Original Article

Risk Factors for Contralateral Metachronous Indirect Inguinal Hernia in Children with Unilateral Inguinal Hernia

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Background: The repair of indirect inguinal hernia is a common operation among pediatric surgeons. The incidence of inguinal hernia in children ranging from 0.8% to 4.4%. After unilateral repair of the inguinal hernia, the incidence of a contralateral inguinal hernia is about 6%.

Objective: To identify the risk factors of metachronous contralateral indirect inguinal hernia (MCIH).

Materials and Methods: A retrospective cohort study of the indirect inguinal hernia patients (ICD-10 code K40.9) was performed. Patients having bilateral inguinal hernia at the initial presentation were excluded. The patient between 0 and 15 years old visiting the authors' institute between January 2007 and December 2014 were included. The data collected including gender, age at presentation, birthweight, gestational age, initial side of indirect inguinal hernia, history of incarceration, post-operative complication, recurrence, comorbidity, and presence of MCIH as the outcome of the present study.

Results: Five hundred seventy-five indirect inguinal hernia patients' data were collected. Fifty-nine patients were excluded due to bilateral indirect inguinal hernias at presentation. Five hundred sixteen patients were included for final analysis. Incarceration in the initial side was found in 23%. The MCIH was found in 7.9% with a mean follow-up time of 21 months (maximum time 124 months). The multivariable analysis of the factors associated with MCIH clustering by gender was performed and the significant risk factors were initial left side hernia (risk ratio [RR] 1.27, p=0.011, number needed to treat [NNT] 50), age less than six months (RR 1.04, p=0.001, NNT 200), underlying heart disease (RR 2.50, p<0.001, NNT 8), and lung disease (RR 1.39, p=0.007, NNT 20).

Conclusion: The risk factors of the MCIH in the present study were initial left side hernia, age less than six months, and underlying heart and lung diseases clustering by gender. The history of risk factors combined with the definite physical examination and investigation aided in the judgement for contralateral inguinal exploration.

Keywords: Indirect inguinal hernia, Metachronous, Contralateral, Risk factors

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The repair of indirect inguinal hernia is a common operation among pediatric surgeons. The incidence of inguinal hernia in children ranges from 0.8% to 4.4%[1]. After the unilateral repair of the inguinal hernia, the incidence of the contralateral inguinal hernia is approximately 6%[2]. The contralateral exploration of pediatric inguinal hernia is being debated. In 1995, Rothenberg and Barnet reported a very high incidence of 68.5% to 100% of bilateral inguinal hernias in infants and children[3]. Therefore, routine contralateral exploration was recommended. Many studies regarding contralateral exploration was reported with both positive and negative results. Many cases did not have a hernia sac in contralateral exploration. As a result, contralateral inguinal exploration decreased[4]. Many studies tried to correlate the incidence of metachronous contralateral indirect inguinal hernia (MCIH) with potential risk factors but could not get compatible results. The complications of the hernia surgery are scrotal swelling, testicular

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atrophy, iatrogenic undescended testes, and injury to the vas deferens. One study regarding complications of the exploration of the asymptomatic side showed post-operative complications to be significantly more frequent in case of prophylactic herniotomies[5]. Some studies recommended performing contralateral exploration in special circumstances such as in cases of premature newborns who had a high risk of strangulation or a high risk of general anesthesia[6]. In 1999, Steinau suggested that contralateral exploration should be done in infants under two months of age with predisposing factors of prematurity, ventriculo-peritoneal shunt, ascites, and asthma[7]. The risk factors for metachronous contralateral inguinal hernia from the previous studies were initially left side[2], female gender[2], findings suspicion for contralateral hydrocele (scanty fluid collection within the scrotum) on ultrasound[8], and prematurity[9]. In 2014, Hoshino proposed the pre-operative risk scoring system for the prediction of contralateral inguinal hernia. The parameters used were age at initial operation, gender, initial side, and birthweight[10]. However, the significant parameter was only the initial left side at the operation. Since 1993, Holcomb reported the use of diagnostic peritoneoscopy via umbilical incisions for the evaluation of the contralateral inguinal region. Then, the laparoscopic treatments became an alternative in hernia repair[11]. The advantages were less pain, and ability to diagnose and repair the contralateral side. Disadvantages were high cost, longer operative time, and entering the peritoneum. Many pediatric surgeons still use an open repair technique secondary to a small incision because of the ease of the technique and the less pain generated. Because the risk factors of the contralateral indirect inguinal hernia are still unreported, the present study aimed to identify the risk factors of metachronous indirect inguinal hernia.

Materials and Methods

This retrospective cohort study was approved by the Ethics Committee of the authors' institute. The authors declare that there is no conflict of interest. The data were obtained by medical chart review and electronic databases. All indirect inguinal hernia patients (ICD-10 code K40.9) aged less than 15 years were included in the present study. Patients having bilateral inguinal hernia at initial presentation were excluded. The study patients were evaluated between January 2007 and December 2014. The data collection included gender, age at presentation, birthweight, gestational age, initial side of indirect inguinal hernia, history of incarceration, post-operative complication, history of ventriculoperitoneal shunt (VP shunt), history of peritoneal dialysis (PD), recurrence, comorbidity, and presence of MCIH.

Diagnosis of indirect inguinal hernia was determined by history and physical examination including a history of intermittent bulge in the groin, labia, or scrotum, which appeared with increased intra-abdominal pressure such as crying or straining. The physical examination showed an asymmetrical inguinal mass that was reducible. If no mass was identified, the silk glove sign was done by palpating above the pubic tubercle to identify the sac[1].

Patients were treated with a herniotomy performed by open technique via a transverse inguinal incision on the lowest skin crease under general anesthesia. The high ligation of the sac at the level of deep inguinal ring was performed.

The outcomes of the present study were presence or absence of MCIH. All the collected data above were used for identification of the risk factors of MCIH.

Statistical analysis was prepared with commercial statistical software (Stata 11.0; StataCorp LP, College Station, TX, USA). The categorical descriptive data were reported in count (n) and percent. The categorical univariable analysis was done by Fisher's exact test. The numerical descriptive data were reported in mean and standard deviation or median and interquartile range. The numerical univariable analysis was completed by student's t-test or Wilcoxon rank sum test. The factors associated with MCIH were reported by risk ratio. The multivariable regression analysis for the association of factors with MCIH was exponential risk regression. Statistical significance level was set as two-tailed with p-value of less than 0.05. Number needed to treat (NNT) was calculated for each significant risk factor.

Results

The data of 575 indirect inguinal hernia patients in Chiang Mai University Hospital was collected. The overall characteristics of the indirect inguinal hernia patients are shown in Table 1 and 2. Fifty-nine patients were excluded due to having bilateral indirect inguinal hernia at initial presentation. Five hundred sixteen patients were included for the final analysis (Figure 1). Twenty-three percent of the patients had incarceration on the initial side. No emergency operation or bowel resections were required. MCIH was identified in 7.9% of the patients with a median duration of 12 months prior to the presentation of MCIH after repair of the initial side. The characteristics of the patients

Table 1. Baseline characteristics of all children with indirect inguinal hernia in Chiang Mai University Hospital between 2007 and 2014 (all 575 cases)

Characteristics	n (%)
Sex	
Male	483 (84.0)
Female	92 (16.0)
Age (months), Median (IQR)	13 (3 to 37)
Gestational age (weeks), Mean±SD	35.2±4.4
Preterm (gestational age <37 weeks)	109 (41.8)
Term (gestational age ≥37 weeks)	152 (58.2)
Birthweight (kg), Mean±SD	2,400.3±896.5
Initial side of hernia	
Right	308 (53.6)
Left	208 (36.2)
Bilateral	59 (10.3)

SD=standard deviation; IQR=interquartile range

Table 2. Post-operative characteristics of all children with indirect inguinal hernia in Chiang Mai University Hospital between 2007 and 2014 (all 575 cases)

Characteristics	n (%)
Complications	
Wound Infection	8 (1.39)
Scrotal Hematoma	3 (0.52)
Postoperative Hydrocele	2 (0.35)
Comorbidities	
Heart disease	14 (2.4)
Lung disease (BPD, asthma)	22 (3.8)
Neurologic disease	7 (1.2)
Recurrence	12 (2.1)
MCIH	41 (7.9)
Interval of the MCIH, Median (IQR)	12 (3 to 26)

BPD=bronchopulmonary dysplasia; MCIH=metachronous contralateral indirect inguinal hernia; IQR=interquartile range

with and without MCIH are shown in Table 3. The mean follow-up time was 21 months (maximum time 124 months). No significant risk factors of MCIH in univariable analysis were identified, however, the occurrence of indirect inguinal hernia between both genders had anatomical differences. The multivariable analysis of the factors associated with MCIH clustering by gender were collected and are shown in Table 4. The significant risk factors

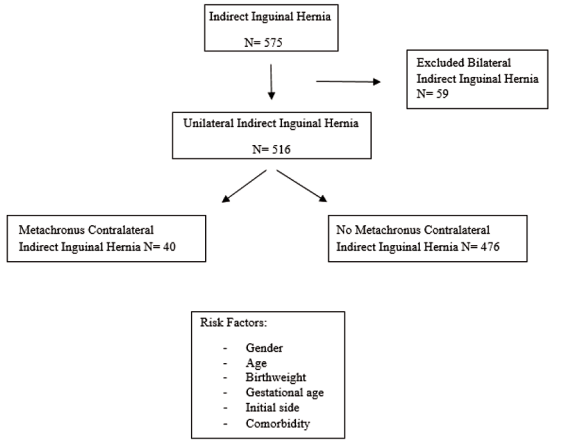

Figure 1. Study flow of the study of indirect inguinal hernia.

were initial left side of the hernia, age less than six months, and underlying heart and lung diseases. The NNT for contralateral exploration of each factors is shown in Table 5.

Discussion

Patent processus vaginalis (PPV) was widely accepted to be the cause of indirect inguinal hernia in pediatric patients. The MCIH presented in 7.9% in the present study. Studies regarding contralateral patent processus vaginalis (CPPV) and MCIH are shown in Table 5. The incidence rate of CPPV reported was between 30% and 45% with MCIH occurring 0.33% to 10%. The findings indicated that not all the PPV became indirect inguinal hernias.

Risk factors of MCIH have been discussed in many studies. The present study also found that after clustering by gender, initial left side of the hernia, age less than six months, and underlying heart and lung diseases were the risk factors. In this laparoscopic era, CPPV could be identified and prophylactic herniotomy could be done. However, not all CPPV would become MCIH. Open herniotomy remained the primary operative technique used. Therefore, the method to identify CPPV were physical examination and ultrasound. Physical examination referred to the silk glove sign. This examination is performed by placing a finger on the pubic tubercle at the spermatic cord level and rubbed over the cord from side to side. However, these signs are subjective and not completely accurate[1]. In 2015, Kaneda et al reported utilizing ultrasound to evaluate CPPV to predict the contralateral indirect inguinal hernia[12]. They found that the occurrence of contralateral inguinal hernia

Table 3. Baseline characteristics of children with unilateral indirect inguinal hernia with and without MCIH (n=516)

Characteristics	MCIH (n=41) n (%)	No MCIH (n=475) n (%)	p-value
Sex			0.123
Male	31 (7.1)	403 (92.9)	
Female	10 (12.2)	72 (87.8)	
Age, Median (IQR)	16 (3.7 to 34)	14 (3 to 42)	0.568*
<6 months	27 (7.8)	321 (92.2)	
≥6 months	14 (8.3)	154 (91.7)	
Gestational age, Mean±SD	35.5±4.6	35.6±4.1	0.916#
<37 weeks	8 (9.3)	78 (90.7)	
≥37 weeks	14 (10.1)	124 (89.9)	
Birthweight (kg), Mean±SD	2,485.6±860.5	2,403.4±916.2	0.674
Initial side of hernia			0.412
Right	22 (7.1)	286 (92.9)	
Left	19 (9.1)	189 (90.9)	
Comorbidity			
Heart disease	2 (20.0)	8 (80.0)	0.185
Lung disease (BPD, asthma)	2 (13.3)	13 (86.7)	0.338

BPD=bronchopulmonary dysplasia; MCIH=metachronous contralateral indirect inguinal hernia; SD=standard deviation; IQR=interquartile range

* p-value from Wilcoxon rank sum test, # p-value from student's t-test

Table 4. Multivariable risk ratio of factors associated with MCIH clustering by male vs. female

Characteristics	Crude risk ratio (95% confidence interval)	p-value	Multivariable risk ratio (95% confidence interval)	p-value
Initial left side of hernia	1.27 (1.11 to 1.47)	0.001	1.27 (1.06 to 1.54)	0.011
Age <6 months	1.07 (1.05 to 1.10)	<0.001	1.04 (1.02 to 1.07)	0.001
Underlying heart diseases	2.59 (2.37 to 2.84)	<0.001	2.50 (2.25 to 2.78)	<0.001
Underlying lung diseases	1.71 (1.21 to 2.43)	0.003	1.39 (1.09 to 1.76)	0.007

associated with the presence of CPPV was wider than two millimeters by ultrasound. Ultrasound was used in cases of a good history and equivocal physical examination and evaluation of the contralateral groin.

The contralateral groin exploration was mentioned in many studies. The review of the studies including PPV and MCIH was shown in Table 6. Recommended operative procedures for herniotomies were laparoscopy and open technique. The benefit of contralateral exploration was to prevent the contralateral occurrence of hernia and reduce the risk of anesthesia while undergoing another operation for MCIH. The risks of contralateral exploration were the closing of only the CPPV and a significantly greater risk of operative complication in the asymptomatic side compared with the symptomatic side according to Maillet et al, 2014[5]. Therefore, contralateral exploration is still controversial. In the present study, the authors identified the risk factors associated with the occurrence of MCIH. The NNT from the statistical analysis for the contralateral exploration were too high to save one MICH.

Limitation of the present study was a retrospective study, thus, there were some missing data. The mean follow-up time was 21 months (range from 0 to 124 months), which is short for identifying MCIH.

Table 5. Number needed to treat for contralateral exploration in unilateral indirect inguinal hernia

Characteristics	Risk of MCIH	Absolute risk reduction	Number needed to treat
Initial side of hernia			
Left	19/208=0.09	0.02	50
Right	22/308=0.07	-	-
Age			
<6 months	14/168=0.083	0.005	200
≥6 months	27/348=0.078	-	-
Underlying heart diseases			
Present	2/10=0.2	0.12	8
Absent	39/506=0.08	-	-
Underlying lung diseases			
Present	2/15=0.13	0.05	20
Absent	39/501=0.08	-	-

MCIH=metachronous contralateral indirect inguinal hernia

Table 6. Characteristics of previous studies regarding PPV and MCIH

Study	Yilmaz, et al. 2015[13]	Simida, et al. 2015[14]	Pini, et al. 2015[15]	Miyake, et al. 2015[16]	Chin, et al. 2015[17]
All patients	60	1113	154	2067	92,308
Main operative technique	Laparoscopy	Laparoscopy	Open	Open vs. laparoscopy	Open
CPPV	30%	45%	30%	41.7%	NA
MCIH	NA	NA	10%	6.48% vs. 0.33%	9.6%
Recurrence	6%	NA	NA	0.52% vs. 0.27%	1.23%

NA=not applicable; CPPV=contralateral patent processus vaginalis; MCIH=metachronous contralateral inguinal hernia

The complications and recurrence rate (2.1%) of the present study as shown in Table 2 were similar to other series[1]. In patient who presented with risk factors, the options of treatment might be laparoscopically repair, contralateral exploration, or advise parents of the risk of MCIH.

Conclusion

The risk factors of the MCIH in the present study were initial left side hernia, age less than six months, and underlying heart and lung diseases clustering by gender. The history of risk factors combined with the definite physical examination and investigation aided in the judgement for contralateral inguinal exploration.

What is already known on this topic?

The incidence of MCIH in pediatric patient was around 6% to 10%. The contralateral exploration has been debated. The known risk factors for MCIH were preterm, female, initial left side, and contralateral hydrocele.

What this study adds?

The risk factors of MCIH in this study were initial left side hernia, age less than six months, and underlying heart and lung diseases clustering by gender. The options of treatment in patient who presented with risk factors might be laparoscopically repair, contralateral exploration, or advice parents about the risk of MCIH.

Conflicts of interest

The authors declare no conflict of interest.

References

1. Glick PL, Boulanger SC. Inguinal hernias and hydroceles. In: Coran AG, Adzick NS, Krummel TM, Laberge JM, Shamberger R, Caldamone A, editors. Pediatric surgery. 7th ed. Philadelphia, PA: Elsevier Mosby; 2012. p. 985-1002.

2. Wenk K, Sick B, Sasse T, Moehrlen U, Meuli M, Vuille-dit-Bille RN. Incidence of metachronous contralateral inguinal hernias in children following unilateral repair - A meta-analysis of prospective studies. J Pediatr Surg 2015;50:2147-54.
3. Rothenberg RE, Barnett T. Bilateral herniotomy in infants and children. Surgery 1955;37:947-50.
4. Nataraja RM, Mahomed AA. Systematic review for paediatric metachronous contralateral inguinal hernia: a decreasing concern. Pediatr Surg Int 2011;27:953-61.
5. Maillet OP, Garnier S, Dadure C, Bringuier S, Podevin G, Arnaud A, et al. Inguinal hernia in premature boys: should we systematically explore the contralateral side? J Pediatr Surg 2014;49:1419-23.
6. de Lange DH, Kreeft M, van Ramshorst GH, Aufenacker TJ, Rauwerda JA, Simons MP. Inguinal hernia surgery in The Netherlands: are patients treated according to the guidelines? Hernia 2010;14:143-8.
7. Steinau G, Dreuw B, Schleef J, Lawong G, Schumpelick V. Recommendations for treatment of contralateral inguinal hernias in children. Hernia 1999;3:53-6.
8. Lee DG, Lee YS, Park KH, Baek M. Risk factors for contralateral patent processus vaginalis determined by transinguinal laparoscopic examination. Exp Ther Med 2015;9:421-4.
9. Burgmeier C, Dreyhaupt J, Schier F. Gender-related differences of inguinal hernia and asymptomatic patent processus vaginalis in term and preterm infants. J Pediatr Surg 2015;50:478-80.
10. Hoshino M, Sugito K, Kawashima H, Goto S, Kaneda H, Furuya T, et al. Prediction of contralateral inguinal hernias in children: a prospective study of 357 unilateral inguinal hernias. Hernia 2014;18:333-7.
11. Holcomb GW 3rd. Laparoscopic evaluation for a contralateral inguinal hernia or a nonpalpable testis. Pediatr Ann 1993;22:678-84.
12. Kaneda H, Furuya T, Sugito K, Goto S, Kawashima H, Inoue M, et al. Preoperative ultrasonographic evaluation of the contralateral patent processus vaginalis at the level of the internal inguinal ring is useful for predicting contralateral inguinal hernias in children: a prospective analysis. Hernia 2015;19:595-8.
13. Yilmaz E, Afsarlar CE, Senel E, Cavusoglu YH, Karaman I, Karaman A, et al. A novel technique for laparoscopic inguinal hernia repair in children: single-port laparoscopic percutaneous extraperitoneal closure assisted by an optical forceps. Pediatr Surg Int 2015;31:639-46.
14. Sumida W, Watanabe Y, Takasu H, Oshima K, Komatsuzaki N. Incidence of contralateral patent processus vaginalis in relation to age at laparoscopic percutaneous extraperitoneal closure for pediatric inguinal hernia. Surg Today 2016;46:466-70.
15. Pini PA, Rossi V, Mosconi M, Disma N, Mameli L, Montobbio G, et al. Inguinal hernia in neonates and ex-preterm: complications, timing and need for routine contralateral exploration. Pediatr Surg Int 2015;31: 131-6.
16. Miyake H, Fukumoto K, Yamoto M, Nouso H, Kaneshiro M, Nakajima H, et al. Comparison of percutaneous extraperitoneal closure (LPEC) and open repair for pediatric inguinal hernia: experience of a single institution with over 1000 cases. Surg Endosc 2016;30:1466-72.
17. Chin TW, Pan ML, Lee HC, Tsai HL, Liu CS. Second hernia repairs in children-a nationwide study. J Pediatr Surg 2015;50:2056-9.