Indirect Right Inguinal Hernia in a Six-Year-Old Girl: A Case Report and Literature Review

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Abstract

Background:
Pediatric inguinal hernia is a common surgical problem, yet direct hernias in girls account for fewer than 1.5% of childhood groin defects. Although often painless and reducible, the cumulative risk of incarceration approaches 6%, warranting early repair.

Case Description:
A healthy six-year-old girl presented with a two-month history of an intermittent, painless right-groin bulge that appeared with crying or coughing. Physical examination revealed a 2.5 × 2 cm fully reducible mass; ultrasonography confirmed a fat-containing herniation medial to the inferior epigastric vessels, consistent with a reducible direct inguinal hernia. After optimization, she underwent an open high ligation herniotomy. The hernia sac was dissected to the internal ring and securely ligated without mesh. Operative time was 25 minutes and blood loss were negligible. The patient was discharged the same day, resumed unrestricted activity within one week, and remained asymptomatic at six-month follow-up with no evidence of recurrence.

Conclusions:
This case illustrates that open high ligation provides safe, durable closure for the exceedingly rare direct inguinal hernia in pediatric females, mirroring success rates above 98% reported for indirect defects. Early elective repair eliminates the risk of incarceration, avoids mesh-related morbidity, and allows rapid return to normal activity.

Introduction

Inguinal hernia represents one of the most frequent surgical problems in childhood, with pooled global estimates suggesting that between 1% and 5% of full-term children will develop a groin hernia, compared with almost one third of those born prematurely.[1] More than 95% of pediatric hernias are indirect because they follow the patent processus vaginalis lateral to the inferior epigastric vessels.[2] Direct hernia is extremely uncommon before adolescence; population-based registries from North America and Asia place its incidence below 1.5% of all childhood groin hernias and reports in girls are rarer still.[3,4] The natural course is not benign since contemporary systematic reviews report an overall incarceration risk of about 6% in children and up to 17% in infants, a statistic that justifies early elective repair.

Open high ligation herniotomy remains the reference standard for pediatric hernia repair because it removes the sac at the internal ring without mesh while preserving normal anatomy.[5] Large multicenter cohorts comprising more than 300 operations have documented surgical success rates exceeding 98%, with recurrence approaching 1% and major complications such as testicular atrophy or wound infection occurring in fewer than 2%.[6] Laparoscopic high ligation offers a similar safety profile and allows inspection

of the contralateral groin, yet direct defects demand posterior wall closure and therefore continue to present an important learning point for pediatric surgeons.[7]

The present report describes the clinical presentation, operative management, and early outcome of a six-year-old girl with a reducible right direct inguinal hernia. By sharing detailed operative findings and postoperative progress we aim to emphasize the anatomic features that distinguish direct from indirect sacs in children, to confirm the effectiveness of high ligation without mesh in this unusual scenario, and to add contemporary outcome data for pediatric females. The case is presented in line with the SCARE 2025 surgical case report guideline.[8]

Case Description

A previously healthy six-year-old girl (weight 20 kg) was referred from the pediatric clinic to the surgical outpatient department with a two-month history of a painless swelling in the right groin. The mass became apparent whenever the child cried, coughed, or strained and spontaneously disappeared when she was calm or asleep. There was no overlying skin discoloration, fever, constipation, nausea, or vomiting, and intestinal gas passage remained normal.

The patient had no prior episodes of similar complaints and no history of abdominal or inguinal trauma, surgery, or allergies. She was the second of two siblings, born at term via spontaneous vaginal delivery (birth weight 3000 g) after an uncomplicated pregnancy. Family history was negative for congenital anomalies or hernias. Immunizations were complete for age, and developmental milestones were appropriate. She lived in a clean household with non-smoking parents.

On examination the child was alert and comfortable. Vital signs were within normal limits (temperature 36.8 °C, heart rate 96 beats per min, respiratory rate 24 breaths per minute, blood pressure 90/60 mmHg). Inspection of the right inguinal region during Valsalva maneuver revealed a 2.5 × 2 cm ovoid swelling that was firm, non-tender, non-fluctuant, and completely reducible with normal overlying skin and no signs of erythema. Abdominal examination showed a soft, non-distended abdomen with normal bowel sounds and no peritoneal signs; the remainder of the systemic examination was unremarkable. Baseline laboratory studies demonstrated normal bleeding and clotting times, mild microcytic anaemia (hemoglobin 11.4 g/dL, MCV 77 fL), a low-normal total leukocyte count (4.57 × 10^3/µL) with a neutrophil-predominant differential, and adequate platelet count (354 × 10^3/µL). Random blood glucose was 127 mg/dL.

High-resolution ultrasonography of the right inguinal region revealed a fat-containing herniation passing medial to the inferior epigastric vessels, visible both with and without Valsalva, and no regional lymph-node enlargement. These findings consistent with a medial or direct inguinal hernia.

The overall clinical and radiological picture was therefore compatible with a reducible right direct inguinal hernia. The family received counselling regarding elective surgical repair with a high ligation herniotomy to prevent incarceration or strangulation. Pre-operative optimization was planned, and the parents were advised to seek immediate care if the swelling became irreducible, painful, or associated with gastrointestinal symptoms.

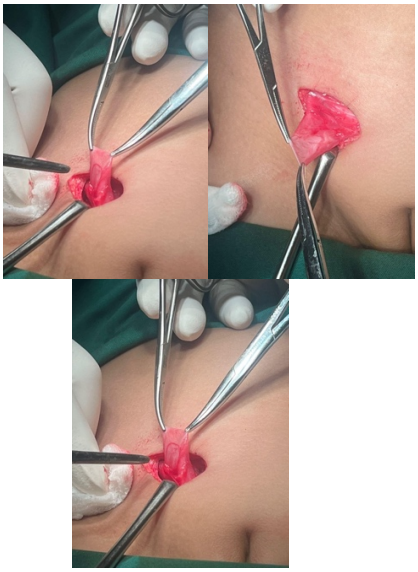

Figure 1. Intraoperative documentation of the patient.

Under general anesthesia with the child in the supine position, the right groin is prepared and draped in a sterile fashion. A 2–3 cm transverse incision is made just above the inguinal ligament over the palpable swelling, and the subcutaneous tissues are gently dissected to expose the external oblique aponeurosis. The aponeurosis is incised in line with its fibers to reveal the inguinal canal; careful blunt and sharp dissection is then used to isolate the hernia sac from the spermatic cord structures. Once the fat-containing sac is clearly delineated, it is opened, inspected for viability, and its contents are reduced into the peritoneal cavity. The proximal sac neck is ligated flush with the peritoneum (high ligation), and the distal sac is excised. Hemostasis is secured, the external oblique aponeurosis is approximated with absorbable sutures, and the subcutaneous tissue and skin are closed in layers. A sterile dressing is applied, and the patient is monitored postoperatively for adequate pain control and return of normal feeding and activity.

Postoperatively, the child recovered uneventfully in the pediatric ward, with vital signs remaining stable and pain well controlled on scheduled weight-appropriate analgesia. Early feeding was resumed within four hours, and the surgical site was inspected daily for signs of infection, hematoma, or seroma formation.

Discussion

Pediatric inguinal hernia repair is largely preventive surgery. Although inguinal hernias affect about 1–5 % of full-term children, they are much less common in girls than boys and direct hernias like the one in this six-year-old represent only around 0.2–1 % of pediatric groin hernias.[9,10] The natural course is not entirely benign: contemporary systematic reviews place the overall risk of incarceration at roughly 4–7 % in childhood, rising to 8–11 % in infants and pre-term babies. Because strangulation can follow incarceration, elective repair is recommended once the diagnosis is secure, even when the swelling is painless and fully reducible as in this case.[11,12]

The operation of choice in children is a high-ligation herniotomy—excision and suture ligation of the hernia sac at the internal ring without mesh. Large contemporary cohorts and database studies show that when this technique is performed by pediatric surgeons it achieves durable closure in more than 98 % of patients: five-year recurrence is typically ≤1 % in children aged 6–10 years (0.8 % in one nationwide cohort) and remains below 2 % across most series, with testicular atrophy reported in about 1 % and wound infection in <2 %.[13] These figures compare favorably with mesh-based repairs in adolescents and with laparoscopic approaches, while avoiding the long-term foreign-body concerns of mesh. Therefore, elective high ligation offers an excellent balance of safety and efficacy for this six-year-old girl.

Post-operatively, most children are managed as day cases or overnight stays, resume unrestricted play within a week, and return to full activities, including school and sport activities, by 10–14 days.[14] Parents should be advised that a contralateral inguinal hernia can still develop later in about 5 % of cases, usually within the first five years, so any new groin swelling warrants prompt review.[15] Overall, elective high-ligation herniotomy offers a surgical “success rate” (defined as freedom from recurrence and serious morbidity) of roughly 98–99%, making it the gold-standard treatment to eliminate the future risks of incarceration and to ensure normal growth and activity in otherwise healthy children like this patient.[16,17]

Definition

An inguinal hernia is the protrusion of abdominal contents through a weak point in the anterior abdominal wall of the groin.[18] In pediatric patients the great majority are indirect, meaning the hernia sac passes lateral to the inferior epigastric vessels through a patent processus vaginalis. A direct or medial inguinal hernia, as in this case, occurs when abdominal or pre-peritoneal contents push through the posterior wall of the inguinal canal inside Hesselbach’s triangle, which lies medial to the inferior epigastric vessels.[19] The hernia is called reducible when its contents can be

returned to the peritoneal cavity without tension. Elective surgical repair is advised to prevent incarceration or strangulation.[19]

Epidemiology

Inguinal hernia is one of the most common conditions requiring pediatric surgery, affecting approximately 1 %–5 % of full-term infants and children and up to 30 % of those born prematurely.[20] The male-to-female ratio is roughly 4 – 8 : 1 because testicular descent leaves a potential patent processus vaginalis.[21] Right-sided hernias predominate, mirroring the later descent of the right testis, but bilateral hernias are identified in up to 10 % of cases.[22] Direct hernias, however, are exceedingly rare in childhood because the posterior inguinal wall is normally robust before adolescence.[23] Despite their rarity, direct hernias merit the same prompt elective repair as indirect defects because the lifetime risk of incarceration in children approaches 4 %–7 % and rises sharply in infants.[23]

Pathophysiology

The inguinal canal is an oblique passage about 4 centimeters long with the external oblique aponeurosis forming its anterior wall and the transversalis fascia forming most of its posterior wall, which is reinforced medially by the conjoint tendon.[24] During fetal development the processus vaginalis guides the testis or round ligament through this canal. Normally it obliterates within the first six months after birth; persistence leaves an open conduit through which bowel, omentum, or even an ovary can herniate.[24] When the sac passes lateral to the inferior epigastric vessels and exits via the deep inguinal ring the defect is classified as indirect. Such a congenital channel may manifest at any age, usually when intra-abdominal pressure rises with crying, coughing, or straining.

A direct hernia originates from a weakness of the transversalis fascia inside Hesselbach's triangle, which is bounded by the rectus abdominis muscle medially, the inferior epigastric vessels laterally, and the inguinal ligament inferiorly.[25] In young children this fascial layer is usually strong, which explains the rarity of direct hernias before adolescence. Nevertheless, repeated increases in abdominal pressure, intrinsic connective-tissue laxity, or small local defects can allow pre-peritoneal fat or peritoneum to bulge forward through the posterior wall.[25] Because the sac in a direct hernia does not travel through the protective oblique tunnel of the deep and superficial rings, it may be more prone to incarceration once the neck enlarges. This anatomical vulnerability supports the recommendation for timely high ligation herniotomy in an otherwise healthy six-year-old.[25]

Diagnosis

A detailed history often yields the first diagnostic clue. Caregivers typically describe an intermittent, painless bulge in the groin that becomes visible when the child cries, coughs, or strains and disappears at rest.[26] This classic scenario predicts an inguinal hernia with sensitivity approaching 90% and positive predictive value near 85 – 90%.[27] Red flags that heighten urgency include episodes of irreducibility, sudden pain, or gastrointestinal symptoms, which suggest impending incarceration.[27] Absence of systemic symptoms or discoloration supports a reducible lesion, but the history alone cannot distinguish indirect from direct sac location.

Inspection and gentle palpation during a Valsalva maneuver remain the cornerstone of bedside diagnosis.[28] Characteristic findings are a soft or firm groin swelling that moves downward and medially with increased intra-abdominal pressure, produces an expansile impulse on cough, and can be reduced smoothly toward the internal ring. Dynamic examination in children yields sensitivity ranging from 85 – 90% and specificity from 75 – 90%, with the highest accuracy in cooperative patients and experienced hands.[29,30] Transillumination helps differentiate hernia from hydrocele, and absence of overlying erythema or tenderness supports an elective rather than emergent presentation.[31]

High-resolution ultrasonography is reserved for equivocal or atypical presentations and for very small hernias not

evident on examination. Modern pediatric series report sonographic sensitivity between 85 – 95% and specificity between 97% and 100% when surgical findings are the reference standard.[32] Typical ultrasound features include a hernia sac that protrudes medial to the inferior epigastric vessels for a direct type or lateral for an indirect type, with omental fat or bowel visible sliding through the defect during Valsalva.[29,30] Color Doppler confirms vascular flow in incarcerated bowel if present.[29,30] Magnetic resonance imaging with dynamic sequences achieves sensitivity and specificity in the low 90% range and is considered the problem-solving modality for occult hernia or for complex groin anatomy, though it is rarely necessary in routine pediatric practice.[33]

Treatment

Observation without surgery is limited to exceptional circumstances such as extreme prematurity, significant cardiorespiratory instability, or palliative settings where anesthesia poses prohibitive risk. A supportive truss is rarely employed in children because compliance is poor and it does not eliminate the underlying defect.[34] Data on conservative management are sparse, but available series suggest progression to incarceration in up to 10 – 15% of infants within a year. Because the potential consequences of strangulation include bowel necrosis and testicular loss, expert consensus favors timely elective repair once the diagnosis is established, making non operative care a temporary bridge rather than a definitive solution.[35]

Elective surgical repair is recommended for nearly all pediatric inguinal hernias because of the cumulative risk of incarceration, estimated at 4 – 7% overall and even higher in infants.[36] The standard operation is an open high ligation herniotomy, which involves dissecting and excising the sac at the internal ring and closing the peritoneal defect without mesh. Contemporary database and cohort studies document surgical success rates of 89-90%, defined by freedom from recurrence and major morbidity.[37] Recurrence after high ligation in children older than one year is typically below 2%, wound infection occurs in fewer than 2%, and testicular atrophy is reported in roughly 1% of boys.[38] Laparoscopic high ligation offers comparable recurrence and complication rates, permits inspection of the contralateral side, and may shorten anesthesia time for bilateral disease, although it demands specific expertise.

Combined evidence from recent randomized trials and cohort series indicates that open high-ligation herniotomy in children achieves excellent outcomes: in controlled comparisons recurrence remained negligible in infants (0% in a 2017 RCT) and low in adolescents (about 6% with high ligation versus roughly 6% with mesh)[39], while national database analyses involving more than fifty-three thousand patients showed an operated-side recurrence of only 0.4% for open repair compared with 1.5% after laparoscopy (odds ratio 3.7);[40] complication profiles were uniformly mild, with postoperative events ranging from no detected difference between open and laparoscopic groups to transient chronic pain of under 2% in suture-only repairs and 9% in mesh repairs, and length of stay was generally short or day-surgery for most series (Table 1). Cohort data focused solely on high ligation reinforce this durability, reporting long-term recurrence rates near 1% after open repair in adolescents, approximately 3-6% after laparoscopic repair when technical factors were suboptimal, and even 0% over 6 years in a single-center adolescent series; notable complications were limited to occasional chronic groin pain (about 7%), rare wound infection (1.4%) and intermittent discomfort that resolved with time, with a mean hospital stay of roughly two and a half days where documented (Table 2).

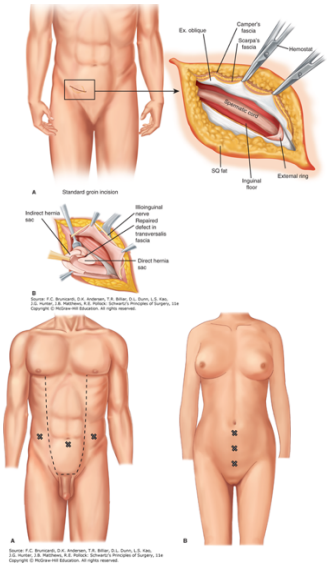

Figure 2. Gross anatomy for approaching patient with hernia of the inguinal.[41]

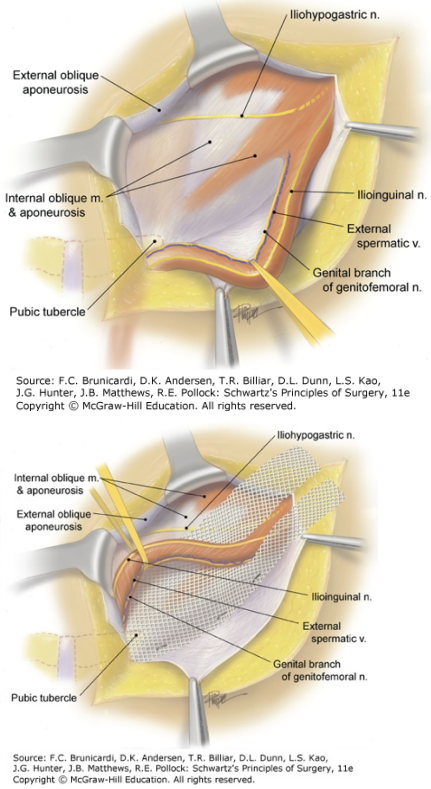

Figure 3. Surgical view during hernia repair surgery.[41]

Table 1. Key outcomes from RCT studies of high ligation versus other techniques.

Study ID	Design / Patients	Interventions	Recurrence Rate	Complications	Recovery Time
Gause et al., 2017[42]	RCT, N=41 infants ≤3y	Open high ligation vs. Lap repair	0% vs. 0% (no recurrences in ~2 yrs)	No difference in complications; no testicular atrophy noted	No difference in LOS or pain (lap had shorter OR time)
Criss et al., 2018[43]	Retrospective, N=213 (age 12–25)	High ligation vs. Mesh repair	6.3% vs. 5.8% (p = 0.57)	17% vs. 16% postoperative complications (p = 0.45)	Not reported (outpatient surgery)
Kim et al., 2021[44]	Retrospective, N=243 (males 18–21y)	Suture repair (no mesh) vs. Mesh	2.6% vs. 0.8% at 2 years	Acute complications 6.6% vs. 8.2% Chronic pain 1.7% vs. 9.0% (p = 0.023)	17–18 days vs. 18.5 days
Carter et al., 2025[45]	Retrospective DB, N=53,287 (<18y)	Open repair vs. Laparoscopic	0.4% vs. 1.5% (OR 3.7, p<0.001)	Second hernia (incl. contralateral) 2.6% vs. 2.9% (no adjusted difference)	Not reported (most same-day)

Table 2. A summary of key outcomes from these cohort studies of high ligation repairs

Study ID	Design / Population	High Ligation Technique	Recurrence Rate	Notable Complications	Recovery (LOS)
Gasior et al., 2015[46]	2-center cohort, N=210 (adolescents)	Open high ligation (pediatric surg.)	~1% (2/210 over long-term)	~6.7% chronic groin pain; 2.4% numbness	Not reported
Gibbons et al., 2021[47]	Multi-center cohort, N=144 (12–18y)	Laparoscopic high ligation	5.6% overall (3% excluding outlier)	No major complications reported (proper suture technique critical)	Not reported
Fan & Yao, 2023[48]	Single-center cohort, N=70 (13–18y)	Laparoscopic high ligation	0% (no recurrences at ~6 yrs)	1 case (1.4%) wound infection; 4 cases (5.7%) intermittent pain	2.4 days (mean LOS)

Conclusion

This case highlights the successful application of open high-ligation herniotomy for a rare direct inguinal hernia in a six-year-old girl and affirms that timely elective repair offers excellent safety and durability in the pediatric population. Contemporary evidence demonstrates recurrence rates well below 2% for open repairs and similarly low complication profiles, with most children discharged the same day or after a brief overnight stay. When combined with our uneventful postoperative course, these outcomes reinforce high ligation as the preferred treatment for both indirect and the uncommon direct hernias in children, ensuring effective defect closure while avoiding mesh-related morbidity and permitting rapid return to normal activity.

Acknowledgment

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