The Irreducible Ovary: A True Emergency
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Although there is almost universal agreement that all incarcerated hernias in male infants and children and hernias containing intestine in females require emergency operation if nonoperative attempts at reduction are unsuccessful, there is a diversity of opinion on the proper management of the asymptomatic irreducible ovary. A review of the literature and an informal survey of senior pediatric surgeons showed recommendations varying from performance of elective herniorrhaphy with no urgency, as with any reducible hernia, to operation on the next available elective date, to emergency operation, as with any incarcerated hernia. For the past 35 years the authors have shared the most prevalent view, that the asymptomatic irreducible ovary was not at great risk of strangulation or torsion; therefore, children presenting in this manner have been managed as those presenting with any other reducible inguinal hernia. However, within the past year, two children presented with asymptomatic irreducible ovaries who subsequently developed increased swelling and tenderness and at the time of emergency operation were found to have torsion with infarction of the involved ovary and tube.

Case Reports

Case 1

This 2-month-old girl born by normal delivery was noted to have a left inguinal hernia at age 1 month. She was referred to the Pediatric Surgical Service where the diagnosis was confirmed and an asymptomatic irreducible ovary was noted. Arrangements were made for repair 4 weeks later. At the time of the preoperative assessment 2 days prior to scheduled operation, the patient remained asymptomatic. However, on the morning of admission for operation, the left groin was swollen, erythematous, and painful and she was obviously in great discomfort having become cranky during the night. At operation, the ovary and a portion of the fallopian tube were observed to have undergone 720° torsion and were obviously gangrenous requiring salpingo-oophorectomy. The contralateral side was explored and a hernia was found and repaired. The patient’s postoperative course was uncomplicated.

Case 2

This girl weighed 1,120 g at birth following a complicated pregnancy and delivery. She was intubated for several days and had several short “apneic spells” that required hospitalization for 3 months. During this time a right inguinal hernia with an irreducible right ovary was diagnosed. The patient was scheduled for elective repair at age 6 months, expecting that her “apneic spells” would have disappeared. At age 4 months the patient became cranky and was noted to have a swollen painful erythematous right groin of several hours duration. At operation the ovary was found to be twisted on its pedicle, but because it seemed to be possibly viable after detorsion and observation, it was returned to the peritoneal cavity and the hernia repaired. A contralateral indirect hernia was also repaired. The postoperative course was complicated by prolonged apnea in the recovery room, but she was discharged 10 days later in stable condition.

These two patients prompted a review of the authors’ experience as well as an extensive review of the literature in an attempt to elucidate the true risk of torsion of an asymptomatic ovary trapped in an inguinal hernia.

Materials, Methods, and Results

The records of all children operated on for inguinal hernia at the Albert Einstein College of Medicine/Montefiore Medical Center complex between the years of 1984 and 1989 were reviewed.

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During that period 1,649 children with inguinal hernias underwent operation, 386 of whom (23%) were girls. Fifteen girls (4%) had irreducible ovaries present at the time of operation; there were no incarcerated hernias containing bowel in females. In 4 of the 15 children with irreducible ovaries (27%), the ovary and tube were twisted and ischemic at the time of operation, requiring oophorectomy in 3; the other ovary and tube, although of questionable viability, were twisted and replaced in the peritoneal cavity. The 2 index children have previously been described in detail. In the other 2 girls, physical findings of an infarcted ovary were present when the hernia was first diagnosed and emergency operations were performed.

Therefore, 27% of irreducible ovaries underwent torsion and in half of these the torsion occurred while the child was awaiting elective herniorrhaphy.

**DISCUSSION**

Although inguinal hernias in infants and children are more common in males than females, reported ratios varying from 3:1 to 10:1, the 15% to 43% incidence of incarceration in females in the literature is higher than that reported in males, especially in children under the age of 1 year. Most series of incarcerated hernias in girls report that in 90% to 100% of patients the contents were ovaries or ovaries and tubes. The authors' investigation observed that only 4% of inguinal hernias in females were incarcerated and all contained irreducible ovaries. None of the incarcerated hernias in girls contained intestine. An accurate incidence of incarceration from the literature is difficult to determine because some authors apparently did not include asymptomatic irreducible ovaries as incarcerated hernias in their series. Therefore, the incidence of irreducible ovaries can only be estimated but probably ranges from 4% to 15%.

The most important finding in the authors' investigation was the occurrence of torsion of the ovary and tube with ischemic compromise in 4 of the 15 children operated on for irreducible ovaries. This incidence of torsion is much higher than reported in most series and may represent a chance aberration. However, strangulated ovaries in inguinal hernias in girls have been described as far back as 50 years ago and are reported in almost every series of incarcerated hernias, varying in frequency from 2% to 33% (Table 1). Moreover, several of those investigators commented that they may have under-reported the number of twisted ovaries and tubes because questionably viable ovaries were often returned to the abdomen in their retrospective series. Regardless of the exact incidence, it is clear that ovaries trapped within inguinal hernias do undergo torsion far more frequently than ovaries and tubes in the normal pelvic position and, therefore, are at increased risk of infarction.

There is no evidence suggesting a critical time interval between ovarian entrapment in a hernia and subsequent torsion. The two patients with ovarian torsion at the time of the initial presentation of a hernia suggest that torsion can occur at any time. In patient 1 the torsion occurred within 36 hours of her prior examination.

It has been correctly stated that the irreducible ovary does not have the same risk of infarction as does a testicle during incarceration because there is no compression of the gonadal blood vessels at the internal ring in girls as occurs in boys. However, the true risk to the blood supply of an incarcerated ovary lies not in compression but in torsion of the ovarian pedicle.

The occurrence of torsion when an ovary is trapped in a hernia can be explained on an anatomic basis. In the normal position the ovary is fixed to the pelvic wall laterally by the suspensory ligament that contains the ovarian artery and vein and medially to the cornua of the uterus by the proper ovarian ligament (Fig 1). The cornua of the uterus and adjacent medial end of the fallopian tube are anchored anterolaterally by the round ligament that exits through the inguinal rings and forms part of the labia majora (Fig 2). In the newborn, the medial end of the fallopian tube is within 14 mm of the internal inguinal ring.

![Fig 1. Posterior view of pelvic structures in infant. SL, suspensory ligament of ovary; BL, broad ligament; OV, ovary; PL, proper ligament of ovary; RL, round ligament; MO, mesovarium; OVV, ovarian vessels; U, uterus.](image)
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Fig 2. Anterior view of pelvic structures in infant. SL, suspensory ligament of ovary; BL, broad ligament; RL, round ligament; U, uterus; O, ovary; FT, fallopian tube.

with the broad ligament, which is not well developed in infants, the ovarian ligaments create a broad short pedicle (mesovarium) for the ovary (Fig 3A), which prevents torsion. However, when an ovary is trapped outside the internal ring in an inguinal hernia, the pedicle is narrowed and lengthened (Fig 3B). The cornua of the uterus is pulled anterolaterally by the round ligament, shortening the distance between the medial attachment of the proper ligament of the ovary and the lateral attachment of the suspensory ligament of the ovary, therefore narrowing the pedicle. The pull on the suspensory ligament by the fixed ovary stretches that ligament, therefore lengthening the pedicle. The pedicle is narrowest where it traverses the abdominal wall through the internal ring, the inguinal canal, and the external ring, and is no wider than these openings.

Equally important as the longer narrower pedicle in the genesis of torsion of the adnexa is the fixed fulcrum created by the ovary stuck outside of the abdominal wall. In an earlier study of volvulus of the transverse colon,\textsuperscript{10} the authors showed that torsion of that viscus was rare unless some portion of the transverse was colon adherent in the lower abdomen or pelvis to provide a fixed point around which a twist could develop. In one case the midtransverse colon was stuck to the internal ring in a hernia sac. The latter instance is analogous to the irreducible ovary as they both provide a fixed fulcrum around which a torsion can occur.

Recognition that the irreducible ovary is at increased risk of torsion and infarction and that there is an anatomic reason for this being so should alter the prevailing lack of concern about this entity. The authors’ review of the literature and informal survey of pediatric surgeons showed that a near majority of surgeons share Cox’s view that “the presence of an irreducible ovary in the inguinal hernia in an otherwise asymptomatic patient should . . . not necessitate an urgent trip to the operating room for reduction . . . . These patients may be scheduled for operative repair in the customary elective fashion.”\textsuperscript{11}

An equal proportion of surgeons share Woolley’s view\textsuperscript{3} that “such hernias should be repaired at the earliest elective opportunity.” Few surgeons treat the asymptomatic irreducible ovary as an emergency with immediate admission to the hospital. Kottmeier and coinvestigators\textsuperscript{11} attempt reduction under sedation, and if this is unsuccessful operate the following day. Rickham,\textsuperscript{3} based on one patient similar to the authors, states that “the experience related above has convinced us that in female neonates incarcerated inguinal hernias should be operated upon immediately.”

The results of this review and recent experiences have caused us to change our previous 35-year approach to the child with an asymptomatic irreducible ovary. We now treat all girls with incarcerated hernias, albeit an asymptomatic irreducible ovary, the same as boys: immediate hospitalization, attempts at nonoperative reduction under sedation, and, if unsuccessful, prompt operation. This approach is the only assurance that preventable loss of an ovary and possibly a tube will be avoided.

Fig 3. Diagrammatic depiction of altered anatomy with irreducible ovary. (A) Normal anatomy. The pedicle of the ovary and tube (ab) is broad and short so torsion is difficult. (B) Irreducible ovary. Pedicle (ab) is narrowed and longer, being most narrow as it traverses the abdominal wall. U, uterus; PL, proper ligament of ovary; SL, suspensory ligament of ovary; O, ovary; HS, hernia sac; IR, internal ring.
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Discussion

J. White (Loma Linda, CA): About 10 years ago I examined a nurse's daughter with an irreducible asymptomatic ovary. The nurse had to work the next week and requested that we do the repair the following week. The infant came in with a strangulated ovary 5 days later. My own data for the 5-year period, 1976 to 1981, showed 18% of the hernias referred were girls and 18% of these were incarcerated. I reduced 2 nonoperatively; 7 needed operative reduction, of which 6 were ovaries. Two of these ovaries were strangulated, which is a 3% incidence of the total number of girls with hernias and 20% incidence of those that were incarcerated. I agree with Dr Boley that this is an urgent if not emergent problem. If you cannot reduce an incarcerated ovary in a girl, she should be operated on as soon as possible.

S. Boley (response): I went through the literature and spoke to our colleagues. It was interesting that the only ones other than Mr Rickham who recommend immediate surgery were the women surgeons in our field.

W. Sieber (Invited Editorial Comment): The authors' conclusions that the risk of torsion in the asymptomatic incarcerated or prolapsed ovary is significant enough to warrant treatment as a true emergency will not be accepted by all surgeons. The literature review presented reports a 10% incidence of strangulated ovaries in a total of 114 instances of incarceration in girls. The actual incidence varied from 2% in 48 cases to 33% in 3 cases. Only 4 of the 15 cases in this report proved to be strangulated and in two of these, incarceration was the presenting sign of a hernia. The authors explanation of torsion rather than compression as the mechanism of strangulation in their cases is pertinent. Irreducible prolapse of an ovary in an infant will often reduce spontaneously between examinations and all signs of a hernia disappear for a period of time. Attempts at manual reduction of an asymptomatic prolapsed ovary are painful, harmful, and unnecessary. In my review of 150 girls who underwent inguinal herniorrhaphy, 10 were "incarcerated," varying in extent from asymptomatic prolapse to symptomatic incarceration containing intestine. In none of these was the ovary strangulated. Because of these considerations, we shall continue to advise surgical correction of the prolapsed asymptomatic ovary to be done at the earliest elective opportunity.
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