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Variation in the use of laparoscopy with inguinal hernia repairs in a sample of pediatric patients at children's hospitals

K.W. Herbst [a], H. Thaker [b], G.M. Lockwood [c,d], J.I. Hagadorn [e,f], S. Masoud [g], P. Kokorowski [h]

[a]Division of Urology and Nephrology, Department of Research, Connecticut Children's Medical Center, Hartford, CT, USA

[b]Institute of Urology, Keck School of Medicine, University of Southern California, Los Angeles, CA, USA

[c]Division of Urology, Connecticut Children's Medical Center, Hartford, CT, USA

[d]Department of Surgery, University of Connecticut School of Medicine, Farmington, CT, USA

[e]Division of Neonatology, Connecticut Children's Medical Center, Hartford, CT, USA

[f]Department of Pediatrics, University of Connecticut School of Medicine, Farmington, CT, USA

[g]Duke University School of Medicine, Durham, NC, USA

[h]Division of Urology, Children's Hospital Los Angeles, Los Angeles, CA, USA

Correspondence to: K. W. Herbst, 282 Washington Street, Hartford, CT, 06106, USA. Tel.: +1 860 837-5203; fax: +1 860 837 6370

kherbst@connecticutchildrens.org (K.W. Herbst)

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Summary

Introduction/background
Metachronous contralateral inguinal hernias (MCH) occur in approximately 10% of pediatric patients following unilateral inguinal hernia repairs (UIHR). Laparoscopic evaluation of the contralateral internal ring is a method of identifying high-risk individuals for prophylactic contralateral exploration and repair.

Objective
The objective of this study was to assess variation in utilization of diagnostic laparoscopy, and report costs associated with the evaluation of a contralateral patent processus vaginalis during hernia repair in pediatric hospitals.

Study design
The Pediatric Health Information System database was searched to identify outpatient surgical encounters for pediatric patients with a diagnosis of inguinal hernia during a 1-year period (2014). Records were identified that contained diagnostic codes for unilateral or bilateral inguinal hernia in combination with a procedure code for open hernia repair with or without diagnostic laparoscopy.

Results
After exclusions there were 3952 hernia repairs performed at 30 hospitals; median age was 4 years (IQR 1–7), 78.8% were male, and 64.9% Caucasian. Three-quarters (76.7%) had UIHR, 8.6% had unilateral repairs with laparoscopy (UIHRL), 12.2% had bilateral inguinal hernia repairs (BIHR), and 2.4% had bilateral repairs with laparoscopy (BIHRL). Where laparoscopy was used, 78% resulted in a unilateral repair and 22% in a bilateral procedure. The percent of patients undergoing laparoscopy varied from 0 to 57% among hospitals, and 0–100% among surgeons. Pediatric surgeons were more than three times more likely to perform a diagnostic laparoscopy compared with pediatric urologists. Median adjusted costs were $2298 (IQR 1659–2955) for UIHR, $2713 (IQR 1873–3409) for UIHRL, $2752 (IQR 2230–3411) for BIHR, and $2783 (IQR 2233–3453) for BIHRL. Median costs varied over two-fold among hospitals ($1310–4434), and over four-fold among surgeons ($948–5040).

Discussion
Data suggested that <10% of patients with clinically unilateral inguinal hernias developed MCH. A negative diagnostic laparoscopy ensured that 0.9–1.31% developed MCH. However, up to 30% of patients underwent contralateral exploration/repair when diagnostic laparoscopy was used. The current study found increased costs associated with the use of laparoscopy, with considerable variation in costs among surgeons and hospitals. These data elucidate competing financial and clinical consequences associated with the use of diagnostic laparoscopy with clinically unilateral hernias.

Conclusions
Variation existed in the use of laparoscopy during inguinal hernia repairs and associated costs within the current sample from children's hospitals in the United States. The additional costs of laparoscopic evaluation must be considered against the clinical utility and therapeutic consequences of identifying individuals with a higher risk of metachronous contralateral inguinal hernia.

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Summary Table Characteristics of population and proportion, and cost of hernia repairs with and without diagnostic laparoscopy.

Characteristic	Total (n = 3.952)	Hernia without laparoscopy (n = 3.515)	Hernia with diagnostic laparoscopy (n = 437)
Laterality:			
Unilateral	3375 (85.4)	3033 (86.3)	342 (78.3)
Bilateral	577 (14.6)	482 (13.7)	95 (21.7)
Age, years:			
Median (IQR)	4 (1–7)	4 (1–7)	2 (0–5)
<1	665 (16.8)	542 (15.4)	123 (28.1)
1–2	917 (23.2)	815 (23.2)	102 (23.3)
3–5	1034 (26.2)	925 (26.3)	109 (24.9)
6–11	869 (22.0)	784 (22.3)	85 (19.5)
12–18	467 (11.8)	449 (12.8)	18 (4.1)
Gender:			
Male	3115 (78.8)	2807 (79.9)	308 (70.5)
Female	837 (21.2)	708 (20.1)	129 (29.5)
Race/Ethnicity:			
Caucasian	2565 (64.9)	2264 (64.4)	301 (68.9)
Black	658 (16.6)	586 (16.7)	72 (16.5)
Other	587 (14.9)	543 (15.4)	44 (10.1)
Missing	142 (3.6)	122 (3.5)	20 (4.6)
Hispanic	592 (15.0)	544 (15.5)	48 (11.0)
Payer type:			
Public	1849 (46.8)	1658 (47.2)	191 (43.7)
Private	1934 (48.9)	1697 (48.3)	237 (54.2)
Self/other	169 (4.3)	160 (4.5)	9 (2.1)
Surgeon type:			
Pediatric surgeon	2766 (70.0)	2387 (67.9)	379 (86.7)
Pediatric urologist	1186 (30.0)	1128 (32.1)	58 (13.3)
Adjusted cost:	$2395 ($1735–3071)	$2363 ($1718–3024)	$2735 ($1990–3425)

Table given as median (IQR) or n (%).

Introduction

Clinically significant metachronous contralateral hernias (MCH) presenting after correction of unilateral inguinal hernias occur at an estimated rate of 7.3% (with a 95% posterior interval of 6.5–8.1%) [1,2]. Metachronous contralateral hernias in premature males occur at a slightly higher rate of 11%, placing this population at increased risk [3]. Because MCH typically reflects an underlying patent processus vaginalis (PPV), evaluation of the contralateral inguinal ring for a PPV is used as a predictor of MCH. Extensive discussions exist in the literature regarding the value of this evaluation, but few papers describe the extent of variation in practice patterns and costs.

Historically, reports from the 1950s by Rothenberg and Barnett advocated for contralateral exploration [4]. At that time, prevention of repeat anesthetic at a young age was a prudent consideration supporting the practice. A decade later, Rowe et al. [5] reported that 40% of PPV close within a few months of life, 20% by 2 years, leaving 40% open beyond this age. Others have reported that 67–91% of PPV will close spontaneously by the age of 9 months [6]. Of those patients who undergo diagnostic laparoscopy during a unilateral inguinal hernia repair (UIHR) up to 30% have a contralateral PPV [1,7]. Nonetheless, visualization of the contralateral PPV during UIHR repair offers surgeons the opportunity for simultaneous repair, obviating the risk of symptomatic MCH development. With advances in safety and the understanding that PPV may close spontaneously, management of contralateral PPV has shifted over time, and the practice of diagnostic laparoscopy in the setting of UIHR is no longer performed by many surgeons.

The aim of the current study was to assess variation in utilization of, and report costs associated with, the use of diagnostic laparoscopy for contralateral hernia evaluation during unilateral inguinal hernia repair in pediatric hospitals.

Methods

Data for this study were obtained from the Pediatric Health Information System (PHIS), an administrative database containing data from 49 not-for-profit, tertiary care pediatric hospitals in the United States. These hospitals are affiliated with the Children's Hospital Association (CHA). Data quality and reliability are assured through a joint effort between the CHA and participating hospitals, while the data warehouse function for the database is managed by Truven Health Analytics. Data are de-identified but linked at the time of submission, and are subjected to reliability and validity checks before inclusion in the database. Hospitals were omitted if they did not submit billing data for the entire duration of the study period. This study was approved by the Institutional Review Board at Connecticut Children's Medical Center.

The target population was children aged 1 month to 18 years who underwent an initial ambulatory inguinal hernia surgical procedure between January 1, 2014 and December 31, 2014. Records containing International Classification of Diseases, Ninth Revision (ICD-9) diagnosis codes for unilateral inguinal hernia (550.0, 550.90, 550.10) or bilateral

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