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Incidence of pediatric metachronous contralateral inguinal hernia and the relationship with contralateral patent processus vaginalis

Yanan Li[1] · Yang Wu[1] · Chuan Wang[1] · Qi Wang[1] · Yiyang Zhao[1] · Yi Ji[1] · Bo Xiang[2]

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Abstract

Background The management of contralateral patent processus vaginalis (CPPV) in children with unilateral inguinal hernia is still controversial. The objective of this study was to verify the relationship between metachronous contralateral inguinal hernia (MCIH) and CPPV, and the risk factors of MCIH.

Methods Children with unilateral inguinal hernia from three medical centers underwent either open or laparoscopic repairs. Clinical information, including demographics, morphological characteristics of CPPV, follow-up outcomes were collected.

Results Among 2942 patients (92.2%) who received open repair with successful follow-up, 185 (6.29%) developed MCIHs [125 (10.9%) on the right side and 60 (3.3%)] on the left including 156 (7.07%) younger than 3 years old and 29 (3.94%) older than 3 years old. Patients younger than 3 years old with primary left inguinal hernias more easily develop MCIHs and the difference is statistically significant. Among 5370 patients (96.0%) who received laparoscopic repair with successful follow-up, the morphology of ipsilateral patent processus vaginalis were cavernous type in 5318 (99%) and 52 (1%) were fissure type. CPPVs were identified in 2233 (41.5%) cases [1256 (35.01%) on the left side and 977 (54.80%) on the right side, $P<0.001$]; 1503 cases were cavernous type (1276 cases younger than 3 years old and 227 cases older than 3 years old) and 730 cases were fissure type (422 cases younger than 3 years old and 308 cases older than 3 years old). The probability of occurence of cavernous type and CPPV in children younger than 3 years old was higher than that in children older than 3 years old.

Conclusions Not all CPPVS progress into an MIH, and approximate one of 15 CPPVs would progress into MIH. If patient with initial left-sided inguinal hernia is younger than 3 years old, when the morphology of CPPV is cavernous type identified by laparoscopic exploration, the contralateral repair would be recommended.

Keywords Inguinal hernia · Management · Children · Contralateral · Risk factor

Inguinal hernia is a common surgical diseases in children with an overall rate of 0.8–4.4% and 75–90% of these patients were with unilateral inguinal hernia (UIH) [1]. Children with UIH are at risk of subsequently developing metachronous contralateral inguinal hernia (MCIH). It is reported that MCIH is relevant to contralateral patent processus vaginalis (CPPV) [2, 3].

Whether to explore the contralateral side in children with UIH is still controversial, but it is not recommended during open repair [2]. Nonetheless, laparoscopy can be used for

✉ Bo Xiang
xewkxb@sina.com

Yanan Li
2510870429@qq.com

Yang Wu
656478751@qq.com

Chuan Wang
724147911@163.com

Qi Wang
qiwang1991@126.com

Yiyang Zhao
582839520@qq.com

Yi Ji
jijiyuanyuan@163.com

[1] Department of Pediatric Surgery, West China Hospital of Sichuan University, Chengdu 610041, China

[2] Division of Oncology, Department of Pediatric Surgery, West China Hospital of Sichuan University, #37 Guo-Xue-Xiang, Chengdu 610041, China

detecting contralateral pathology and accurately diagnose CPPV. If CPPV exists, procedure could be done to close it and avoid a second surgery. The development of a MCIH remains unknown. However, not all CPPVS progress into a MCIH, routine repair may lead to overtreatment [4].

It is unknown what type of CPPV need to be repaired and few reports have investigated the accurate relationship between MCIH and CPPV. In this study, we retrospectively evaluated and analyzed all patients with UIH in the West China Hospital of Sichuan University, Children's Hospital of Chongqing Medical University and Chongqing Three Gorges Central Hospital over a period of 4 years, with the aim to explore the relationship between CPPV and subsequent MIH, to investigate risk factors of MCIH.

Materials and methods

This study was undertaken at the West China Hospital of Sichuan University, Children's Hospital of Chongqing Medical University and Chongqing Three Gorges Central Hospital with the approval of the human ethics review committee. We conducted a retrospective analysis of children with UIH diagnosed from 2010 to 2014 in the three medical centers. Children with bilateral hernias were excluded. Written informed consents were obtained from all patients' parents. Children in Children's Hospital of Chongqing Medical University and Chongqing Three Gorges Central Hospital underwent open hernia repair, whereas those in the West China Hospital of Sichuan University had laparoscopic repair. Clinical information, including demographics, morphological characteristics of CPPV, follow-up examinations, and outcome, were collected.

Open repair was done with general anesthesia. A skin incision was made along the inguinal crease on the ipsilateral side. The hernial sac was separated from the surrounding cord structures and double-ligated without any exploration on the contralateral side.

Laparoscopic repair was performed by positioning the child supine on the table with hips raised for 20°. Under general anesthesia, a 5-mm transumbilical incision was made to insufflate carbon dioxide (abdominal pressure: 8–10 mmHg) and direct visualization of the inguinal rings with the assistance of trocar. Both internal rings were explored by laparoscopy, and the type of CPPV was recorded if CPPV was identified. Inguinal hernia and CPPV were closed at the same procedure.

SPSS 21.0 was used in the statistical analysis of the study (SPSS, Inc, Chicago, USA). Data are expressed as the mean ± SD for all quantitative data. The quantitative data were analyzed by *t*-test. The Fisher exact and χ^2 test were used to compare qualitative variables. *P* values less than 0.05 were considered statistically significant.

Results

Among the 3197 patients with UIH, who received open repair, 2942 patients (92.2%) with successful follow-up were included for analysis. There were 2645 males and 297 females, with a male-to-female ratio of 8.9:1 (Table 1). MCIH were reported in 185 patients (6.29%). The incidence of MCIH was not significantly different in boys and girls [159 of 2645 (6.01%) vs. 26 of 297 (8.75%)]. The average time to develop MCIHs in patients with UIHs was 21.1 months (range from 5 to 56 months) after the open repair, compared with 18.5 months (range from 7 to 36 months) after laparoscopic repair ($P = 0.559$). In totally, 2206 cases diagnosed as UIH were less than 3 years old, including of 156 (7.07%) cases developing MCIH, and 736 cases were more than 3 years old, including of 29 (3.94%) cases developing MCIH. The difference was statistically significant in developing MCIH between patients younger than 3 years old and patients older than 3 years old ($P = 0.001$). A total of 1146 cases were primary left inguinal hernia, and the number of cases with MCIH was 125 (10.9%) cases. In addition, 1796 cases were primary right inguinal hernia, and the number of patients with MCIH was 60 (3.3%) cases. Patients with primary left

Table 1 Clinic characteristics of children

	Laparoscopic ($n = 5370$)	Open ($n = 2942$)	*P*-values
Age (years)*	3.65 (3.7)	3.31 (3.07)	0.082
Sex			0.750
Male	4816	2645	
Female	554	297	
Side of hernia			< 0.001
Right	3587	1796	
Left	1783	1146	
CPPV			
Right	977	–	< 0.001‡
Left	1256	–	
MIH			
Right	2	125	< 0.001
Left	3	60	
Male	5	26	0.065
Female	0	159	
< 3 y	5	156	0.002
≥ 3 y	0	29	

CPPV contralateral patent processus vaginalis, *MCIH* metachronous contralateral inguinal hernia

*Standard deviation

‡Comparison of location in laparoscopic group

inguinal hernias more easily develop MCIHs and the difference is statistically significant ($P = 0.006$).

Laparoscopic repairs were received in 5593 patients; follow-up was successfully completed in 5370 (96.0%). There were 4816 boys and 554 girls, with a boy-to-girl ratio of 8.7:1 (Table 1). By laparoscopic exploration, the morphology of patent processus vaginalis (PPV) can be divided into two forms: cavernous type and fissure type. The former was clear cave-like open, and the latter could be clearly revealed by pulling a layer of peritoneum with a grasping pliers (Fig. 1). In total of 5370 patients who were diagnosed with UIH, the morphology of ipsilateral PPV was cavernous type in 5318 (99%) cases and fissure typology of ipsilateral PPV in 52 (1%) cases. CPPV was identified in 2233 cases (41.5%), including 1503 cases with cavernous type and 730 cases with fissure type. In children younger than 3 years old, CPPV was identified in 1698 children of 3455 children, including 1276 cases with cavernous type and 422 cases with fissure type (Table 2). In children older than 3 years old, CPPV was identified in 535 children of 1915 children, including 227 cases with cavernous type and 308 cases with fissure type (Table 2). In children younger than 3 years old, the probabilities of occurrence of cavernous type and CPPV were greater than those of children older than 3 years old and the differences were statistically significant. In total, 1256 (35.01%) cases with CPPV were found in 3587 children with the right inguinal hernia, compared with 977 (54.80%) cases with CPPV identified in 1783 children with left inguinal hernia ($P < 0.001$).

Assuming that the two groups are similar in population epidemiology, and that the rate of CPPV was 41.58%; 1223 CPPVs would appear in the population of children with open hernia repair. In fact, 185 MCIHs were reported in the open group.

All patients were followed up for 3 years.

Table 2 The morphology of patent processus vaginalis

	Laparoscopic ($n = 5370$)		
	Cavernous type	Fissure type	Normal
< 3 Y	1276	422	1757
> 3 Y	227	308	1380
P	< 0.001	< 0.001	< 0.001

Y year

Discussion

MCIH occurs in 5.8–11.6% of children after open unilateral hernia repair [5, 6]. In this study, the incidence of MCIH of children with UIH was 6.29% after the initial repair, which is similar to the previous reports [7]. Children with UIH are at risk of developing a MCIH after the initial open repair. It is considered that children with a CPPV are easier to progress into a MCIH. To avoid a second anesthesia and surgery, if CPPV is identified, simultaneous contralateral repair is performed [8–10]. However, some studies have reported that CPPV is a poor indicator of MCIH. It is still controversial about the management of CPPV in patients with unilateral hernia [4, 11].

Laparoscopic inspection is a safe and effective instrument for the diagnosis and treatment of CPPV [11]. However, the relationship between the existence of a CPPV and the subsequent development of a MCIH remains unaware. Operation had potential risks, including injury of the vas deferens, testicular atrophy, and spermatic vessel. So controversy as to whether the CPPV should be closed still exists. It was reported that CPPV occurs in 80–94% of newborn infants, but 60% would disappear after age of 2 [12]. Autopsy data suggested that 15–30% of adults with a PPV do not have a hernia [13]. In addition, the CPPV can exist for a long time without any lesion. Interestingly, five patients with a

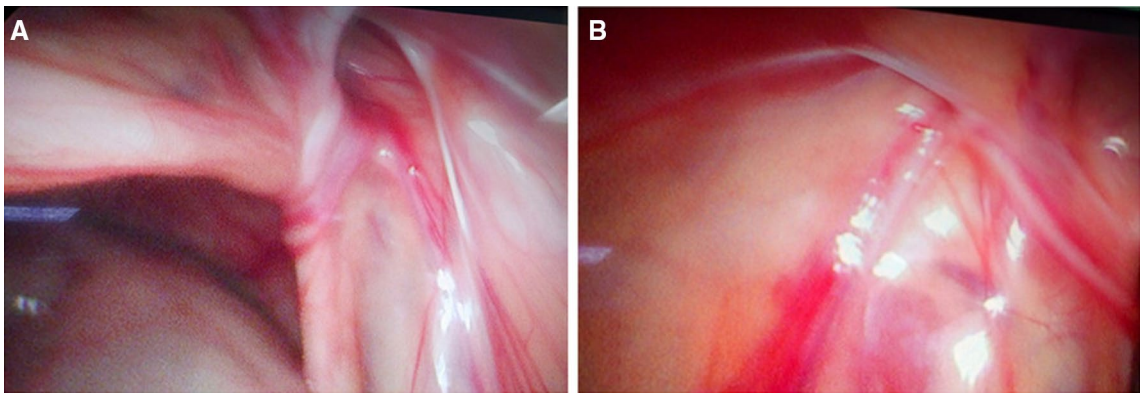

Fig. 1 The morphology of patent processus vaginalis (PPV). **A** cavernous type (clear cave-like open). **B** fissure type (The unclosed PPV, when pull a layer of peritoneum with a grasping pliers, can be clearly revealed.)

negative diagnostic test for CPPV were still developed a MCIH in our study. It is unclear if this is related to pneumoperitoneum pressure, the laparoscopic angle, inaccurate assessment for CPPV, or patients having a closed ring but subsequently developing hernia [1, 14].

It is reported that age is one of the risk factors of the incidence of MCIH and the risk of MCIH gradually decreased as the age increased [9]. In this study, the incidence of MCIH in children younger than 3 years old was higher (7.07%), compared with those of older than 3 years old (3.94%), which is consistent with the previous reports [2, 4].

The morphology of patent processus vaginalis defined by laparoscopy can be divided into two forms: cavernous type and fissure type. Cavernous type occured in 99% children with ipsilateral patent processus vaginalis. Moreover, in this present study, we found the probability of occurrence of cavernous type (75.1%) and CPPV (49.1%) in children younger than 3 years old was greater than those of children older than 3 years (cavernous type: 42.4%, CPPV: 27.9%).

It was reported that the risk of MCIH is around 3–4% higher in children with an initial left-sided inguinal hernia than children with an initial right-side inguinal hernia [1, 11, 15]. However, the incidence of MCIH in children with an initial left-sided inguinal hernia was 10.9%, compared with 3.3% in children with an initial right-sided inguinal hernia in this study.

In the present study, we found repairs need to be conducted in 15 CPPVs to prevent one MIH, and a majority of CPPV would not develop into clinical MCH.

Some limitations exit in our study. This is a retrospective study that may be influenced by the available data. Furthermore, the number of lost to follow-up may have influenced the accuracy of incidence of MCIH and CPPV. Recent studies reported that 63.6% of MCIH developed within 2 years after their initial hernia repair and 76.4% of MCIH develop within 3 years [9]. All patients were only followed up for 3 years in this study.

Conclusion

The true incidence of contralateral inguinal hernia is low. The simultaneous repair of all CPPV may lead to overtreatment. Moreover, if patient with initial left-sided inguinal hernia is younger than 3 years old and the morphology of CPPV is cavernous type defined by laparoscopic exploration, we suggest that the CPPV should be repaired simultaneously.

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Compliance with ethical standards

Disclosures Yanan Li, Yang Wu, Chuan Wang, Qi Wang, Yiyang Zhao, Yi Ji, and Bo Xiang have no conflicts of interest or financial ties to disclose.

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