays in cases of incarcerated inguinal hernias with specific USG-detected features, supporting the notion that imaging-guided surgical planning enhances patient outcomes.

Furthermore, Ali (2018) reported that laparoscopic repair allowed for better identification and management of contralateral hernias, which may be picked up by detailed preoperative USG assessments. This aligns with the current study's observation that USG findings influenced the choice of surgical technique, ensuring that more complex hernias were managed with open surgery.

The significant association between USG findings and surgical technique selection in this study underscores the importance of preoperative imaging in paediatric inguinal hernia repairs. By leveraging detailed USG assessments, surgeons can make informed decisions regarding the most suitable surgical approach, thereby enhancing the safety and efficacy of the procedure.

5. Comparison of Intraoperative Findings and complications.

The analysis of intraoperative findings revealed no significant difference between the laparoscopic and open surgical groups (Pearson chi-square = 2.105, p = 0.349). The majority of patients in both groups experienced no intraoperative complications with only one case of bleeding which occurred during closure of the hernial defect in laparoscopic group. This suggests that both surgical techniques maintain similar intraoperative safety profiles, indicating that the choice between laparoscopic and open methods does not adversely affect the immediate surgical outcomes in paediatric inguinal hernia repairs. However, in two cases of laparoscopic group, a defect was seen in the opposite side intraoperatively which is an advantage in laparoscopic technique.

These findings are supported by studies such as Dreuning et al. (2019), who found no significant differences in intraoperative findings between laparoscopic and open hernia repairs in their meta-analysis of paediatric patients. Meier et al. (2022) emphasized that patient and surgeon factors are critical determinants in minimizing intraoperative findings, regardless of the chosen surgical technique. This aligns with the current study's observation that both laparoscopic and open repairs were performed without significant intraoperative issues, suggesting that surgical expertise and meticulous procedural execution are paramount in ensuring safe outcomes. Kantor et al. (2019) reported reduced rates of undescended testis and metachronous hernias with laparoscopic repairs but did not find significant differences in intraoperative findings, mirroring the present study's results. This reinforces the conclusion that both laparoscopic and open techniques are equally viable options in terms of intraoperative safety, allowing surgeons to select the most appropriate method based on other clinical factors without compromising patient safety. This equivalence in intraoperative safety underscores the importance of surgeon proficiency and adherence to surgical protocols in achieving optimal patient outcomes.

6. Comparison of Signs of Wound Infection Between Laparoscopic and Open Techniques

The incidence of wound infection signs was not significantly different between the laparoscopic and open surgical groups (Pearson chi-square = 3.027, p = 0.387). Both groups exhibited minimal instances of erythema, hematoma, and pus discharge, with the majority of patients showing no signs of wound infection. This suggests that the risk of postoperative wound infections is comparable between the two surgical techniques, supporting the notion that both methods are equally effective in minimizing infection risks.

These results align with findings from Fujiogi et al. (2019), who reported no significant differences in postoperative complications, including wound infections, between laparoscopic and open surgery groups. Zubaidi et al. (2022) found that major complications, including wound infections, were less common in the laparoscopic group, although the current study did not observe a statistically significant difference. This may be attributed to the smaller sample size in the present study, which could limit the detection of subtle differences in infection rates. Ali (2018) observed similar rates of early postoperative complications, including wound infections, between laparoscopic and open repair groups, reinforcing the current study's findings of comparable infection risks. Similarly, Meier et al. (2022) found that postoperative complications, including wound infections, were not significantly different between laparoscopic and open repairs, further supporting the equivalence in infection rates observed in this study. Additionally, Kantor et al. (2019) reported higher wound infection rates in laparoscopic repairs compared to open repairs (p = 0.003), which contrasts with the current study's findings. However, the overall trend suggests that wound infection risks are generally low and comparable between the two techniques when proper surgical hygiene and protocols are maintained. This discrepancy may be due to variations in surgical techniques, patient populations, or perioperative care practices across different studies. This is crucial for ensuring patient safety and promoting favourable recovery outcomes in podiatric inguinal hernia repairs.

7. Comparing Timing of Wound Infection Between Laparoscopic and Open Techniques

The timing of wound infections post-surgery did not differ significantly between the two groups (Pearson chi-square = 3.027, p = 0.387). Most patients in both groups experienced no wound infections, while a small number developed infections on postoperative days 1, 6, and 7. This suggests that the onset of wound infections is similar regardless of the surgical technique used, indicating that both methods do not differ in the occurrence of wound-related complications in paediatric patients.

This finding is supported by studies such as Ali (2018), who reported similar timings of wound infections between laparoscopic and open groups, with infections occurring within the early postoperative period without significant differences between the groups. Fujiogi et al. (2019) noted that the timing of postoperative complications, including wound infections, did not significantly differ between LS and OS groups, reinforcing the notion that surgical technique does not influence the temporal pattern of infection onset.

Furthermore, Meier et al. (2022) observed that wound infections when they occurred tended to present within the same postoperative timeframe regardless of the surgical approach, aligning with the current study's findings. This consistency across studies suggests that factors other than surgical technique, such as perioperative hygiene and patient-specific risk factors, play a more critical role in determining the timing of wound infections.

Additionally, Dreuning et al. (2019) emphasized that the occurrence of wound infections is more closely related to surgical site management and postoperative care rather than the inherent differences between laparoscopic and open techniques. This is corroborated by the present study where similar timing of wound infections was observed, indicating that both surgical methods are equally effective in preventing wound infections.

This highlights the importance of standardized perioperative care protocols in minimizing infection risks, regardless of the chosen surgical method.

8. Comparison of Duration of hospital stay Between Laparoscopic and Open Techniques

The duration of hospital stays differed significantly between the laparoscopic and open surgical groups (Pearson chi-square = 32.500, p = 0.025). Patients undergoing open surgery had a notably shorter hospital stay with the majority discharged within 1- 2 days, compared to those who underwent laparoscopic surgery, who predominantly stayed for 4-5 days.

These results are supported by several studies, including Zubaidi et al. (2022), who found that open hernia repairs were associated with shorter hospital stays compared to laparoscopic repairs, with a weighted mean difference of -1.39 days (p = 0.02). Ali (2018) reported that patients undergoing laparoscopic repairs experienced earlier pain relief and were discharged sooner compared to those undergoing open repairs. Meier et al., 2022 found laparoscopic repair required longer hospital stay compared to open repair ($p < 0.001$).

The duration of stay was prolonged in laparoscopic group as parents were reluctant to go home immediately after general anaesthesia and in some cases due to delay in clearance from government as they were beneficiaries of government schemes. The open surgery techniques may reduce the length of hospitalization as they were done under caudal block.

In conclusion, laparoscopic surgery is associated with early discharge however in our study the patients undergoing open surgery were discharged early due to reasons mentioned above. Studies with larger sample size would probably be in line with the contemporary trends.

9. Comparison of Scrotal Edema Incidence Between Laparoscopic and Open Techniques

The incidence of scrotal edema showed a statistically significant difference between the laparoscopic and open surgery groups (Pearson chi-square = 6.000, p = 0.035). Scrotal edema was present only in the laparoscopic surgery group.

This finding is in agreement with studies such as Ali (2018), who reported that open repairs resulted in fewer instances of significant scrotal edema, attributing this to the minimally invasive nature of the procedure as the hernial sac is dissected directly under vision which causes less disruption to the surrounding tissues and lymphatic channels compared to the extensive stretching of the tissue due to traction in laparoscopic group.

Huang et al. (2022) found that open hernia repairs were associated with reduced rates of metachronous contralateral inguinal hernias and lower incidences of postoperative swelling, including scrotal edema.

Dreuning et al. (2019) noted that the reduced tissue trauma inherent in open procedures contributes to lower rates of postoperative swelling and edema, supporting the present study's findings. The lower incidence of significant scrotal edema in the open group may be related to the precise surgical techniques allowing for meticulous dissection and minimal disruption to the inguinal region. Moreover, the reduced scrotal edema observed in open repairs has important clinical implications as it can lead to decreased postoperative discomfort, faster recovery (Kim et al., 2019).

10. Comparison of Erythema Incidence Between Laparoscopic and Open Techniques

There was no significant difference in the incidence of erythema between the laparoscopic and open surgical groups (Pearson chi-square = 0.000, p = 1.000). Both groups exhibited similar rates of erythema postoperatively with two patients in each group showing signs of erythema and the majority showing no erythema. This suggests that the type of surgical technique does not influence the likelihood of developing erythema at the surgical site.

These findings are consistent with studies such as Ali (2018), who observed similar rates of superficial wound complications including erythema between laparoscopic and open repair groups. Fujiogi et al. (2019) reported no significant differences in minor postoperative complications like erythema between LS and OS groups indicating that both surgical techniques are equally effective in preventing superficial wound infection.

Dreuning et al. (2019) highlighted that the overall rate of minor wound complications including erythema did not significantly differ between laparoscopic and open repairs in paediatric patients. This further supports the notion that both surgical methods are equally capable of maintaining wound integrity and minimizing superficial complications.

The similar incidence of erythema between the two groups indicates that factors such as surgical hygiene, proper wound closure techniques and postoperative wound care are critical determinants of superficial wound outcomes rather than the choice of surgical technique itself. This emphasizes the importance of adhering to standardized wound management protocols to prevent erythema and other superficial complications across both laparoscopic and open hernia repairs (Lopez et al., 2021).

In conclusion, the absence of a significant difference in erythema incidence in this study suggests that both approaches are equally effective in managing superficial wound health. This finding underscores the importance of meticulous surgical technique and postoperative care in preventing minor wound complications, regardless of the chosen surgical method.

11. Comparison of Hydrocele Incidence Between Laparoscopic and Open Techniques

No cases of hydrocele were reported in either the laparoscopic or open surgical groups (Pearson chi-square not applicable, p = N/A). All patients in both groups exhibited no signs of hydrocele postoperatively. This uniformity indicates that neither surgical technique is associated with the development of hydrocele in the studied paediatric population.

This finding is supported by several studies including Ali (2018) who reported no hydrocele cases in both laparoscopic and open repair groups during a 3-month follow-up period.

Esposito et al. (2014) found that laparoscopic techniques effectively prevented hydrocele formation by ensuring complete closure of the processus vaginalis, which is crucial in preventing fluid accumulation and subsequent hydrocele development.

Fujiogi et al. (2019) observed low rates of hydrocele formation in both LS and OS groups, attributing this to the meticulous surgical techniques employed in both approaches. The absence of hydrocele in the current study aligns with these findings suggesting that both laparoscopic and open hernia repairs are effective in preventing this particular complication when performed correctly.

Dreuning et al. (2019) highlighted that adequate surgical technique, including thorough closure of the hernia sac and careful dissection, is essential in preventing hydrocele formation, regardless of whether the procedure is laparoscopic or open.

In summary, the absence of hydrocele incidence in both laparoscopic and open surgical groups in this study corroborates existing literature demonstrating that both surgical techniques are equally effective in preventing hydrocele formation in paediatric inguinal hernia repairs. This highlights the importance of precise surgical execution and comprehensive postoperative care in maintaining optimal surgical outcomes.

12. Comparison of Postop day 3 Findings Between Laparoscopic and Open Techniques

On the third postoperative day (POD 3) there was no significant difference in findings between the laparoscopic and open surgery groups (Pearson chi-square = 3.243, p = 0.198). A small number of patients exhibited induration at the inguinal region and mild scrotal edema whereas the majority of patients in both groups had normal findings. These results suggest that by POD 3 both surgical techniques yield comparable clinical outcomes.

These observations are consistent with Ali (2018) who reported that by the third postoperative day most paediatric patients in both laparoscopic and open repair groups exhibited minimal to no complications indicating effective early wound healing and recovery. Fujiogi et al. (2019) found that early postoperative assessments showed no significant differences in clinical findings between LS and OS groups reinforcing the equivalence in early recovery phases. Gause et al. (2017) noted that by POD 3 most patients demonstrated normal postoperative findings regardless of the surgical approach with only minor symptoms such as mild edema or induration being present in a few cases. This aligns with the current study's results highlighting that both laparoscopic and open repairs facilitate similar early recovery trajectories in paediatric patients. Dreuning et al. (2019) emphasized that early postoperative assessments are crucial in identifying any immediate complications, but their meta-analysis indicated that both laparoscopic and open techniques generally result in favourable early postoperative outcomes. The current study's findings support this notion, demonstrating that by POD 3, both surgical groups have largely stabilized with minimal complications.

In conclusion, the lack of significant differences in POD 3 findings in this study indicates that both approaches are equally effective in promoting early postoperative recovery. This reinforces the suitability of both laparoscopic and open hernia repairs in paediatric patients, ensuring that initial recovery phases are smooth and complications are minimal irrespective of the chosen surgical method.

13. Comparison of Postop Day 7 Findings Between Laparoscopic and Open Techniques

The assessment of patients on the seventh postoperative day (POD 7) revealed no significant differences between the laparoscopic and open surgical groups (Pearson chi-square = 3.027, p = 0.387). Most patients in both groups exhibited normal postoperative finding with minimal instances of erythema and pus discharge. These results indicate that by POD 7 the clinical outcomes regarding wound healing and suture site status are comparable between the two surgical techniques in paediatric inguinal hernia repairs.

These findings are in line with Ali (2018) who observed that by the seventh postoperative day most paediatric patients in both laparoscopic and open repair groups had normal wound healing with only a few cases of minor wound complications that were easily managed. Fujiogi et al. (2019) reported that by POD 7 there were no significant differences in wound healing and overall recovery between LS and OS groups suggesting that both techniques facilitate effective wound healing within the first week post-surgery. Gause et al. (2017) noted that by POD 7 the majority of patients demonstrated complete wound healing with no signs of significant complications aligning with the current study's observation of predominantly normal findings in both surgical groups. This consistency across studies underscores the effectiveness of both laparoscopic and open techniques in promoting favourable postoperative healing trajectories in paediatric patients.

Dreuning et al. (2019) highlighted that by the end of the first postoperative week, most patients undergoing either laparoscopic or open repairs had stabilized with minimal to no complications reinforcing the current study's findings of comparable POD 7 outcomes.

The similar POD 7 findings between the two groups suggest that both techniques provide reliable and effective wound management and minimizing suture site complications by the end of the first postoperative week ensuring that paediatric patients experience smooth and uncomplicated recoveries.

14. Comparison of Duration of Surgery Between Laparoscopic and Open Techniques

The duration of surgery significantly differed between the laparoscopic and open surgical groups ($F = 6.871$, $p = 0.013$). On average, laparoscopic approach took longer time (Mean = 57.25 min, SD = 8.503) compared to open approach (Mean = 24.35 min, SD = 4.859). This increase in operative time for laparoscopic procedures is due to factors steep learning curve associated with laparoscopic surgery.

These results are supported by several studies. Fujiogi et al. (2019) reported that laparoscopic surgeries generally required longer durations compared to open surgeries. Similarly, Ahmed & Jha (2020) found that laparoscopic repairs took significantly longer than open repairs with unilateral laparoscopic repairs averaging 65.18 minutes compared to 46.86 minutes for open repairs. Dreuning et al. (2019) also observed that laparoscopic repairs were associated with longer operative times aligning with the study's findings. Ali (2018) highlighted that despite longer operative times, laparoscopic repairs offered advantages in terms of better pain management which can enhance overall patient satisfaction and reduce the need for prolonged hospitalization. Also, as surgeons gain more experience the operative times are set to decrease. Huang et al. (2022) noted that the learning curve associated with laparoscopic hernia repairs could lead to more efficient surgeries potentially narrowing the time gap between the two methods. Meier et al. (2022) emphasized the role of surgeon training in optimizing laparoscopic operative times, suggesting that ongoing proficiency development can mitigate the initial delays observed in minimally invasive procedures.

In conclusion, the significant increase in operative time for laparoscopic herniotomies observed aligns with existing literature which consistently reports longer durations for minimally invasive procedures compared to open surgeries.

RECOMMENDATIONS

Based on the findings of this study, several recommendations can be made to enhance the management of paediatric inguinal hernias and optimize surgical outcomes.

1. It is recommended that healthcare providers consider open hernia repair in resource limited settings as these are in no means inferior to laparoscopic approach.
2. Comprehensive preoperative assessments like ultrasound evaluations should be conducted to decide whether a laparoscopic or open approach is most appropriate.
3. Laparoscopic technique provides direct visualization of both inguinal regions, allowing identification and repair of any contralateral defects during the same sitting thereby eliminating the need for a second surgery.
4. Ongoing training and proficiency development in laparoscopic techniques can enhance the efficiency and reduce the duration of surgery.
5. The comparable rates of wound infections highlight the importance of consistent and effective postoperative care in minimizing complications and promoting swift recovery.
6. Collaborative efforts in surgical planning, perioperative care and postoperative monitoring can ensure that all aspects of patient care are addressed comprehensively leading to improved surgical outcomes and enhanced patient well-being.

CONCLUSION

This observational study comprehensively evaluated the outcomes of paediatric inguinal hernia repair performed by open versus laparoscopic surgical techniques. The analysis encompassed a balanced cohort of 40 paediatric patients distributed evenly.

The study highlighted that age, sex and past history distributions did not significantly influence the choice of surgical technique. We found significant reduction in hospital stay duration for patients undergoing open surgery compared to laparoscopic surgery- as parents were reluctant to go home immediately after general anaesthesia and in some cases due to delay in clearance from government agencies as they were beneficiaries of government schemes, while open surgery was done under caudal block and clearance for government schemes was quicker. Preoperative ultrasound findings were significant factors influencing the choice of surgical technique as hernia with simpler contents were frequently repaired laparoscopically while those with more complex contents were commonly managed with open surgery.

There was lower incidence of significant scrotal edema in the open group owing to the direct meticulous dissection of the hernia sac under vision. Laparoscopic surgeries were associated with longer operative times compared to open surgeries due to the steep learning curve.

The majority of patients experienced no intraoperative complications and postoperative complications were low and manageable across both groups.

Future research with larger, multi-centre randomized controlled trials and extended follow-up periods is necessary to assess the recurrence rates, chronic pain associated with each surgical technique and provide more definitive conclusions. The relatively small sample size limits the statistical power of the study and may reduce the ability to detect smaller but clinically significant differences between the two surgical groups.

In conclusion the choice of surgical method should be individualized based on preoperative assessments and surgeon expertise to ensure optimal patient outcomes.

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ANNEXURES

ANNEXURES I - INFORMED CONSENT FORM

Title- Outcome analysis of paediatric Inguinal hernia repair by Open versus Laparoscopic technique -An Observational Study

Mr./Mrs. _____ we are requesting you to enrol yourself in study titled -Outcome analysis of paediatric Inguinal hernia repair by Open versus Laparoscopic technique - An Observational Study" Conducted by BH0122002 in Department of General Surgery, J.N. Medical college, Belgaum under KLE university, Belagavi.

Respected Sir/ Madam,

We request you to participate in our study. Your participation in the research is voluntary. Your decision to participate in the study or otherwise will not affect the relationship with KLES Prabhakar Kore hospital. If you decided not to participate, you are free to withdraw any time.

Procedure involved:

Procedure after counselling and proper consent the patients included in the study were subjected for proper history since birth, before and after surgery. The patient subjected to both clinical examination and systemic examination i.e., mainly per abdominal examination. Per abdominal examination involves with respect to abdominal distension, scars and their healing.

Risks and Benefits: There is no risk involved.

Type of Study- This study is an observational study. It involves patients with open and laparoscopic surgery for inguinal hernia repair.

Participant selection:

It includes all patient diagnosed with inguinal hernia from age 1 to 12 years and admitted in KLE Dr. Prabhakar Kore Hospital from 1st March 2023- 28th Feb 2024.

Voluntary Participation:

Your participation in research is voluntary. It is your choice whether to participate or not. Your decision whether to participate in the study or not will not change present or future health care services offered to you and will not affect your relationship with J.N. Medical College Belagavi. If you choose not to participate in this study, you will still be offered the routine treatment of inguinal hernia that is given at our hospital. You will continue to receive the routine care at our hospital even if you decline to participate in this study. If you decide to participate you are free to withdraw at any time.

Privacy and Confidentiality:

The only people who will know that you are the research subject will be the members of the research team. No information about you or information provided by you during the research will be disclosed to others without your written permission except:

1. In emergency to protect your rights and welfare.
2. If required by law.

Authorization to Publish Results:

When the results of the research are published or discussed, in a conference, no information will be displayed that would disclose your identity. Any information that is obtained in connection with this study and that can be identified with you will remain confidential. Results of the study will be used to compare the two procedures on the points listed above.

Right to refuse or withdraw from study:

You do not have to participate in this research if you do not wish to. You can withdraw at any time from the study. There will be no penalty for withdrawal. Your treatment and care in this hospital will not change irrespective of whether you agree to participate or not. You can be removed from the study if necessary.

Alternative:

You are free to withdraw yourself from this study at any point of time. You will continue to receive the routine care even if you decline to participate in the study. You will be treated for the same even if you have declined from the study. You will be informed about any new information that may affect your decision to participate in the study.

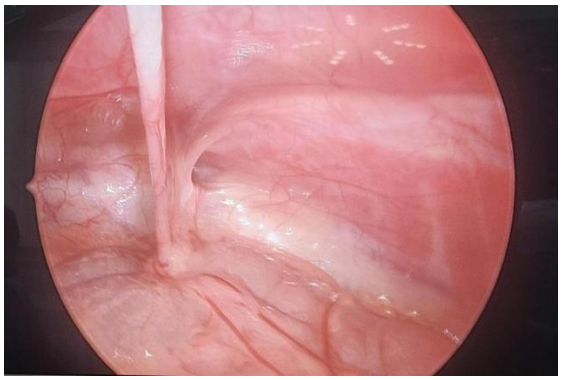
Institutional/sponsor's policy:

In the event of any injury related to the study, treatment will be made available through KLE's Hospital & MRC, Belagavi. There is no compensation or payment for such medical treatment by law. If you are injured you may contact the Principal Investigator, Reg No. BH0122002, post graduate student Department of General Surgery, KLE's Hospital& MRC Belagavi.

ANNEXURES II - PROFORMA

NAME OF THE PATIENT-	
AGE (YEARS)	
SEX:	MALE/ FEMALE
INFORMANT:	
ADDRESS: MOBILE NO-	
IP NO:	
UNIT/WARD:	
DATE OF ADMISSION:	
DATE OF SURGERY:	
SURGICAL PROCEDURE	OPEN INGUINAL HERNIA REPAIR LAPAROSCOPIC INGUINAL HERNIA REPAIR
DATE OF DISCHARGE:	
CHIEF COMPLAINTS:	
PAST HISTORY:	
PERSONAL HISTORY:	
TREATMENT HISTORY:	
CLINICAL DIAGNOSIS:	
GENERAL PHYSICAL EXAMINATION:	
INVESTIGATIONS: 1. CBC 2. BLOOD UREA (mg/dl) 3. SERUM CREATININE 4. USG ABDOMEN 5. OTHERS (AS PER REQUIREMENT)	
POST OPERATIVE: 1. ANTIBIOTICS: 2. SIGNS OF WOUND INFECTION: 3. DAY OF WOUND INFECTION 4. MANAGEMENT OF WOUND INFECTION: 5. HOSPITAL STAY:	
FOLLOW UP-	3^{RD} POD 7^{TH} POD 1 MONTH POD

ANNEXURES III- PHOTOGRAPHS



LAPAROSCOPIC VIEW OF HERNIAL DEFECT

INTRACORPOREAL SUTURING OF HERNIAL DEFECT.

LAPAROSCOPIC PORT PLACEMENT

SCAR OF LAPAROSCOPIC INGUINAL HERNIA REPAIR

SCAR OF OPEN INGUINAL HERNIA REPAIR

ANNEXURES IV- MASTERCHART

DOS	DOD	CHIEF COMPLAINTS	PAST HISTORY	DIAGNOSIS	HB (GM%)	S.CREAT (MG/DL)	USG (ABD+PEVLIS)	TYPE OF SURGERY	SURGICAL PROCEDURE	DURATION (MINS)	INTRAOP FINDINGS/ COMPLICATIONS	ANTIBIOTICS	SIGNS OF WOUND INFECTION	DAY OF WOUND INFECTION	MANAGEMENT OF INFECTION	HOSPITAL STAY	COMPLICATIONS			FOLLOW UP (POD)		
																	SCROTAL EDEMA	ERYTHEMA	HYDROCELE	3RD	7TH	1ST MONTH
26-03-2024	28-03-2024	C/O SWELLING OVER RIGHT GROIN SINCE 6 MONTHS.	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	10	0.31	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	45	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	5 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
03-04-2024	05-04-2024	C/O SWELLING OVER RIGHT GROIN SINCE 3 YEARS.	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	11.5	0.41	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	50	NIL	SYP CEFIXIME 9ML	NIL	NIL	NIL	4 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
26-04-2024	27-04-2024	C/O SWELLING OVER RIGHT GROIN TILL SCROTUM SINCE 8 MONTHS.	NICU ADMISSION POST DELIVERY I/V/O LOW BIRTH WEIGHT	RIGHT INDIRECT INGUINAL HERNIA	11.8	0.45	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	45	NIL	SYP CEFIXIME 4.5ML	NIL	NIL	NIL	4 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
17-05-2024	20-05-2024	C/O SWELLING OVER RIGHT GROIN SINCE 6 MONTHS.	NICU ADMISSION I/V/O PRE TERM DELIVERY	RIGHT INDIRECT INGUINAL HERNIA	12.1	0.345	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	50	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	5 DAYS	MILD EDEMA	PRESENT	NIL	MILD SCROTAL EDEMA +	NORMAL	NORMAL
17-03-2024	19-03-82024	C/O SWELLING OVER THE RIGHT GROIN SINCE 1 YEAR	H/O DENUGUE FEVER 15 DAYS BACK..	RIGHT INDIRECT INGUINAL HERNIA	11.9	0.29	RIGHT CANAL OF NUCK HERNIA WITH MINIMAL ASCITES	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	75	NIL	SYP CEFIXIME 9ML	NIL	NIL	NIL	5 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
19-05-2024	20-05-2024	C/O SWELLING OVER RIGHT GROIN SINCE 6 MONTHS.	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	10	0.6	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	70	NIL	SYP CEFIXIME 8ML	NIL	NIL	NIL	3 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
29-03-2024	30-03-2024	C/O SWELLING OVER LEFT GROIN SINCE 1 MONTH	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	12.52	0.52	SAC WITH OMENTUM AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC LEFT INGUINAL HERNIOTOMY	60	NIL	TAB CEFIXIME 50MG	NIL	NIL	NIL	3 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
08-04-2024	10-04-2024	C/O SWELLING OVER LEFT GROIN SINCE 6MONTHS	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	11	0.28	NOT DONE	LAPAROSCOPY	LAPAROSCOPIC LEFT INGUINAL HERNIOTOMY	65	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	4 DAYS	MILD EDEMA	PRESENT	NIL	MILD SCROTAL EDEMA +	NORMAL	NORMAL
18-06-2024	20-06-2024	C/O SWELLING OVER LEFT GROIN SINCE 15 DAYS	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	11.2	0.27	SAC WITH OMENTUM AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC LEFT INGUINAL HERNIOTOMY	50	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	4 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
29-06-2024	31-04-2024	C/O SWELLING OVER LEFT GROIN SINCE 15 DAYS	H/O PRETERM DELIVERY, NICU ADMISSION FOR 30 DAYS	LEFT INDIRECT INGUINAL HERNIA	10.1	0.26	SAC WITH OMENTUM AND BOWEL AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC LEFT INGUINAL HERNIOTOMY	55	NIL	SYP CEFIXIME 3ML	NIL	NIL	NIL	4 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
24-06-2024	26-06-2024	C/O SWELLING OVER RIGHT GROIN SINCE 15 DAYS	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	10.1	0.28	SAC WITH OMENTUM AND BOWEL AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	55	NIL	SYP CEFIXIME 3ML	NIL	NIL	NIL	4 DAYS	MILD EDEMA	NIL	NIL	NORMAL	NORMAL	NORMAL
27-06-2024	29-06-2024	C/O SWELLING OVER RIGHT GROIN SINCE 1 MONTH	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	13	0.62	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	60	NIL	TAB CEFIXIME 200MG	NIL	NIL	NIL	4 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
03-07-2024	04-07-2024	C/O SWELLING OVER RIGHT GROIN SINCE 2 MONTH	H/O PRETERM DELIVERY, NICU ADMISSION FOR 9 DAYS .	RIGHT INDIRECT INGUINAL HERNIA	10.7	0.49	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	50	NIL	TAB CEFIXIME 200MG	NIL	NIL	NIL	3 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
11-07-2024	13-07-2024	C/O SWELLING OVER LEFT GROIN SINCE 6 MONTHS	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	11.4	0.6	SAC WITH OMENTUM AND BOWEL AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC LEFT INGUINAL HERNIOTOMY	55	NIL	TAB CEFIXIME 200MG	NIL	NIL	NIL	4 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
26-06-2024	28-06-2024	C/O SWELLING OVER RIGHT GROIN SINCE 2 MONTH	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	11.1	0.34	NOT DONE	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	50	NIL	SYP CEFIXIME 9ML	NIL	NIL	NIL	4 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
11-07-2024	13-07-2024	C/O SWELLING OVER RIGHT GROIN SINCE 3 MONTH	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	10.8	0.5	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	55	NIL	SYP CEFIXIME 3ML	NIL	NIL	NIL	4 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
09-09-2024	11-09-2024	C/O SWELLING OVER LEFT GROIN SINCE 20 DAYS	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	10.39	0.31	SAC WITH OMENTUM AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC LEFT INGUINAL HERNIOTOMY	60	DEFECT FOUND ON RIGHT SIDE WITH HERNIATION OF OMENTUM	SYP CEFIXIME 5ML	NIL	NIL	NIL	3 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
18-08-2024	20-08-2024	C/O SWELLING OVER RIGHT GROIN SINCE 6 MONTH	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	13.5	0.5	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	70	NIL	TAB CEFIXIME 200MG	NIL	NIL	NIL	3 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
22-04-2024	24-04-2024	C/O SWELLING OVER RIGHT GROIN SINCE 6 MONTH	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	10.6	0.32	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	60	BLEEDING DURING CLOSURE OF DEEP RING WITH VICRYL 4-0	SYP CEFIXIME 9ML	HEMATOMA OVER RIGHT INGUINAL REGION	POD 1	SELF RESOLUTION WITH ANTIBIOTICS AND ANALGESICS	4 DAYS	NIL	NIL	NIL	INDURATION AT RIGHT INGUINAL REGION	INDURATION REDUCED	NORMAL
21-07-2024	23-07-2024	C/O SWELLING OVER RIGHT GROIN SINCE 15 DAYS	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	9.5	0.3	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	LAPAROSCOPY	LAPAROSCOPIC RIGHT INGUINAL HERNIOTOMY	65	NIL	SYP CEFIXIME 2ML	NIL	NIL	NIL	4 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
28-05-2024	28-05-2024	C/O SWELLING OVER LEFT GROIN SINCE 1 MONTH	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	10.8	0.45	SAC WITH OMENTUM AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	OPEN	OPEN LEFT INGUINAL HERNIOTOMY	20	NIL	TAB CEFIXIME 100MG	NIL	NIL	NIL	1 DAY	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
27-05-2024	28-05-2024	C/O SWELLING OVER RIGHT GROIN SINCE 3 MONTHS	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	10.8	0.23	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	OPEN	OPEN RIGHT INGUINAL HERNIOTOMY	25	NIL	SYP CEFIXIME 6ML	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
26-04-2024	26-04-2024	C/O SWELLING OVER LEFT GROIN SINCE 3 MONTHS	NICU ADMISSION I/V/O LOW BIRTH WEIGHT, PRETERM DELIVERY	LEFT INDIRECT INGUINAL HERNIA	11.7	0.43	SAC WITH OMENTUM AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	OPEN	OPEN LEFT INGUINAL HERNIOTOMY	22	NIL	TAB CEFIXIME 100MG	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
26-04-2024	27-04-2024	C/O SWELLING OVER RIGHT GROIN SINCE 3 MONTHS	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	13.5	0.39	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	OPEN	OPEN RIGHT INGUINAL HERNIOTOMY	20	NIL	SYP CEFIXIME 3.5ML	MINIMAL PUS DISCHARGE ON DAY 7	POD 7	SUTURE REMOVED, REGULAR DRESSING	2 DAYS	NIL	PRESENT	NIL	NORMAL	PUS DISCHARGE FROM SUTURE SITE	NORMAL
17-04-2024	18-04-2024	C/O SWELLING OVER LEFT GROIN SINCE 5 DAYS	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	12.7	0.67	SAC WITH OMENTUM AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	OPEN	OPEN LEFT INGUINAL HERNIOTOMY	20	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
05-04-2024	06-04-2024	C/O SWELLING OVER LEFT GROIN TILL SCROTUM SINCE 3 YEARS	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	12	0.69	SAC WITH OMENTUM AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	OPEN	OPEN LEFT INGUINAL HERNIOTOMY	25	NIL	TAB CEFIXIME 100MG	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
20-03-2024	21-03-2024	C/O SWELLING OVER RIGHT GROIN SINCE 1 MONTHS	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	9.4	0.31	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	OPEN	OPEN RIGHT INGUINAL HERNIOTOMY	18	NIL	SYP CEFIXIME 3ML	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
29-03-2024	30-03-2024	C/O SWELLING OVER RIGHT GROIN SINCE 1 MONTHS	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	10.2	0.6.	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	OPEN	OPEN RIGHT INGUINAL HERNIOTOMY	22	NIL	SYP-CEFIXIME 5ML	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
24-03-2024	25-03-2024	C/O SWELLING OVER RIGHT GROIN SINCE 8 DAYS	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	10.4	0.4	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	OPEN	OPEN RIGHT INGUINAL HERNIOTOMY	25	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
28-03-2024	30-03-2024	C/O SWELLING OVER LEFT GROIN SINCE 15 DAYS	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	8.4	0.24	NOT DONE	OPEN	OPEN LEFT INGUINAL HERNIOTOMY	22	NIL	SYP CEFIXIME 5ML	ERYTHEMA	POD 6	REGULAR DRESSING	3 DAYS	NIL	PRESENT	NIL	NORMAL	ERYTHEMA AT SUTURE SITE	NORMAL
24-03-2024	25-03-2024	C/O SWELLING OVER LEFT GROIN SINCE 1 YEAR	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	12.2	0.6	SAC WITH OMENTUM AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	OPEN	OPEN LEFT INGUINAL HERNIOTOMY	30	NIL	TAB CEFIXIME 100MG	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
03-04-2024	04-04-2024	C/O SWELLING OVER LEFT GROIN SINCE 4 MONTHS	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	10.4	0.4	SAC WITH OMENTUM AS CONTENT- S/O LEFT INDIRECT INGUINAL HERNIA	OPEN	OPEN LEFT INGUINAL HERNIOTOMY	20	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
26-03-2024	27-03-2024	C/O SWELLING OVER LEFT GROIN SINCE BIRTH	H/O NICU ADMISSION I/V/O NEONATAL RESPIRATORY DISTRESS, JAUNDICE	LEFT INDIRECT INGUINAL HERNIA	10.5	0.22	NOT DONE	OPEN	OPEN LEFT INGUINAL HERNIOTOMY	22	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	3 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
22-04-2024	22-04-2024	C/O SWELLING OVER RIGHT GROIN SINCE 2 MONTHS	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	11.2	0.14	SAC WITH OMENTUM AS CONTENT- S/O RIGHT INDIRECT INGUINAL HERNIA	OPEN	OPEN RIGHT INGUINAL HERNIOTOMY	25	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
20-04-2024	20-04-2024	C/O SWELLING OVER RIGHT GROIN SINCE 3 MONTHS	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	9.9	0.28	SAC WITH OMENTUM AS CONTENT-S/O RIGHT INDIRECT INGUINAL HERNIA	OPEN	OPEN RIGHT INGUINAL HERNIOTOMY	27	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
13-04-2024	14-04-2024	C/O SWELLING OVER RIGHT GROIN SINCE 1 MONTH	NOTHING SIGNIFICANT	RIGHT INDIRECT INGUINAL HERNIA	12	0.5	SAC WITH OMENTUM AS CONTENT-S/O RIGHT INDIRECT INGUINAL HERNIA	OPEN	OPEN RIGHT INGUINAL HERNIOTOMY	22	NIL	TAB CEFIXIME 100MG	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
17-04-2024	18-04-2024	C/O SWELLING OVER RIGHT GROIN SINCE 15 DAYS	H/O FEVER , COUGH 1 MONTH AGO	RIGHT INDIRECT INGUINAL HERNIA	11	0.6	NOT DONE	OPEN	OPEN RIGHT INGUINAL HERNIOTOMY	30	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
16-03-2024	17-03-2024	C/O SWELLING OVER LEFT GROIN SINCE 2 DAYS, NOT REDUCIBLE	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	11.6	0.32	LEFT SIDED OBSTRUCTED HERNIA WITH OMENTUM AS CONTENT	OPEN	OPEN RIGHT INGUINAL HERNIOTOMY	35	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	2 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
08-04-2024	09-04-2024	C/O SWELLING OVER LEFT GROIN SINCE BIRTH	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	11.3	0.23	DEFECT OF 2x1.7CM IN LEFT INGUINAL REGION WITH HERNIATION OF BOWEL LOOPS, MESENTRY.	OPEN	OPEN LEFT INGUINAL HERNIOTOMY	35	NIL	SYP CEFIXIME 5ML	NIL	NIL	NIL	3 DAYS	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL
14-04-2024	04-04-2024	C/O SWELLING OVER LEFT GROIN SINCE 3 MONTHS	NOTHING SIGNIFICANT	LEFT INDIRECT INGUINAL HERNIA	10.4	0.56	SAC WITH OMENTUM AS CONTENT-S/O LEFT INDIRECT INGUINAL HERNIA	OPEN	OPEN LEFT INGUINAL HERNIOTOMY	22	NIL	TAB CEFIXIME 100MG	NIL	NIL	NIL	1 DAY	NIL	NIL	NIL	NORMAL	NORMAL	NORMAL