Synchronous contralateral asymptomatic inguinal hernia in children presented with unilateral inguinal hernia: a comparison between preoperative ultrasound and operative findings

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Background
Is to evaluate the sensitivity and specificity of pre-operative inguinal ultrasonography in detection of CPPV after comparing its results with that found during surgical exploration, and to assess if this policy will be helpful in decreasing the incidence of metachronous inguinal hernia development.

Patients and methods
A prospective study of children presented clinically with unilateral inguinal hernia, Pre-operative US was performed to all of them to assess the contralateral groin; if the contralateral groin proved to have patent processus vaginalis (PPV) by US, bilateral groin exploration was done. Surgical findings were reported in two categories: Normal groin (no contralateral sac found) or Positive finding (if contralateral hernia sac found), the surgical finding was compared to the US finding. If the contralateral groin has no PPV by US those patients were strictly followed up for at least 18 months to detect the possible development of metachronous inguinal hernia. False positive and false negative cases were recorded and compared to true positive and negative cases and statistically analyzed, US sensitivity and specificity were calculated.

Results
137 children diagnosed clinically with unilateral inguinal hernia were included in this study, Ultrasonography detected the presence of contralateral patent processus vaginalis (CPPV) in 52 patients (38%), while 85 patients have no CPPV (62%), After surgical exploration of the clinically negative 52 groin, hernia sac were found in 50 of them (96.2%) , false positive US finding was about 3.8%.The incidence of CPPV was much more common in patients diagnosed with left sided unilateral hernia (54.5%), No contralateral groin exploration was performed in 85 patients, those patients were strictly followed up for the development of metacronous inguinal hernia(MCIH) , only one of them developed MCIH 6 months post-operatively, the incidence of developing a MCIH after negative US finding was 1.17 %.The US proved to have 98% sensitivity and 97.7% specificity in diagnosing the CPPV after comparing its results with that found during surgical exploration.

Conclusion
pre-operative inguinal US detect the presence of CPPV correctly in almost all cases, contralateral surgical exploration of those patient significantly decreased the incidence of MCIH in our follow up period.

Keywords:
asymptomatic, hernia, inguinal, MCIH, synchronous

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Introduction

Inguinal hernia repair is one of the most common procedures in pediatric surgical practice with an incidence of 1–4% [1]. In 75–90%, the hernia is unilateral at the time of presentation, but after surgical repair some children develop a hernia on the opposite side, which is a metachronous contralateral inguinal hernia (MCIH) [2]. Incidence of MCIH as determined in several reviews is 7–10%, with higher incidence if the initial presenting side was on the left, and among younger children [3–6].

A MCIH is typically related to a contralateral patent processus vaginalis (CPPV); incidence of CPPV is reported to be 20–50%; all MCIH precede by patent processus vaginalis (PPV) but not all PPVs become hernias; the relationship is not fully understood [1].

Management of the clinically free side in patients presented by unilateral inguinal hernia has been debated for many decades. Exploration of the silent contralateral side surgically was practiced previously by many pediatric surgeons due to the high reported

incidence of CPPV; those surgeons suggest that the repair of CPPVs would prevent the probable development of MCIHs [3,4].

Many surgeons practice selective contralateral exploration, but there is no general agreement on the selection criteria. Surgeons use age, sex, and side of the initial presenting hernia in varying combinations to decide on contralateral exploration [2,7].

Surgeons who are averse believe that the incidence of clinically significant MCIH does not support routine contralateral exploration. In their view, routine exploration would subject children to a procedure that would only benefit a small minority with increases in morbidity such as risks of testicular injury [8].

Laparoscopic techniques have been used at the time of unilateral hernia repair to evaluate the contralateral inguinal ring in an attempt to identify the presence of CPPV. Preoperative ultrasound has also been utilized to this end. When a CPPV is identified, simultaneous repair can be performed, preventing later contralateral hernia development and obviating the need for subsequent inguinal surgery. However, the use of these techniques may lead to both false positive and false negative findings, and the balance of risks and benefits of such strategies are uncertain [9].

Aim

The aim was to evaluate the accuracy of preoperative inguinal ultrasonography in the detection of CPPV after comparing its positive results with that found during surgical exploration, and to assess if this policy will be helpful in decreasing the incidence of metachronous inguinal hernia development during the follow-up period, also to evaluate if age, gender, and site of initial presentation are risk factors of CPPV.

Patients and methods

Between October 2013 and April 2016, 137 children diagnosed clinically with unilateral inguinal hernia were included in the study. According to the age we classified the patients into three groups (first group: 0–3 months, second above 3 months to 1 year, third above 1–10 years).

Clinical assessment

Parents were carefully asked about any history of a bulge in the groin; clinical examination was carefully performed to ensure a contralateral free side.

Ultrasonography

Preoperative US was performed on all patients to confirm the presence of hernia sac in the clinically diagnosed side and to assess the contralateral groin; clinically suspected side was not mentioned in the referral. All US examinations were performed by the same senior radiologist who has about 10 years of experience.

US technique

US examinations were carried out with one of the two machines Toshiba Xario XG (USA, California) utilizing linear transducer 9.2-4 MHz or logic S7 expert utilizing 12–3 MHz transducer.

All examinations were carried out without sedation and with straining conditions such as crying and coughing; the examination started from the scrotum in boys and the inguinal canal in girls and continued proximally toward the peritoneal cavity in both groins.

US report included the following:

(1) Presence of bowel loops, omentum, ovaries, fallopian tubes, or fluid in the inguinal canal.
(2) If the bowel loops or other contents extended to the scrotum.
(3) Width of the inguinal canal at the internal ring (4 mm or more considered widened internal ring).
(4) Testicular size and site.
(5) Any other pathology such as vaginal hydrocele, encysted hydrocele of the cord, or undescended testis.

PPV was seen as fluid in the inguinal canal that communicated freely with the peritoneal cavity through a wide internal ring. If the contralateral groin proved to have PPV by US, the possibility of MCIH was discussed with the parents. Bilateral groin exploration was done after parent approval and informed consent.

Surgery

All patients underwent open hernia repair by making a small inguinal crease incision, careful dissection of the inguinal canal content, and conventional high ligation of the sac in the case of sac presence. This was done under general anesthesia.

All operations were carried out by the authors of the paper; all of them have an MD degree in general surgery and at least 10 years experience of surgery practice.

We reported our surgical findings in two categories:

(1) Normal groin (no hernia sac found).
(2) Positive finding (if the hernia sac was found).

The surgical findings were compared with the US findings and then statistically analyzed. If the contralateral groin has no PPV by US, the patients were followed up for at least 18 months. False positive and false negative cases were recorded and compared with true positive and negative cases and statistically analyzed. False positive means: a positive US finding of PPV and negative surgical finding. False negative means: a negative US finding of PPV on the clinically diagnosed side. Or negative finding of PPV in the contralateral side with development of an MCIH in the follow-up period.

US sensitivity and specificity were recorded.

Follow-up: the parents were given instructions on how to monitor complications:

(1) The follow-up was done by careful clinical history taking and examination of the nonexplored side at rest and with straining, also in supine position and standing if possible to detect any MCIH development.
(2) Testicular site and size were clinically assessed.
(3) The follow-up was done after 3 days, 1 week, 1 month, and then every 6 months after surgery for 18 months.

Closer follow-up was needed in some cases presented by postoperative scrotal and inguinal swelling.

Exclusion criteria

(1) Patients with clinically bilateral inguinal hernias.
(2) Patient presented by recurrent inguinal hernia.
(3) Patients with clinically unilateral hernia but with past history of surgical exploration of the contralateral groin.
(4) Clinically incarcerated unilateral inguinal hernia.
(5) Vaginal hydrocele, noncommunicating hydrocele, or encysted hydrocele.
(6) Concomitant undescended testis.
(7) Patients refused to explore the contralateral groin after positive US finding.
(8) Patient not fulfilling the follow-up criteria.

The study was approved by our local ethics committee.

Data collection

All data were collected and presented anonymously and no personal data were disclosed.

Results

In all, 137 children diagnosed clinically with unilateral inguinal hernia were included in this study, 131 (95.62%) men, six (4.38%) women. Their age ranged from 12 days to 10 years with a median of 5 months. According to the age the patients were classified into three groups such as the first group: 0–3 months, the second group from above 3 months to 1 year, third group from above 1–10 years.

Ninety-three (67.88%) of them presented with right-sided hernia and 44 (32.11%) with left-sided hernia.

Ultrasonography proved the presence of hernia in the clinically diagnosed side in all the patients (100%). CPPV was found in 52 (38%) patients, while 85 (62%) patients had no CPPV.

After surgical exploration of the clinically negative 52 groin hernias, hernia sac was found in 50 of them (96.2%), false positive US finding was about 3.8%.

The relation between each age group and the incidence of CPPV are shown in Table 1.

The incidence of CPPV was much more common in patients diagnosed with left-sided unilateral hernia (54.5%), while patients diagnosed clinically with unilateral rightsided hernia and proved to have CPPV were 28% only.

The relation between CPPV and the clinically presented side are shown in Table 2.

Incidence of true CPPV in women was 33.3% (two cases), while in men 36.64% (48 cases). The relation between sex and incidence of CPPV is shown in Table 3.

Follow-up

No contralateral groin exploration was performed in 85 patients. Those patients were strictly followed up for the development of MCIH, only one of them

Table 1 The relation between each age group and the incidence of CPPV

Age group	Number of total cases	Positive CPPV (US) (*n*=52) [*n* (%)]	True positive CPPV (surgically) (*n*=50) [*n* (%)]
First group: 0–3 months	64	38 (59.37)	36 (56.25)
Second group: above 3–12 months	20	6 (30)	6 (30)
Third group: above 12–120 months	53	8 (15.1)	8 (15.1)
Total	137	52	50

CPPV, contralateral patent processus vaginalis; US, ultrasound.

Table 2 The relation between CPPV and the clinically presented side

	Total no.	Positive CPPV (US) [*n* (%)]	True positive CPPV (surgically) [*n* (%)]	True negative CPPV [*n* (%)]
Clinically right side	93	28 (30.1)	26 (28)	67 (72)
Clinically left side	44	24 (54.5)	24 (54.5)	20 (45.5)
Total	137	52	50	87 (63.5)

CPPV, contralateral patent processus vaginalis; US, ultrasound.

Table 3 The relation between gender and incidence of CPPV

	Total number of cases [*n* (%)]	Number of true CPPV [*n* (%)]
Female	6 (4.37)	2 (33.33)
Male	131 (95.62)	48 (36.64)
Total	137	50 (36.5)

CPPV, contralateral patent processus vaginalis

Table 4 The incidence of developing a MCIH after negative US finding

Positive US CPPV	False positive (i.e. no sac found on surgical exploration) [*n* (%)]	Negative US CPPV	False negative (i.e. development of MCIH) [*n* (%)]
52	2 (3.84)	85	1 (1.17)

CPPV, contralateral patent processus vaginalis; MCIH, metachronous contralateral inguinal hernia; US, ultrasound.

Table 5 Postoperative complications

Total cases	Number of cases presented by hematoma postoperative (incidence) [*n* (%)]
137 groins (clinical side)	21 (15.3)
52 groins (contralateral side)	2 (3.84)

developed MCIH after 6 months of the initial operation. This patient presented primarily with a right-sided hernia at the age of 2 months. The incidence of developing an MCIH after negative US finding was 1.17% (Table 4).

The US proved to have 98% sensitivity and 97.7% specificity in diagnosing the CPPV after comparing its results with that found during surgical exploration.

The patients were assessed during the follow-up period for iatrogenic undescended testis, testicular atrophy, or other complications.

Twenty-three cases presented with postoperative tense scrotum hematoma or edema within the first week postoperatively.

Twenty-one of them were on the clinically presented side, and two cases on the contralateral side. All of them resolved spontaneously within 6 weeks (Table 5).

No testicular atrophy, iatrogenic undescended testis, surgical site infection, or recurrence occurred during the follow-up period.

Discussion

Inguinal hernia occurs in 1–4% of children and is unilateral in 75–90%. Those patients are at risk of developing MCIH. CPPV is a precursor for the development of MCIH; if simultaneous contralateral repair is performed, the risk for subsequent surgery is eliminated. Some studies have reported a low overall risk of MCIH 7–10%, which make the value of routine contralateral open repair debatable [1–5].

The use of ultrasonography as a diagnostic tool has made it possible to examine the contralateral inguinal canal, and possibly identify CPPV. This appeared to be a good solution; however, not all CPPVs will change to a frank hernia. The risk of developing MCIH in the presence of CPPV has been determined in many studies, but few have addressed whether simultaneous contralateral repair may be unnecessary [10–14].

Inguinal ultrasonography is a safe noninvasive method for the evaluation of the contralateral groin and so to detect the presence of a CPPV. Few studies have investigated the accuracy of inguinal ultrasonography in the detection of CPPV [14–16]. Hata *et al.* [11] reported that CPPV was detected correctly using US in 94.9%. In our study the US proved to have 98% sensitivity and 97.7% specificity in diagnosing the CPPV after comparing its results with that found during surgical exploration.

The incidence of CPPV in patients presented clinically by unilateral inguinal hernia in the present study was 38%; this is in agreement with other reports by Mollen and Kane [1]. Another study by Hata *et al.* [11] reported an incidence of CPPV using ultrasonography to be 21.3%. He stated that this incidence is almost half of the reported incidence by other studies [11].

The incidence of MCIH after negative finding of CPPV by ultrasonography in this study was 1.17%. The low rate of MCIH could be due to the short follow-up but approximately 85% of children develop MCIH within 12 months of their initial surgery, and more than 90% within 5 years [8–10]. Follow-up in the present study ranged from 18 to 30 months.

In our study CPPVs were significantly more common in children with an initial left-sided inguinal hernia, (54.5%), while patients diagnosed clinically with unilateral right-sided hernia and proved to have CPPV were 28% only, so we concluded that the site of initial presentation could be a risk factor for the development of MCIHS. This is consistent with the results of other studies [2,7].

Also CPPVs were more commonly found in children below 3 months of age in this study (59.37%). This incidence decreased significantly in patients above 1 year (15.1%). Age of presentation may be considered a risk factor for the development of MCIHs, this is in agreement with other published reports [2,7]. Hata *et al.* [11] reported that the incidence of CPPV in children less than 2 years is higher than that in older children, and this result may suggest that a CPPV has the potential to be obliterated in younger children spontaneously.

Kervancioglu *et al.* [12] could not find a significant difference between hernia diameters and the age of the patients, sex, and site of initial presentation.

In conclusion, preoperative inguinal US detected the presence of CPPV correctly in almost all cases. Contralateral surgical exploration of those patients with positive US finding of patent processus vaginalis significantly decreased the incidence of MCIH in our follow-up period. Positive US finding of PPV in combination with the age of the patient and the initially presenting side may be considered as a risk factor for the development of MCIH.

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Conflicts of interest
There are no conflicts of interest.

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