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Original Article

Delaying surgery for inguinal hernia in neonates: Is it worthwhile?

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المخلص

أهداف البحث: لدى الأطفال الخدج نسبة عالية من الفتق الإربي، في حين أن الإصلاح الجراحي هو عملية عالية الخطورة. لا يزال توقيت إصلاح الفتق مختلفاً عليه. نهدف في هذا البحث إلى تحديد التوقيت الأمثل لإصلاح الفتق الإربي حديثي الولادة في مستشفى عام.

طرق البحث: أُجريت دراسة أتراب مستقبلية من مارس ٢٠١٤ إلى سبتمبر ٢٠١٨. تم قبول ما مجموعه ١٢٧ من الأطفال حديثي الولادة والخدج في عيادة جراحة الأطفال ممن لديهم فتق إربي غير مصحوب بمضاعفات. تم إصلاح الفتق لدى جميع حديثي الولادة وتمت متابعتهم لمدة ثمانية أشهر بعد العملية لمعرفة المضاعفات المصاحبة للعملية. تم توقيت العملية بناء على قرار الجراح بالإضافة إلى موافقة العائلة على التدخل الجراحي.

النتائج: بلغ عدد من خضع لعملية إصلاح الفتق المبكرة ٥٣ من ١١٨ (٤٥٪) ومن خضع لعملية إصلاح الفتق المتأخرة ٦٥ من ١١٨ (٥٥٪). وكانت البيانات الديموغرافية متشابهة بين المجموعتين دون وجود اختلافات ذات أهمية. كما أنه لم يكن هناك اختلاف ذو دلالة إحصائية في احتباس الفتق وتكوين القيلة إلا أنه كان هناك ارتفاع في معدل معاودة الفتق الإربي، وتوقف التنفس بعد العملية الجراحية في مجموعة الإصلاح المبكر.

الاستنتاجات: الإصلاح الجراحي للفتق الإربي ممكن في الأطفال الخدج ويصاحبه مضاعفات بسيطة. لم تزد خطورة احتباس الفتق وضمور الخصية مع التأخر الاختياري لإصلاح الفتق لدى حديثي الولادة. وقد قل تأخر إصلاح الفتق من احتمالية حدوث المضاعفات المصاحبة للعملية التي تحدث بعدها. توصي هذه الدراسة بتأخير إصلاح الفتق الاختياري لحديثي الولادة والأطفال الخدج.

الكلمات المفتاحية: الفتق الإربي؛ حديثي الولادة؛ الخدج؛ توقيت الإصلاح؛ مضاعفات جراحة الفتق

Abstract

Objective: The incidence of inguinal hernia is high in premature infants; however, surgical repair is a high-risk procedure for these patients. The timing of hernia repair is still controversial. This study aimed to determine the optimal timing for inguinal herniotomy in neonates in a general hospital.

Methods: A prospective cohort study was conducted from March 2014 to September 2018. A total of 127 neonates and preterm infants were admitted to the paediatric surgery clinic with uncomplicated inguinal hernia. Herniotomy was performed in all neonates, and the patients were followed up for up to 8 months after surgery for perioperative and postoperative complications. The timing of surgery was based on the surgeon's decision along with the consent of the family to the surgical intervention.

Results: Of 118 neonates, as many as 53 (45%) underwent early repair and 65 (55%) underwent late repair of inguinal hernia. The demographic data were similar between the 2 groups with no significant difference. There were no significant differences in the incidence of inguinal hernia incarceration and hydrocele formation ($p = 0.11$ and $p = 0.8$, respectively); however, there was a higher incidence of inguinal hernia recurrence ($p = 0.05$) and postoperative apnoea ($p = 0.02$) in the early repair group.

Conclusion: Surgical repair of inguinal hernia is feasible with low morbidity in preterm babies. The risk of hernia incarceration and testicular atrophy did not increase with delayed elective hernia repair in neonates. Delayed hernia repair decreased the risk of perioperative and postoperative complications. This study recommends delaying elective hernia repair in neonates and preterm babies.

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Keywords: Hernia surgery complication; Inguinal hernia; Neonates; Preterm; Repair timing

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Introduction

Inguinal hernia in neonates is a real dilemma, especially in premature and low-weight babies. The major concern with delayed repair is the risk of hernia incarceration; however, early repair entails a high risk of anaesthesia-related and postoperative complications including apnoea, hernia recurrence, and vas injury. Regional anaesthesia with a caudal block for hernia repair has been investigated to avoid the potential complications of intubation and general anaesthesia in neonates.¹ However, awake surgery for hernia repair may not provide satisfactory results and the use of sedation will increase the risk of complications.

The timing of inguinal hernia repair is controversial. Delayed repair could be associated with hernia-related complications, whereas early repair has a high surgical risk and is technically challenging.² Inguinal hernia is very common in prematurely born children, with an incidence reaching up to 9%. It has been reported that >50% of affected children will undergo hernia repair in the first year of life.^{3–5} Delayed repair will lead to the occurrence of hernia incarceration in up to 30–40% of patients.⁶ In addition, the risk of testicular atrophy can reach up to 30% in patients whose hernia became incarcerated.⁷ Meanwhile, the requirement for postoperative respiratory sustenance after repair in the early ages was as high as 38% in many studies.⁸

There is a paucity of data about the effect of the timing of inguinal hernia repair on the outcomes.² The objective of this study was to determine if delayed hernia repair in neonates who presented to the clinic with a non-obstructed hernia would have better overall outcomes than early repair.

Materials and Methods

Research design and selection criteria

This prospective observational study was performed between March 2014 and September 2018. Neonates and former preterm babies (term newborn [40 weeks] up to 4 weeks of age and preterm newborns up to 40 ± 4 weeks of postconceptional age) of both sexes with a weight of <5 kg and who presented to paediatric surgery clinic (Jeddah, KSA) with an inguinal hernia were included in the study. Neonates who were lost to follow-up or managed at a different institution were excluded. Additionally, we excluded preterm babies with a body weight of <2 kg, those who were diagnosed with hernia while in the neonatal

intensive care unit (NICU), and those who required emergency surgery.

Data collection, surgery, and follow-up

We collected demographic and clinical data including birth weight, gestational age, and sex. Additionally, we collected operative details including the timing of surgery (early vs. late), interval between diagnosis and surgery, laterality of hernia (left-sided vs. right-sided vs. bilateral), and surgical complications (incarceration, surgical injury, postoperative infection, and apnoea). Early repair was defined as repair of inguinal hernia at the time of presentation to our clinic, and late repair was defined as interval repair at postconceptional age of 50 weeks or upon reaching a weight of 5 kg regardless of the postconceptional age.

A paediatric surgeon reviewed all neonates who visited the paediatric surgery clinic and had a herniotomy, and those who met the study criteria were enrolled. A total of 127 neonates and former preterm babies presented to the paediatric surgery clinic with an asymptomatic inguinal hernia. The babies were allocated to either the early or late surgery group depending on the surgeon's preference and with the consent of the family to the surgery. The timing of surgery was based on the discretion of the treating physicians unless emergency surgery was indicated for cases such as irreducible, incarcerated inguinal hernias with possible ischemia or gangrene. Herniotomy was performed in 53 neonates at the time of diagnosis (before 44 weeks, early surgery group), whereas surgery was done at the postconceptional age of 50 weeks or upon reaching a weight of 5 kg in 65 neonates (late surgery group).

All infants were followed from presentation to 8 months after surgery for perioperative and postoperative complications (incarceration, surgical injury, postoperative infection, apnoea). The diagnosis of inguinal hernia and its incarceration was made clinically and confirmed through surgical exploration. These nine infants lost their follow up.

Statistical methods

We presented continuous data as means and standard deviations and categorical data as numbers with percentages. The characteristics of the population were compared using the chi-square test for categorical variables and the paired-sample t-test or Mann–Whitney test for continuous variables. Significance was set at a p-value of <0.05. Statistical analysis was performed using IBM SPSS Statistics for Windows (version 22.0, released 2013; IBM Corp., Armonk, NY, USA).

Ethics of research

The institutional review board of the hospital approved the study (protocol no. 1022). The study protocol was reviewed and approved by the institutional ethics committee. Verbal consent was obtained from all parents of the neonates enrolled into the study.

Results

During the study period, 127 neonates presented to the paediatric surgery clinic with an inguinal hernia. Nine infants

Table 1: Comparison of the demographic data of infants between the early and late repair groups [* Statistically significant, $p < 0.05$. Continuous variables are presented as mean \pm standard deviation and categorical variables as number (percentage).]

	Early group (n = 52)	Late group (n = 63)	p-Value
Gestational age at birth (weeks)	30.32 \pm 5.2	31.45 \pm 4.11	0.19
Birth weight (kg)	1.96 \pm 0.82	2.01 \pm 0.79	0.7
Sex			0.5
	Female	10 (16%)	
	Male	53 (84%)	
Postmenstrual age at diagnosis (weeks)	35.15 \pm 4.13	36.72 \pm 5.24	0.17
Weight at surgery (kg)	3.05 \pm 0.83	5.16 \pm 0.51	<0.001*
Postmenstrual age at surgery (weeks)	41.33 \pm 3.12	51.63 \pm 4.27	<0.001*

Table 2: Comparison of complications and outcomes between the early and late repair groups [* Statistically significant, $p < 0.05$. Categorical variables are presented as number (percentage). PICU: paediatric intensive care unit.]

	Early group (n = 52)	Late group (n = 63)	p-Value
Irreducibility/incarceration	0 (0%)	2 (3.2%)	0.11
Postoperative apnoea	6 (11.5%)	1 (1.6%)	0.02*
Need postoperative PICU	4 (7.7%)	0 (0%)	0.02*
Hydrocele formation	1 (1.9%)	1 (1.6%)	0.8
Hernia recurrence	3 (5.8%)	0 (0%)	0.05
Testicular atrophy	4 (7.7%)	0 (0%)	0.02*
Total complication	18 (34.6%)	4 (6.3%)	0.0001*

were excluded from the study because the parents preferred to transfer to another institution. A total of 118 neonates underwent open herniotomy, of whom 45% (53/118) underwent early repair and 55% (65/118) underwent late repair of inguinal hernia. One baby from the early repair group and 2 babies from the late repair group were lost to follow-up. Therefore, the data of 45% (52/115) of the early group and 55% (63/115) of the late group were analysed.

Infants who underwent early repair were comparable to those who underwent late repair in terms of gestational age (30.32 \pm 5.2 vs. 31.45 \pm 4.11 weeks, $p = 0.19$), birth weight (1.96 \pm 0.82 vs. 2.01 \pm 0.79 kg, $p = 0.7$), and male-to-female ratio ($p = 0.5$). The 2 groups had comparable postmenstrual age (35.15 \pm 4.13 vs. 36.72 \pm 5.24 weeks, $p = 0.17$). However, the late group had higher weight (5.16 \pm 0.51 vs. 3.05 \pm 0.83 kg, $p < 0.001$) and postmenstrual age (41.33 \pm 3.12 vs. 51.63 \pm 4.27 weeks, $p < 0.001$) at the time of diagnosis (Table 1).

There were no significant differences in the incidence of inguinal hernia incarceration and hydrocele formation postoperatively ($p = 0.11$) between groups; however, there was a higher incidence of inguinal hernia recurrence ($p = 0.05$), postoperative apnoea, admission to the paediatric intensive care unit (PICU) ($p = 0.02$), and testicular atrophy ($p = 0.02$) in the early repair group (Table 2).

Discussion

Inguinal hernia repair in preterm and low-birth-weight infants is challenging, especially in hospitals with limited resources and limited availability of highly trained neonatal

anaesthesiologists. Hernia repair in this subset of patients carries a high risk, including increased technical difficulty and postoperative apnoea with the need for mechanical ventilation.¹⁹ Inguinal hernias are frequent in premature children, with an incidence of 13% in infants delivered before 32 weeks of gestation,¹⁰ and the frequency decreases with increasing age. The natural course of inguinal hernia is highly variable; however, surgical repair is essential to avoid complications such as hernia incarceration and testicular atrophy.

The optimal timing of hernia repair in preterm infants is debatable. A balance between the complications of hernia and the risk of intraoperative and postoperative respiratory and surgical complications must be considered. Few studies have evaluated the timing of repair, with variable conclusions. We prospectively investigated the effect of the timing of surgery on the outcomes after hernia repair in neonates. In our study, the preoperative characteristics of infants including birth weight, gestational age, and sex were comparable between the groups.

Delayed repair may increase the risk of incarceration; however, there are conflicting reports about the incidence of incarceration with an observation period from the diagnosis to the surgical repair of inguinal hernia. Several investigators reported that the risk of incarceration is doubled after an extended delay.¹¹ Conversely, other studies documented lower incidences of incarcerated hernia with delayed repair, including an article that did not report any case of incarcerated hernia among 35 neonates diagnosed with an inguinal hernia while in the NICU.⁸ We did not find any differences in outcomes related to inguinal hernia repair, including inguinal hernia incarceration and hydrocele formation postoperatively between the early and late repair groups. The present work revealed that the incidence of hernia incarceration was <5% in infants who underwent delayed hernia repair (no significant difference compared with the early repair group, $p = 0.11$).

Other concerns about early repair in neonates include the possibility of neurodegenerative disorders resulting from the administration of different sedatives and anaesthetics.^{12,13} Numerous animal and human paediatric studies have shown evidence of long-term adverse neurodevelopmental outcomes associated with the exposure to anaesthetic agents of the developing brain.¹⁴ Although the difference in the timing of surgery between the 2 groups involved only several weeks in this study, the delay may be crucial in

preventing possible anaesthesia-related neurodegenerative complications.

Postoperative apnoea in premature infants is inversely related to the use of general anaesthesia and the postconceptional age, and the incidence was reported to be <5% when the postconceptional age is > 60 weeks.¹⁵ Lee et al.⁸ proposed that former premature infants with postconceptional age between 41 and 46 weeks can safely undergo outpatient herniorrhaphy if there is no history of apnoea or chronic lung disease. In our study, significant postoperative apnoea that required PICU admission occurred in 6 babies (11.5%) in the early group, with a p-value of 0.02 compared with the late group. In our study, the incidence of hernia recurrence was 5.5% in the early group, whereas there was no recurrence in the late group.

In contrast, infants who underwent early repair had higher rates of hernia reoperation within 1 year in addition to the higher incidence of postoperative apnoea and higher technical difficulty. From the analysis of the cumulative data obtained from this study, the results suggest that delaying hernia repair may be an acceptable decision for particular infants whose families can accept the potential risk and benefits of surgical interference. Because of the risk of hernia incarceration in infants, it is important to consider the concerns of the patient's guardians and their access to proper surgical care when selecting infants for delayed repair.

Limitations of this study

As this study is a single-centre and single-surgeon experience, generalization of the results is an issue. The short follow-up period is another limitation. The minimum follow-up period was 8 months, which is acceptable for the evaluation of most complications but is not enough to detect the lifelong recurrence risk as well as the neurodevelopmental and cognitive sequelae. Another limitation is the relatively small sample size for a common surgical problem. Lastly, as the study is not a randomized trial, several unmeasured confounders may have affected the outcomes.

Conclusion

Inguinal hernia repair in infants is considered a common surgical operation in paediatric surgery. The optimal timing of uncomplicated inguinal hernia repair in neonates and former preterm infants is debatable. Premature babies have a high incidence of inguinal hernias and an increased risk of postoperative apnoea. The risk of hernia incarceration and testicular atrophy does not increase with the decision to delay elective hernia repair in neonates. Delayed repair decreases the risk of perioperative and postoperative complications.

Recommendations

The results of this study suggest delaying elective inguinal hernia repair in neonates until they reach 50 postconceptional weeks or a weight of 5 kg.

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Conflict of interest

The author declares that there is no conflict of interest.

Ethical approval

The study was approved by the ethical committee and was performed according to the tenets of the Declaration of Helsinki.

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