Incarcerated inguinal hernia in children

兒童的箝閉性腹股溝疝

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Introduction: The aim of this study was to document the data of incarceration in a group of children with inguinal hernia and to investigate whether incarceration could have been prevented. ***Materials and methods:*** A retrospective study reviewed the records of 3100 children who underwent herniorrhaphy between 1989 and 2007 in one centre, with 113 patients having hernia incarceration. In 16 patients, manual reduction was not attempted because of signs of strangulation, and in the remaining ones, reduction following sedation was not successful. The patients were evaluated with respect to age, postoperative mortality, and morbidity and especially whether he or she had been scheduled for operation in a surgical department. The incidence of incarcerated inguinal hernia and risk factors were analysed. ***Results:*** Of the 113 patients with incarcerated inguinal hernia, 105 were boys (92.9%), with a male to female ratio of 13:1. The majority of the patients were under one year of age (n=73); and 47 were 0-3 months old. Three laparotomies, 7 small intestinal resection and primary anastomoses, 2 oophorectomy, 7 partial omentectomy and 8 appendectomies were performed. During the 6 months to 18 years follow-up, testicular atrophy was seen in 4 boys. Two babies died. Scrotal oedema, testicular atrophy and mortality rate were significantly higher in incarcerated hernia patients compared with those without incarceration (all with p=0.001). ***Conclusions:*** Apparently, incarceration may be a preventable problem. Priority should be given to the treatment of inguinal hernias in infants less than 1 year of age, especially those 1-3 months old, as their risk of incarceration is higher. (*Hong Kong j.emerg.med.* 2010;17:244-249)

引言：本研究旨在引證一兒童組別腹股溝疝箝閉的數據，及調查可否預防箝閉。**資料及方法：**一個回顧性的研究，審查一中心於 1989 至 2007 年期間 3100 名進行疝修補術兒童的記錄，而 113 名病人有箝閉性疝。因有絞窄徵象，16名病人沒有嘗試用手復位，而其餘在鎮靜後復位失敗。評估病人關於年齡、手術後死亡率及發病率，尤其是否在外科部門已排期做手術，並分析箝閉性腹股溝疝的發生率及風險因素。**結果：**113 名有箝閉性腹股溝疝的病人中，105 為男孩（92.9%），男女比例為 13:1 。大多數的病人為 1 歲以下（73 名），47 名病人為 0-3 月大。進行了 3 個剖腹，7 個小腸切除及接合，2 個卵巢切除，7 個網膜局部切除及 8 個闌尾切除。在 6 個月至 18 年的覆診期間，4 名男孩睪丸萎縮，兩名幼兒死亡。比較沒有箝閉者，箝閉性疝病人的陰囊水腫率、睪丸萎縮率及死亡率都顯著較高（全部 p=0.001）。**結論：**箝閉似乎是可以預防的問題。因箝閉的風險較高，應優先治療1歲以下嬰兒的腹股溝疝，尤其是年齡1-3月者。

Keywords: Child, inguinal hernia

關鍵詞：兒童、腹股溝疝

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Introduction

Inguinal hernia is the most common indication for surgery in the paediatric age group and the incidence of inguinal hernia in those younger than 18 years old varies from 0.8% to 4.4%.[1] An infant with inguinal hernia is at great risk because of complications associated with incarceration such as high recurrence rate; intestinal, testicular, or ovarian circulatory compromise and postoperative wound problems. The key to success in preventing these complications is

repair of the hernia before incarceration. Semi-elective repair has been shown to be superior to emergency operation.[2-5] The timing of hernia operation has been defined for specific paediatric patients. In premature newborns with high risk, post-conception age for repair should be older than 48-50 weeks and in newborns with low birth weight, the weight should be at least 2200 g. In patients who have undergone reduction, operation should be performed after 24-48 hours.[4-6] However, no timing for operation has been defined for healthy children. With 40 years of history and experience, the common consensus of paediatric surgery can be summarised as repair of the hernia at the earliest possible time.[6,7] The marked increase in the number of emergency operations due to incarceration in recent years prompted us to review the issue in more details. This study was a review of children undergoing operative treatment for incarcerated hernia. Thus, we aimed to investigate the incidence of incarceration in paediatric inguinal hernia and the method to prevent or reduce it in light of the findings and to address the issue of timing of operation for paediatric inguinal hernia which is still debatable.

Materials and methods

This retrospective study reviewed the records of 3100 children with age ranging from 0-16 years (20.5% female, n=634) who underwent inguinal herniorrhaphy in Gazi University Medical Faculty between January 1989 and December 2007. This hospital is located in Ankara, Turkey – a developing country. Electronic and paper medical records were reviewed for patient data. The incidence of incarcerated inguinal hernia and risk factors of incarceration were analysed. The age, gender, time from recognition to presentation of the hernia, the side of the hernia, appointment for operation previously made by another centre, the surgical procedure performed, and complications were retrospectively reviewed. All categorical variables were compared by chi square test. A p value less than 0.05 was considered significant.

Results

Of the 113 patients with incarcerated inguinal hernia, 105 were boys (92.9%), resulting in a male to female ratio of 13:1. In contrast, this ratio was 3.8:1 in hernias without incarceration (p=0.001). The mean age of the patients at presentation with incarceration was 12.8 months (range 5 days-7 years). The rate of incarceration in male patients was 4.26%, and in female patients 1.26%. The difference related to gender was significant (p=0.001). Notably, 73 (64.6%) patients were under one year of age and 47 patients (41.6%) were under 3 months of age (Table 1). In contrast, 66.8% of the patients without incarceration were over 1 year of age and 52.9% were over 2 years of age. The incarceration rate was significantly higher in 0-3 months of age, and significantly lower in hernia patients over 2 years of age (p=0.002 and 0.001 respectively). Hernias were located bilaterally in 430 patients, on the left side in 730 patients while it was located on the right side in 1940 patients (total=3100). The sites of the incarcerated inguinal hernia were as follows: right 79, left 34, and in 10 patients, a hernial sac was palpable on the opposite side as well. The lateralization was similar between hernia with incarceration and hernia without incarceration. Of those with an incarcerated hernia on the left side, 5 were females. Hernias without incarceration were on the right side in 2076 (69.5%) patients and on the left side in 911 (30.5%) patients. Comparisons of the incarceration rates according to laterality revealed that the incarceration rate of hernias on the right side was 3.33%, and the incarceration rate for hernias located on the left side was 2.93% (p=0.511). Evaluation of the patient records demonstrated that all patients, except those with strangulation, were subjected to hydration and sedative injection followed by manual reduction, but none was successful.

Inguinal hernia was diagnosed in 15 patients only after incarceration had developed. Some of the patients had not been presented to any healthcare institution although their parents noticed the swelling in the inguinal area (32 patients, 28.3%), and the number of patients who had made an appointment with paediatric surgery was similar (30 patients, 26.5%). Some patients had been examined by departments other than paediatric surgery and were told that they required an operation but it should be performed at an older age. Notably, 75.8% of the patients (47/62) who had been scheduled for operation were under one

year of age, and 11 patients had more than one episode of incarceration. Many patient records were in other centres, and the history obtained from some patients was not reliable. Thus, it was not possible to establish a correlation between the time of presentation to hospital and the development and morbidity of incarceration.

The small bowel (n=45, 39.8%) was the most commonly incarcerated organ as determined intraoperatively (Table 2). In 9 patients, reduction was realised in its own accord during anaesthesia. In 3 patients, however, oedematous spermatic cord and surrounding haematoma, which were thought to be associated with reduction, were found. Almost all resections of the small bowel (6 of the 7 patients), a surgical procedure added to the herniorrhaphy, were made in children under 1 year of age. Incarceration caused organ or tissue loss in 24 patients (Table 3). There was no recurrence in patients with incarcerated hernia as opposed to the 15 (0.5%) recurrences in patients without incarceration (p=0.524). Six of these patients with recurrence were referred by other paediatric surgery clinics and 4 of them were operated by general (adult) surgeons. Scrotal oedema was the most common complication (Table 4). The scrotal oedema rate was significantly higher in incarcerated hernia patients (n=12) compared with those without

Table 1. Data of children with incarcerated and without incarcerated inguinal hernia

	Inguinal hernia with incarceration	Inguinal hernia without incarceration	p
Number of patient	113	2987	
Gender (male/female)	13.1 105 (male) (92.9%) 8 (female)	3.8 2361 (male) (79.0%) 626 (female)	0.001*
Side			
Right	79 (69.9%)	2076 (69.5%)	0.482
Left	34 (30.1%)	911 (30.5%)	
Age			
0-3 months	47 (41.6%)	550 (18.4%)	0.002*
4-12 months	26 (23.0%)	443 (14.8%)	0.194
13-24 months	28 (24.8%)	413 (13.8%)	0.078
>24 months	12 (10.6%)	1581 (52.9%)	0.001*
Recurrence of hernia	0 (0%)	15 (0.5%)	0.524
Scrotal oedema	12 (10.6%)	14 (0.5%)	0.001*
Wound infection	2 (1.8%)	21 (0.7%)	0.149
Testicular atrophy	4 (3.8%)	7 (0.2%)	0.001*
Mortality	2 (1.8%)	0 (0%)	0.001*

*statistically significant

Table 2. Content of the hernial sac

Content	Number	%
Small bowel	45	39.8
Caecum-appendix	13	11.5
Omentum	7	6.2
Fallopian tube	3	2.7
Sigmoid colon	3	2.7
Empty pouch	42	37.2
Total	**113**	**100**

Table 3. Intervention in addition to herniorrhaphy

Procedure	Number
Intestinal resection*	7
Laparotomy	3
Oophorectomy	2
Omentectomy (partial)	7
Appendectomy	8

*6 children under 1 year of age

incarceration (n=14) (p=0.001) (Table 1). Although wound infection, testicular atrophy and mortality rates were higher in incarcerated hernia patients compared with those without incarceration, only testicular atrophy and mortality rates were significant statistically (p=0.001 and p=0.001). Two newborn patients died in the postoperative period due to sepsis and necrotizing enterocolitis.[8]

Discussion

The high rates of mortality and morbidity have led to questions as to when inguinal hernia in children should be operated. There is controversy regarding the best timing for hernia repair, and delaying the surgery in infants is still commonly practised. This approach increases the risk of incarceration. In the study by Niedzielski et al, the records of 1582 children who underwent inguinal herniorrhaphy were evaluated, particularly for the time and circumstances of hernia incarceration. They found incarcerated hernia in 153 (9.7%) patients. Of these patients, 81 (52.9%) were known to have had prior hernia incarceration and 81 (52.9%) were younger than one year of age. Manual reduction of hernia was successful in 130 (85.0%) cases, and 99 of them (76.2%) underwent herniorrhaphy during the same hospitalisation period.[9] The literature reveals high incidence rates of incarceration (3% to 31%) (Table 5). In addition to high rates of incarceration in paediatric patients under 1 year old, particularly in those under 2 months of age, the need for emergency surgery has been reported to be 73%-89%.[5,10-13] In this study, 64.6% of the incarcerated hernia patients were under 1 year of age and 41.6% under 3 months of age. This study has shown that incarceration was more frequent under 3 months of age and also that these patients more frequently required major surgical intervention.

Table 4. Postoperative complication and mortality in incarcerated hernia

	Patient (n)	Death (n)
Sepsis	1	1
Necrotizing enterocolitis	1	1
Testicular atrophy	4	–
Laryngospasm	2	–
Wound infection	2	–
Scrotal oedema	12	–
Total	**22**	**2**

Studies on incarceration and its socioeconomic implications have yielded interesting results. Underdevelopment has increased the risk of incarceration by three-folds, while reduction has been made at a low rate of 34% because these patients attended the hospital late.[14-17] Our country can be classified as a developing country. Thus, we should be more careful in our approach to inguinal hernia. In our study, the high cost of hospitalisation time and the treatment methods applied in the 113 patients was not calculated. Nevertheless, the organ and tissue loss caused by incarcerated inguinal hernias have painted an even gloomier picture.

According to the literature review, the timing of inguinal hernia repair has not been precisely defined. A prospective clinical study aiming to define the proper timing found 13% of 141 patients developed

Table 5. Incarceration rate in large series of patients with inguinal hernia

Authors	Age	Inguinal hernia (n)	Incarceration (n)
Rescorla / Grosfeld[4]	<2 months	100	31 (31.0%)
Rowe / Clatworthy[5]	0-14 years	2764	351 (12.7%)
Niedzielski et al[9]	0->10 years	1582	153 (9.7%)
Zamakhshary et al[10]	<2 years	1065	127 (11.9%)
Stylianos et al[11]	0-14 years	908	85 (9.4%)
Puri et al[12]	<1 year	511	158 (30.9%)
Ein et al[13]	0-18 years	6361	763 (12.0%)
Our series	0-16 years	3100	113 (3.6%)

incarceration. The authors asserted that if children with reducible incarcerated indirect inguinal hernia had been hospitalised and undergone repair 24 to 48 hours later, 83% of subsequent incarcerations would have been prevented. Furthermore, they recommended that for healthy children less than 10 years of age, indirect inguinal hernia repair should be performed on a semi-elective basis within 7 days of diagnosis.[18] In another study by Stylianos et al, 85 of the 908 children presented with incarcerated hernia. Thirty of these 85 patients (35%) were known to have an inguinal hernia prior to incarceration, and 25 of the 30 were awaiting elective hernia repair.[11] Gahukamble and Khamage concluded that all children with inguinal hernia should have hernia repair within 5 days after reduction of incarceration as a precaution against recurrent incarceration.[19] The increased number of major surgical interventions could be due to the fact that our centre is one of the biggest referral centres in the country. Also, until a few years ago, there was not an established referral system between different social security systems and this resulted in longer periods of waiting for elective hernia repair in children. This major obstacle has been largely overcome by now after uniting the social security systems.

The duration of symptoms at presentation was longer in younger children, and the outcome of nonsurgical treatment would be worse. There is an increased incidence of postoperative complication associated with irreducibility.[20] In one study, 38 cases were operated on for incarcerated inguinal hernia, and 5 testes developed total atrophy. Early operation of inguinal hernias in babies seems to be the best prophylaxis against such complications.[21] However, in the study by Timmers et al, children with a non-incarcerated inguinal hernia waiting for operation had a 2% risk of secondary incarceration and complication, a rate which was thought not enough to justify elective hernia repair within 7 days.[22] This study showed scrotal oedema, testicular atrophy, mortality rate and intestinal resection were significantly higher in incarcerated hernia patients compared with non-incarcerated hernia patients. For these reasons, our policy is early treatment of incarcerated inguinal hernia in children on the second or third day after successful reduction. In some cases, operation is performed at the same time immediately after reduction especially in young children as a precaution against re-incarceration. Al-Naami and Al-Shawi reported a case of incarcerated inguinal hernia in which at open surgical repair, the contents of the hernial sac slipped back into the abdomen before evaluation. Using laparoscopy, the involved bowel was retrieved into the groin and its viability assessed.[23]

From our results, 30 out of 113 patients with incarcerated hernia (26.5%) had made an appointment with paediatric surgery. If regulations have been made in the social security system, the rate of emergency surgery for incarcerated inguinal hernia can be reduced by 26.5% in our patients. In addition, 47 of the 62 patients (75.8%) who had been scheduled for operation in various departments were under one year of age. Leaving aside legal regulations, in children under one year of age, earlier repair of inguinal hernia will reduce the rate of emergency operations as a result of incarceration by 75.8%. This paper emphasizes the need to perform further prospective studies to determine whether a safe waiting period exists for inguinal herniorrhaphy in instances when the patient cannot be scheduled for operation due to lack of facilities.

Conclusion

Apparently, incarceration may be a preventable problem. Priority should be given to the treatment of inguinal hernias in infants less than 1 year of age, especially those 1-3 months old, as their risk of incarceration is higher. Considering the high incidence of incarceration in males, the appointment for male babies in particular should not be delayed.

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