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Incidence of metachronous contralateral inguinal hernias in children following unilateral repair — A meta-analysis of prospective studies☆

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ABSTRACT

Purpose: The objective of this review was to systematically evaluate the incidence of a metachronous contralateral inguinal hernia (MCIH) in children with unilateral inguinal hernia and therefore to propose or to reject routine contralateral groin exploration.
Methods: Electronic searches restricted to prospective studies with a minimal follow-up of 1 year included MEDLINE, EMBASE and the Cochrane Central Register of Controlled Trials.
Results: Six studies involving 1669 children were included. Overall MCIH was 6% (95% CI from 4% to 8%). The odds for MCIH development were significantly larger in children with an initial left-sided hernia (OR 2.66 with 95% CI from 1.56 to 4.53) and in children with open contralateral processus vaginalis (CPV) (OR 4.17 with 95% CI from 1.25 to 13.9).
Conclusions: The overall incidence of MCIH following unilateral inguinal hernia repair in children is 6%. Initial left-sided hernia (8.5%) and open CPV (13.8%) are risk factors for MCIH development. Female gender (8.2%) and younger age (<1 year) (6.9%) non-significantly increase the risk of MCIH.

Inguinal hernia repair is one of the most commonly performed operations in pediatric surgery [1]. Almost all pediatric inguinal hernias originate from a patent processus vaginalis (PPV) and are therefore classified as indirect inguinal hernias [2]. Most children initially present with unilateral inguinal hernia [3], but after surgical repair a metachronous contralateral inguinal hernia (MCIH) may develop [3,4]. The risk for MCIH seems to be higher in younger children and after initial left-sided hernia [4–6]. This prompts many surgeons to perform a prophylactic surgical exploration of the contralateral side for many years, especially in neonates [7]. The chance of having a contralateral PPV (CPPV) is about 30% and depends on the age of the patient [2,8,9]. However, despite the relatively high prevalence of CPPV in cases of unilateral childhood inguinal hernia, the absolute incidence of MCIH in non-operated children remained low, indicating that the concomitant risk of a surgical management of the contralateral side [3] would have been unnecessary in most cases [4,5].

To the authors' knowledge there are few meta-analyses published reviewing the incidence of MCIH [4–6,9–12], with overall MCIH incidences being 5.8% [6], 7.0% [12], 7.0% [5], 7.2% [4], 7.4% [9], 10.1% [10] and 15.8% [11]. The systematic review by Tuduri and co-workers [12] is written in Spanish and therefore only the abstract and the reference list were legible for the present authors. The other named reviews [4–6,9–11] differ in search strategies, and are not restricted to a minimal follow-up time. All these meta-analyses include a preponderance of retrospective studies. The incidence of MCIH as presented by these meta-analyses may hence be falsely low.

The aim of the present meta-analysis study is to systematically appraise the incidence of metachronous contralateral childhood inguinal hernia following unilateral inguinal hernia repair using data from well-designed prospective studies.

1. Materials and methods

1.1. Literature search

The Cochrane Central Register of Controlled Trials (The Cochrane library Issue 7 of 12, July 2014), MEDLINE (January 1966 to August 2014) and EMBASE (1947 to August 2014) were searched (Appendix 1 for detailed search strategy). The search was restricted to English and German articles. Study authors were contacted for additional information.

Furthermore, the reference lists from all known systematic reviews assessing the incidence of MCIH [4–6,9–12] were reviewed.

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1.2. In- and exclusion criteria

Inclusion criteria consisted of prospective observational studies (a), with minimal follow-up time of one year (b), assessing newborns, infants, children, adolescents and young adults, aged from 0 to 19 years (c), without contralateral groin exploration or laparoscopic closure of CPPV (d).

Exclusion criteria were retrospective studies, studies with short follow-up, studies without available full text, and studies written in languages other than English or German.

1.3. Outcomes

The primary outcome was the overall incidence of MCIH in children with unilateral inguinal hernia (i). Secondary outcomes consisted of incidence of MCIH in male versus female children (ii); in children younger than 1 year of age versus older children (iii); in children with primarily right- versus primarily left-sided inguinal hernia (iv); and in children with open versus cleft versus closed CPPV (v).

1.4. Data extraction

Data from selected studies were extracted by two authors (RNV and KW). Extracted data were managed using a preformed Excel data sheet.

1.5. Graphical and statistical analysis

We used common descriptive and inferential meta-analysis methods to compare incidence rates and odds ratios of MCIH events across different studies and subgroups. We investigated the association between study size and study results in funnel plots, by plotting Logit Transformed Proportion on the horizontal axis against the standard error of the study on the vertical axis [13]. In case of an existing publication bias we would expect an asymmetric pattern in the funnel plot.

The effect estimates along with the confidence intervals (CIs) of all studies are plotted in a forest plot. We examined heterogeneity between studies with standard chi-square tests and calculated the I-square statistics, which measure the proportion of variation in treatment effect estimates due to between-study heterogeneity [14]. Depending on the result of the heterogeneity test, fixed or random effect models were used to combine the results from the different studies [15]. If homogeneity can be assumed each study gets a weight given by the reciprocal of the squared standard error. If heterogeneity needs to be taken into account, the weights are adapted accordingly and are given by the reciprocal of the sum of the squared standard error and the estimated heterogeneity variance.

2. Results

2.1. Results of the search

The initial MEDLINE search yielded 2747 references. Search of CENTRAL and EMBASE database returned 304 and 3443 references respectively, none in addition to prior search. Searching the reference lists from 7 other known meta-analyses [4,6,9–12] yielded no additional studies that met inclusion criteria. Thirteen prospective studies were not included because of short or undefined follow-up [16–24], bilateral explorations in a subgroup of patients [25,26], and incorrect calculation of MCIH [27] (Appendix 2. Table A1 and Appendix 3. Figure A1).

Six studies met the inclusion criteria [7,28–32]. One study was restricted to male children aged 0.5 to 2 years [28]. In total 1669 children were included. Of this number 1405 (84%) were male and 264 (16%) were female. Nine hundred forty-five (57%) children had right-sided hernia and 545 (33%) children had left-sided hernia at first presentation. Laterality at initial presentation was not given in 179 (11%) patients (Table 1).

2.2. Overall incidence of MCIH

A forest plot was used to summarize and visualize the results of the meta analysis (Fig. 1). Since the test for heterogeneity was significant (p-value < 0.001), results from the random effect model were used. Overall MCIH was 6%. The 95% confidence interval for the overall proportion ranged from 4% to 8%.

Table 1
Characteristics of included studies.

Study	Tepas 1986 [28]	Nassiri 2002 [29]	Maddox 2008 [7]	Kalantari 2009 [30]	Koivusalo 2009 [31]	Hoshino 2014 [32]
All patients with MCIH	2/179 (1.11%)	19/521 (3.65%)	15/222 (6.76%)	28/301 (9.30%)	6/89 (6.74%)	23/357 (6.44%)
Male	2/179 (1.11%)	16/466 (3.43%)	13/211 (6.16%)	n.a./270	3/66 (4.55%)	12/213 (5.63%)
Female	0/0	3/55 (5.45%)	2/11 (18.18%)	n.a./31	3/23 (13.04%)	11/144 (7.64%)
Right-sided	n.a.	7/344 (2.0%)	8/142 (5.63%)	na/213	2/54 (3.70%)	7/192 (3.65%)
Left-sided	n.a.	12/177 (6.78%)	7/80 (8.75%)	n.a./88	4/35 (11.43%)	16/165 (9.70%)
Prematurity	n.a.	n.a.	n.a.	6/30 (20%)	0/0	n.a.
<0.5 year	0/0	n.a.	n.a.	n.a./123	0/0	6/56 (10.71%)
<1 year	n.a.	5/127 (3.94%)	n.a.	n.a.	0/1 (0%)	9/76 (11.84%)
<2 years	2/179 (1.11%)	n.a.	n.a.	23/196 (11.73%)	0/13 (0%)	n.a.
>0.5 year	2/179 (1.11%)	n.a.	n.a.	n.a./178	6/89 (6.74%)	17/301 (5.65%)
>1 year	n.a.	14/394 (3.55%)	n.a.	n.a.	6/88 (6.82%)	14/281 (4.98%)
>2 years	0/0	n.a.	n.a.	5/105 (4.76%)	6/76 (7.89%)	n.a.
Closed CPV	n.a.	n.a.	4/97 (4.12%)	n.a.	0/35 (0%)	n.a.
Open CPV	n.a.	n.a.	6/53 (11.32%)	n.a.	3/12 (25%)	n.a.
Cleft CPV	n.a.	n.a.	3/35 (8.57%)	n.a.	n.a.	n.a.
Positive family history	n.a.	n.a.	5/21 (23.81%)	n.a.	n.a.	n.a.
Increased IAP	n.a.	n.a.	4/48 (8.33%)	n.a.	n.a.	n.a.
Follow-up ≥2 years	n.a.	19/521 (3.65%)	15/222 (6.76%)	n.a.	6/89 (6.74%)	23/357 (6.44%)
Minimal follow-up	1.5 years	4 years	30.1 months	12 months	2 years	3 years
Follow-up modality	Not given	"Annual evaluation" not further specified	Visit and phone call	Visit and phone call	Visit and phone call	Visit, phone call, letter, or e-mail
Age range	0.5–2 years	1 month–12 years	1 day–19 years	1 month–12 years	8 months–15 years	28 days–13 years
Exclusion criteria	Female patients	Suspected high intra-abdominal pressure	No	Severe ascites, collagen disease	Male patients without completely descended testes	No
Dropouts	Not given	56/577 (10%)	64/286 (22%)	Not given	Not given	15/372 (4%)

CPV, contralateral processus vaginalis; IAP, intra-abdominal pressure.