



Recurrent Inguinal Hernias in Infants and Children

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Abstract. The objective of this study was to analyze the etiologic factors possibly associated with the development of recurrent groin hernias in infants and children. For this purpose we analyzed the records of 2754 pediatric patients operated on for primary hernias between 1966 and 1990 at our department who have not had recurrences. They were compared with 28 boys and 4 girls we treated for recurrent hernias during the same period. We found an indirect hernia in 29 cases, a direct hernia in 4 patients, and a femoral hernia in 1 child at the time of reoperation. A significantly high recurrence rate was found to be associated with incarceration (21.9% versus 7.6%), postoperative complications (9.4% versus 1.8%), concomitant diseases (31.2% versus 5.7%), and premature birth. Day case treatment was closely related to concomitant diseases. No impact on the development of recurrences was seen for the surgeons' educational level and the time of day the surgery was performed. Knowledge of the factors contributing to hernia recurrence and perfect surgical technique with reduction of incarcerated hernias and early elective operation may result in fewer recurrences in infants and children.

Primary inguinal hernia is a major surgical disease during infancy, occurring in 1% to 5% of all mature newborns and 9% to 11% of all premature babies [1–4]. Recurrences of inguinal hernias are rare in this group of patients, but their operative treatment may be technically difficult. This report analyzes the impact of possible etiologic factors for recurrences after inguinal hernia repair during infancy and childhood.

Patients and Methods

In a retrospective study the charts of all infants and children operated on for inguinal hernias at our department were evaluated. The data for 32 patients with recurrent hernias were compared with the data for 2754 patients with primary hernias without recurrence. The surgical technique and postoperative complications at primary repair, the surgeons' educational level, the time of operation, day-case treatment versus inpatient treatment, and mature birth versus premature birth were analyzed as possible factors in hernia recurrence. The data (mean \pm SD) were statistically analyzed, and the respective tests are given with the confidence levels.

Primary Inguinal Hernias

Between January 1966 and June 1990 there were 2774 infants and children operated on for primary inguinal hernia at our institution. The group consisted of 74% ($n = 2054$) male and 26% ($n = 729$) female patients. The sites of the hernias are noted in detail in Figure 1.

The mean age at the time of operation was 27 ± 33 months for the boys and 38 ± 38 months for the girls. Surgery was undertaken in 47% of the male patients, during their first year of life, with more than 50% of them taking place during the first 6 months. Hernia repair was carried out in 37% of the female patients during the first year of life, with 75% of them taking place during their first 3 months (Fig. 2). Twenty of these infants and children developed a recurrent hernia; the remaining 2754 patients served as the control group.

Recurrent Inguinal Hernias

During the same period we treated 32 infants and children (28 boys, 4 girls) for 34 recurrent inguinal hernias. The primary operation had been carried out at our department in 20 cases; 12 patients were referred from other clinics. Two male patients presented with a rerecurrent hernia, one with the simultaneous occurrence of an indirect and a direct hernia, another with a femoral hernia following a recurrent indirect hernia repair.

Both "true" recurrent indirect hernias and "false" direct or femoral hernias after repair of an indirect inguinal hernia were counted as recurrences. "True" recurrent hernias were found in 89.3% ($n = 25$) of the boys (19 on the right side and 6 on the left side); one boy (3.6%) presented with a left femoral hernia and four (14.3%) with direct hernias (two right, two left). The four girls (100%) presented with "true" recurrent hernias (three right, one left).

The mean ages at the primary repair of the male and female patients were 16.7 ± 20.0 months and 30.0 ± 27.1 months, respectively. Primary surgery was undertaken in 61% of the boys during their first year of life, with 39% of those operations taking place during their first 3 months. In 82% of the male patients (23 of 28) hernia repair was performed before their third birthday, in three others between the age of 4 and 6 years, and in two beyond age 10. In the female patients the primary operation was carried out at 6 and 18 months and 3 and 5.5 years, respectively. The

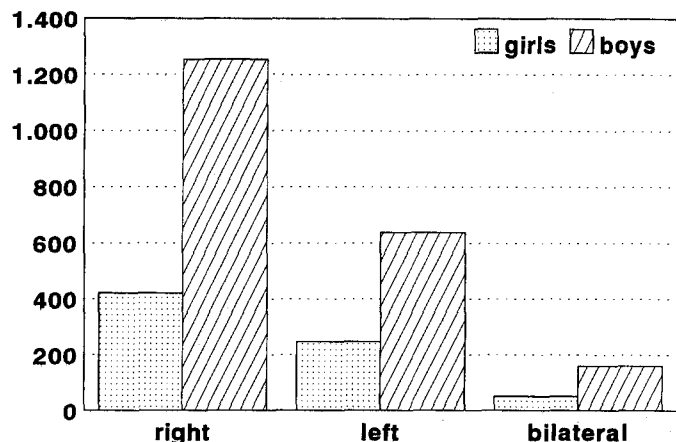


Fig. 1. Site of hernias with respect to gender.

mean age at the time of recurrent hernia repair was 48.2 ± 47.7 months for the boys and 37.8 ± 31.8 months for the girls.

Rehbein-Grob-Bastianelli Hernia Repair

For the Rehbein-Grob-Bastianelli hernia repair, a horizontal incision is made in the skin crease just above the medial to the external ring. Dissection includes the opening of the external oblique aponeurosis. The hernial sac is isolated and divided transversely. The distal part of the sac is left open. The proximal part of the sac is completely isolated and then ligated circumferentially with a transfixion suture, and the redundant tissue is resected on the level with the internal ring (Rehbein procedure). The margin of the internal oblique abdominal muscle is fixed to the lower margin of the inguinal ligament by two interrupted sutures, thereby covering the spermatic cord and narrowing the internal ring (Grob procedure). In girls the ligated neck of the sac is fixed to the back plane of the internal oblique abdominal muscle by a single suture to anchor the round ligament (Bastianelli procedure). The external oblique aponeurosis and the subcutaneous fatty tissue are closed by two lines of interrupted sutures. The skin is closed by subcuticular interrupted sutures with buried knots. Absorbable suture material (polyglycolic acid) is used throughout the operation.

Results

Surgical Technique for Primary Repair

All 2774 patients who underwent surgery for primary inguinal hernias at our department were operated according to the Rehbein-Grob procedure, and the girls underwent additional transposition of the remnant of the hernial sac underneath the internal oblique muscle according to Bastianelli.

In 23 patients with recurrent hernias the primary repair was carried out according to the technique of Rehbein-Grob; 18 patients underwent additional transposition of the hernial sac remnant underneath the internal oblique muscle. Four were operated without dissection of the inguinal canal according to Czerny. One patient had hernia repair according to the technique of Bassini but without dissection of the transversalis fascia. In all four girls the inguinal canal was dissected and the hernial sac

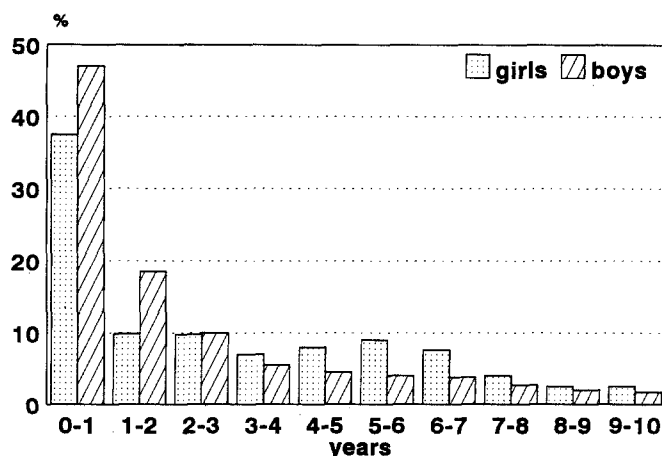


Fig. 2. Frequency of surgery with respect to age.

transposed underneath the internal muscle according to Bastianelli during the primary operation.

Surgeons' Educational Level

The primary operations of patients with recurrent hernias were performed by interns during their second to sixth year of surgical education in 17 boys and 3 girls, by senior surgeons in 5 boys, and by the head of the department in 6 boys and 1 girl. In comparison with our recurrence-free patients there was no significant difference in the surgeons' educational/experience level ($p > 0.05$, Wilcoxon-Mann-Whitney test).

Time of Operation

Of those with recurrent hernias, 20 boys and 4 girls underwent primary surgery during the day, and 8 of the boys had surgery during the evening or at night. Seven of the eight underwent emergency treatment for an incarcerated hernia. There was no significant difference in the distribution of the time of operation compared to our control group ($p > 0.05$, chi-square test).

Day-Case Treatment Versus Inpatient Treatment

Because of premature birth or concomitant diseases, primary hernia repair was carried out as an inpatient procedure on 22 male and 3 female patients (78.1%), and in the group with recurrent hernias six boys and one girl received day-case surgery (21.9%). Compared to the group of infants and children without recurrent hernias who were treated by day-case surgery (84%) this difference was significant ($p < 0.05$, chi-square test).

Postoperative Complications After Primary Hernia Repair

One boy developed an abscess of the abdominal wall from a suture fistula on the third postoperative day. In another case enteritis occurred during the postoperative course. One of the four girls presented with a postoperative hemorrhage and a consequent wound infection. The rate of early postoperative complications was 9.4% (3 of 32). In our series of primary hernia repair without recurrence the complication rate was 1.8%. This difference was significant ($p < 0.05$, chi-square test).

Premature Birth

Of the 28 male patients with recurrent hernias, five had been born prematurely; none of the four female patients were premature. Thus 15.6% of all 32 patients with recurrent hernias were premature. In the control group only 89 patients were born prematurely (3.2%). This difference was significant as analyzed by the chi-square test ($p < 0.01$). The mean age at the time of the primary repair in the premature babies was 7.2 months; for the mature newborn it was 20.4 months.

Surgical Technique for Recurrent Hernia Repair

The 25 cases of recurrent indirect hernias were operated according to the technique of Rehbein-Grob with special respect to ligation of the hernial sac on the level with the internal inguinal ring. The same procedure with additional transposition of the hernial sac underneath the internal oblique muscle (Bastianelli) was applied to the recurrent hernias in girls. The direct hernias were treated after dissection of the transverse fascia by a continuous suture (4/0 polydioxanon) of the transverse fascia and the internal oblique muscle. Repair of the femoral hernia was performed by suturing the ligament of Cooper to the inguinal band. No recurrences were registered during our follow-up examinations of all patients treated for recurrent hernias over a mean period of 8.4 years.

Discussion

The reported recurrence rates after inguinal hernia repair during infancy and childhood range from 0.8% to 3.8% [4–7]. In our experience there were 20 recurrent hernias after 2774 operations, for a rate of 0.67%.

The mean period between the operations for primary and recurrent hernia was less than 6 months in 11 (34.4%) cases. In another 12 (37.5%) patients the recurrences occurred after 6 months to 2 years; in 9 (28.1%) cases the period was 2 to 9 years. Grosfeld et al., however, reported that 50% of all recurrent hernias appeared after 6 months and 76% after 2 years [5].

The mean age of our control group of patients at the time of the primary operation was 27 ± 33 months for boys and 38 ± 38 months for girls. Comparable results (25.9 months) were found by Harvey et al. [8], whereas Mejdahl et al. reported an average age of 48 months [9]. In the group of patients with recurrent hernias, the age at the primary operation compared to the control group was considerably lower in boys (17 months) but not in girls (30 months). This difference was significant compared with our infants and children with recurrence-free primary hernias ($p < 0.05$, chi-square test). Few data can be found on the relation between age at primary repair and recurrence rate. Our results are supported by those of Harvey et al., who reported an increasing risk of recurrence with a decreasing age at primary surgery [8]. Furthermore, the rate of prematurely born babies was significantly higher in the group with recurrent hernias than in the control group.

One risk factor for the recurrence of hernias is incarceration. In our control group the incarceration rate was 7.6%, whereas 21.9% of our patients with recurrent hernias had a history of incarceration at primary repair. This difference was significant ($p < 0.01$, chi-square test). Grosfeld registered a high recurrence rate after

Table 1. Concomitant diseases predisposing to hernial recurrences.

Elevated intraabdominal pressure
Ventriculoperitoneal shunt
Obstructive pulmonary disease
Ascites
Disturbance of growth
Premature birth (< 31 weeks)
Malnutrition
Connective tissue disorder
Exstrophy of the bladder
Arrest of testicular descent

Modified from [4].

primary surgery for incarcerated hernias, too, especially in emergency cases [1]. Comparable results were reported by Harvey et al., with recurrence rates of 2.2% and 5.6% after elective surgery and incarcerated cases, respectively [8]. On the other hand, Moos and Hatch found no recurrence in a group of 384 infants and children operated on for incarcerated hernias up to an age of 2 months [10].

Neither Hecker and Ring-Mrozik [11] nor we could find an influence of the surgeons' educational level on the recurrence rate. Comparable studies on hernia repair in adults do not indicate an increase in the risks of complications and recurrences after operations by a surgeon at the beginning of his or her surgical education when supervised by a senior surgeon [12, 13].

Other risk factors are postoperative complications (e.g., hemorrhage and infections). Our patients who were treated for recurrent hernias had a complication rate of 9.4% at the primary operation; the rate in the control group was significantly lower (1.8%). There are no comparable figures in the literature relating the rates of complications and recurrences in infants and children. The reported complication rates after inguinal hernia repair are 1.5% to 2.5% [8–11]. The complication rates reported after emergency surgery for incarcerated hernias are much higher: 22% to 33% [4, 7]. Therefore all infants and children who undergo hernia repair for incarceration or in an emergency situation should be followed up regularly.

Various concomitant diseases are regarded as predisposing factors for the development of recurrent hernia. First are the disorders accompanied by an elevated intraabdominal pressure (Table 1) [5, 10]. If these cases are combined with a Hurler-Hunter syndrome or an Ehlers-Danlos syndrome, recurrence rates up to 56% can be expected [14–16]. Ten of our patients with recurrent hernias (31.2%) presented with a concomitant disease, such as hydrocephalus with a ventriculoperitoneal shunt, premature birth, or arrest of testicular descent. In the control group only 5.7% of all infants and children suffered from diseases predisposing to a recurrence.

Another reason for recurrence is technical mistakes at primary surgery. From a retrospective analysis of operation reports, causes for the development of recurrent hernia cannot be clearly deduced. The most frequent errors are failure to find the hernial sac, an insufficient low-level resection of the hernial sac, and injuries of the dorsal plane of the inguinal canal. These findings are supported by other authors [1, 5].

We did not find any relation between day-case or inpatient treatment and recurrence rates. The decision for either form of care depends foremost on the diagnosis and the severity of any

concomitant disease. Only 14% of our patients required prolonged inpatient observation after hernia repair.

A knowledge of all the factors predisposing to recurrence together with a technically perfect surgical technique and the reposition of incarcerated hernias followed by an early elective repair can further decrease the recurrence rate during infancy and childhood.

Résumé

Unavailable at press time.

Resumen

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References

1. Grosfeld, J.L.: Current concepts in inguinal hernia in infants and children. *World J. Surg.* 13:506, 1989
2. Holder, T.M., Ashcraft, K.W.: Groin hernias and hydroceles. In *Textbook of Pediatric Surgery*, T.M. Holden, K.W. Ashevaft, editors. Philadelphia, Saunders, 1980, pp. 594–608
3. Lambrecht, W.: Inguinal hernia in the child. In *Atlas of Hernia Surgery*, V. Schumpelick, editor. Philadelphia, B.C. Decker, 1990, pp. 97–123
4. Rescorla, F.J., Grosfeld, J.L.: Inguinal hernia repair in the perinatal

- period and early infancy: clinical considerations. *J. Pediatr. Surg.* 19:832, 1984
5. Grosfeld, J.L., Minnick, K., Shedd, F., West, K.W., Rescorla, F.J., Vane, D.W.: Inguinal hernia in children: factors affecting recurrence in 63 cases. *J. Pediatr. Surg.* 26:283, 1991
6. Rowe, M.I., Clatworthy, H.W.: Incarcerated and strangulated hernias in children. *Arch. Surg.* 101:136, 1970
7. Rowe, M.I., Loyd, D.A.: Inguinal hernia. In *Pediatric Surgery*, K.J. Welch, J.G. Randolph, M.M. Ravitch, et al., editors. Chicago, Year Book, 1986, pp. 779–793
8. Harvey, M.H., Johnstone, M.J., Fossard, D.P.: Inguinal herniotomy in children: a five year survey. *Br. J. Surg.* 72:485, 1985
9. Mejdahl, S., Gyrtrup, H.J., Kvist, E.: Out-patient operation of inguinal hernia in children. *Br. J. Surg.* 76:406, 1989
10. Moos, R.L., Hatch, E.I.: Inguinal hernia repair in early infancy. *Am. J. Surg.* 161:596, 1991
11. Hecker, W.C., Ring-Mrozik, E.: Follow-up results of operations on pediatric inguinal hernias. *Langenbecks Arch. Chir.* 371:115, 1987
12. Decurtins, M., Buchmann, P.: Ist die Behandlung des Leistenbruchs eine Anfängeroperation? *Chirurg* 55:589, 1984
13. Steinau, G., Fischer, H., Knezevic, P.: Lokale postoperative Komplikationen nach Leistenbruchoperation. *Chir. Praxis* 39:49, 1988
14. Coran, A.G., Eraklis, A.H.: Inguinal hernia in the Hurler-Hunter syndrome. *Surgery* 61:302, 1967
15. McEntyre, R.L., Raffensperger, J.G.: Surgical complications of Ehlers-Danlos syndrome in children. *J. Pediatr. Surg.* 12:531, 1977
16. Woolley, M.M., Morgan, S., Hays, D.M.: Heritable disorders of connective tissue: surgical and anesthetic problems. *J. Pediatr. Surg.* 2:325, 1967

Invited Commentary

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This report by Steinau and his colleagues is a large retrospective review of children undergoing hernia repair in the same center over a 24-year period. The authors report a recurrence rate of 0.67%, identify several factors associated with the likelihood of recurrence, and interestingly demonstrate that the educational level of the primary surgeon had no impact on the rate of recurrence.

Although recurrence rates of 3% and 4% have been reported in smaller series by Vibits and Pahle [1] from Kalundborg, Denmark and Fung et al. [2] from East Birmingham, U.K., the figure demonstrated in this article is more in keeping with the large series of Wright [3] from Newcastle, Australia (11 recurrences in 1600 patients, or the same 0.68%). It is also supports the commonly cited recurrence figure in standard pediatric surgical textbooks of 0.5%.

Factors associated with recurrence identified by Steinau et al. include incarceration, postoperative complications, and concomitant disease. Certainly, recurrence after infection and hematoma has been well documented and was identified as a common cause of recurrence by Grosfeld et al. [4]. Rajput and Gauderer [5], in a review of hernias in neonates, demonstrated the high recurrence rate in prematurely born infants with their large problem list of associated maladies. Incarceration complicates repair with edema

and friable tissue planes. These confounding problems may explain to some degree the presence of direct recurrence after indirect repair (documented in almost all large reports of recurrent childhood hernias); the suspicion must be that the original hernia was misdiagnosed and unrepaired because of anatomic distortion associated with swelling or that the anterior floor of the canal was damaged during high ligation of a hernia sac.

Finally, these authors bravely document that recurrence was no greater when the operating surgeon was a second to sixth year house officer, senior surgeon, or head of the department. Because the recurrence rate is acceptably low for all groups, I believe this statement simply reflects good instruction in hernia repair technique from top to bottom in this particular institution.

This article is a comprehensive review of one institution's 24-year experience that encapsulates current repair, complications, and recurrence rates in children. The size of this series and its duration over a quarter century gives it credibility as an authoritative statement on the current care of children with hernia problems.

References

1. Vibits, H., Pahle, E.: Recurrences after inguinal herniotomy in children: long time follow-up. *Ann. Chir. Gynaecol.* 81:300, 1992
2. Fung, A., Barsoum, G., Bentley, T.M., Wild, K., Klidgian, A.M.: Inguinal herniotomy in young infants. *Br. J. Surg.* 79:1071, 1992
3. Wright, J.E.: Recurrent inguinal hernia in infancy and childhood. *Pediatr. Surg. Int.* 9:164, 1994
4. Grosfeld, J.L., Minnick, K., Shedd, F., West, K.W., Rescorla, F.J., Vane, D.W.: Inguinal hernia in children: factors affecting recurrence in 62 cases. *J. Pediatr. Surg.* 26:283, 1992
5. Rajput, A., Gauderer, M.W.: Inguinal hernias in very low birth weight infants: incidence and timing of repair. *J. Pediatr. Surg.* 27:1322, 1992