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Comparison between Laparoscopic and Open Repair of Congenital Diaphragmatic Hernia in Neonates: a Retrospective Analysis

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Abstract. Object: To explore the feasibility of laparoscopic repair of congenital diaphragmatic hernia in neonates. Methods: A retrospective analysis was conduct on 14 cases of newborns with congenital diaphragmatic hernia treated by laparoscopic diaphragmatic repair or laparotomy between September 1, 2011 to December 31, 2013. Duration of operation, amount of bleeding, and length of stay were compared between the two groups, which were divided by surgical methods. Results: No significant difference was observed in duration of operation and amount of bleeding *(P*>0.05*)* between the two groups. However, length of stay was significantly shorter in the patients by laparoscopic diaphragmatic repair than the patients by laparotomy (*P*<0.05). Conclusion: To compare laparoscopic and open repair of congenital diaphragmatic hernia in neonates, a retrospective analysis conducted by us showed the feasibility of laparoscopic repair of congenital diaphragmatic hernia in neonates, and a significant advantage in length of stay.

Introduction

Congenital diaphragmatic hernia (CDH) is a congenital developmental defect of the diaphragm that permits abdominal contents to herniate into the chest cavity. And herniation usually occurs during a critical time when lung development occurs, lung compression by the herniated bowel will lead to pulmonary hypoplasia and lung hypoplasia. Conventionally, neonates with CDH were treated by open diaphragmatic repair. To date, there were several reports on laparoscopic repair successfully applied to neonates with CDH [1,2,3]. However, it remained unclear on comparison of laparoscopic diaphragmatic repair to laparotomy. Since a prospective randomized trial was difficult to perform due to low incidence of CDH, and the complexity of management, we conducted a retrospective analysis comparing laparoscopic repair to laparotomy on neonates with CDH between September 1, 2011 to December 31, 2013.

Patients and Methods

Between September 1, 2011 to December 31, 2013, 14 infants were treated in our hospital, including 6 neonates treated by laparoscopic diaphragmatic repair and 8 newborns treated by laparotomy. Informed written consent was obtained from parents enrolled. They were diagnosed by ultrasound or chest X-ray, and all of them presented no other malformations. Plus, diaphragmatic hernia in all selected patients occurred in the left side. No significant differences in baseline clinical characteristics were observed between the two groups, which is shown in Table 1.

Table 1. Baseline characteristics of study patients

Characteristic	LS group	AS group	*P* value
gestation (week)	43.5	43.2	non-significant
Female	3	4	
Male	3	4	non-significant

*LS means laparoscopic surgery; AS means laparotomy surgery

All patients received preoperative routine preparation including correcting hypoxia, maintaining the acid-base balance, indwelling stomach tube etc. Laparotomy usually adopted the left upper quadrant subcostal transverse incision and sutured affected diaphragm. Laparoscopic repair adopted three 5mm incisions respectively located at median umbilical incision, left in the abdomen and right upper quadrant. All patients were not indwelt peritoneal drainage tube or thoracic tube postoperatively. Chest radiographs were checked routinely on the fist day after the operation, and followed up in the next six months. Duration of operation, amount of bleeding, and length of stay were compared between the two groups, which were divided by surgical methods.

Statistical Analysis

Continuous data were given as means ± SD. Differences between groups were determined by t test for parametric continuous data, χ^2 or Fisher's exact test for categorical data, and Wilcoxon rank sum test for nonparametric continuous data.

SPSS software (version 20.0) was used for all statistical analyses.

Results

All affected neonates underwent surgical diaphragmatic repair successfully. The mean operative time was 92 minutes in 8 infants by the open surgery compared with 115 minutes in 6 newborns by the laparoscopic diaphragmatic repair ($P > 0.05$). Intraoperative blood loss was 6 ml in 8 infants by the open surgery, while 5 ml in newborns by the laparoscopic diaphragmatic repair ($P > 0.05$). However, differences in the length of stay between the two groups were significant ($P < 0.05$), which is shown in Table 2. There were no significant differences between the two groups in recurrence rate of diaphragmatic hernia.

Table 2. Comparison of three groups

	LS group	AS group	Inflammatory cells
Mean operation time*	115	92	non-significant
Blood loss (ml)	5	6	non-significant
Hospital stay (day)		6.5	$P<0.05$

*minute

Discussion

Congenital diaphragmatic hernia (CDH) is a developmental defect of the diaphragm mostly occurring on the left. Right-sided diaphragmatic hernias occur in 11 percent of cases and bilateral herniation in 2 percent [4]. And neonates with CDH often develop accompanying abnormality. In one retrospective study of 2 patients with CDH admitted to a single tertiary center from 2002 to 2008, adrenal insufficiency (defined as a cortisol level ≤15 mcg/dL [415 nmol/L]) was demonstrated in two-thirds of the group who were assessed for adrenal function (n = 34 patients) [5]. In our study, the enrolled patients all developed left-sided diaphragmatic hernias without accompanying malformations.

Preoperative care was critical including placement of a feeding tube into the stomach which may facilitate the diagnosis if the chest radiograph demonstrates the feeding tube within the thoracic cavity or deviation from its expected anatomic course [6]. And all patients should receive Preoperative therapy aimed to stale vital signs, instead of emergency operations. A study revealed emergency operations on neonates with CDH would not benefit the neonates with CDH by leveling off survival of patients [7]. The treatment of congenital diaphragmatic hernia (CDH) in the neonate has changed since the first reports of surgical repair in the 1940s [8,9].Survival rates in newborns with CDH managed with preoperative stabilization and selective use of ECMO followed by delayed surgical correction are reported to be 79 to 92 percent [10-14]. In one retrospective review of a single center, the

survival rate improved in patients whose surgery was delayed (allowing resolution of early pulmonary insufficiency and acute pulmonary hypertension) compared with those who underwent immediate surgical repair (79 versus 56 percent) [11]. As a result, the emphasis shifted from early surgical intervention to preoperative care directed towards optimal management of pulmonary hypoplasia and pulmonary hypertension, followed by surgical repair .

We did not place thoracic tube to prevent dysplastic Pulmonary overdistension, and most scholars proposed not to indwell thoracic tube[15]. Recurrent diaphragmatic hernia occurs in 2 to 22 percent of all CDH survivors. Recurrence is highest (27 to 57 percent) in patients requiring patch repairs and ECMO support [16]. However, no recurrence was found in our study possibly due to the patients in the study without accompanying deformity.

Conclusion

Our study showed that laparoscopic repair of congenital diaphragmatic hernia in neonates was feasible with a shorter length of stay, and worth recommending.

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