Optically guided peritoneal access in pediatric laparoscopy: is it a good alternative for open access? A prospective comparative study

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Received: 17 August 2020
Accepted: 29 September 2020
Published: 24 December 2020

The Egyptian Journal of Surgery 2020, 39:1203–1207

Background
A minimally invasive approach has become the method of choice for treating many surgical cases. The superiority of open peritoneal access is owing to the low probability of visceral injury. Optically guided trocars were designed to decrease the injury risk to intra-abdominal contents by permitting the surgeon to see abdominal wall layers while traversing it and abdominal contents once access is complete.
Materials and methods
A prospective comparative study was done between optical trocar access using Fengh optical port, trocar model FLTC5 (Fengh medical Co. Ltd, Jiangsu, China), and open access using Hasson technique in pediatric patients. The study included 187 patients from the age of 1 year to the age of 16 years. Patients with previous open abdominal surgery, abdominal masses in the periumbilical region, and/or traumatic abdominal injury were excluded from the study. Access time and initial port insertion complications were reported to clarify safety and time for optical access.
Results
Optical access was done in 92 patients and open access in 95 patients. No visceral or major vascular complications were reported in both types of access. Access time in group IA (optical) was 58.06±16.1 s. in comparison with 175.7±54.7 s. in group IB (open) (P=0.0001*), and it was 49.7±9.4 s. in group IIA (optical) in comparison with 169.3±38.3 s. in group IIB (open) (P=0.0001*).
Conclusions
In selected cases, optical access is feasible, safe, and time-saving and avoids many problems in initial port insertion in pediatric laparoscopy.

Keywords:
optical, pediatric laparoscopy, peritoneal access

Egyptian J Surgery 39:1203–1207

1110-1121

Introduction

Laparoscopy has become a method of choice for treating many abdominal surgeries. However, it is not risk free [1]. A basic difference between any operating method and laparoscopy is that, for the latter, the initial access may be done blindly. Blind access may result in damage that might not be discovered intraoperatively and then could necessitate major abdominal repair [2]. The most common laparoscopic entry methods include closed, direct entry, and open method [1]. The superiority of open access is owing to the low probability of vascular injury. To overcome these complications, optical trocars were designed to decrease the injury risk to intra-abdominal contents [3].

Materials and methods

The study was approved by the Minia University Surgery Department Ethical Committee, and it was conducted at Minia University Hospital from April 2019 to February 2020. Informed detailed consent was obtained from the parents before joining the study. All pediatric patients aged from 1 to 16 years who were candidates for laparoscopic surgery during the study period were included. Patients with previous open abdominal surgery, abdominal masses in the periumbilical region, and/or traumatic abdominal injury were excluded. The study included 187 patients. Two groups were created. Group I aged from 1 to 8 years, and group II aged from 8 to 16 years. Each group was subdivided into two subgroups, group A for optical trocar access and group B for open access. Patients were distributed according to age between group I and group II, and then distributed between subgroups using the coin flip method. Open peritoneal access (Hasson technique) and optical trocar

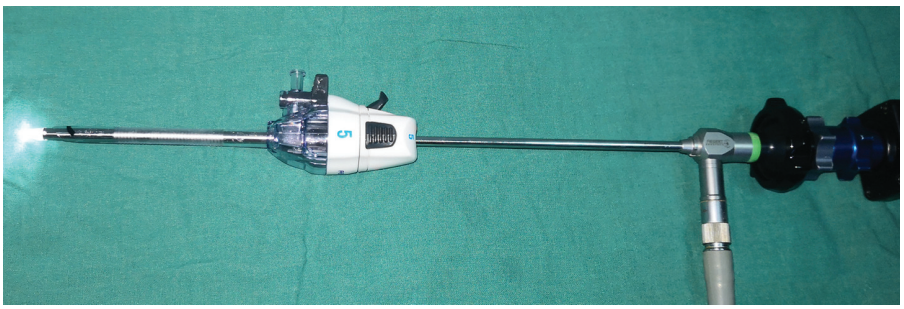
 DOI: 10.4103/ejs.ejs_225_20

peritoneal access techniques were used in first port insertion.

Three senior surgeons (the authors) who are familiar with both access techniques participated in the study. Each surgeon operated nearly one-third of each subgroup of patients. In group IA and IIA, the optical trocar access technique was used through about 5-mm intraumbilical incision. The incision included skin only, and then Fengh port, trocar model FLTC5 (Fengh medical Co. Ltd, Jiangsu, China), with bladeless hollow trocar, visual (transparent) tip, 5 mm diameter, and 75 mm sleeve length was used. The trocar is bladeless with a relatively blunt tip depending on spreading rather than cutting through abdominal wall layers and noninjurious to viscera (if used appropriately). A 0° 5-mm endoscope is mounted through the hollow trocar till reaching the visual tip and then the camera focus was adjusted (Fig. 1). After skin incision, the whole system (optical port with endoscope inside) is held perpendicular to the abdomen, and peritoneal access is started by grasping and lifting anterior abdominal wall and then pushing the port tip through the incision with a clockwise and anticlock wise screwing motion. The whole abdominal wall layers are visualized while penetrating through them till reaching the abdominal cavity where intestine and/or omentum could be seen through the transparent tip (Figs 2 and 3). Before starting insufflation, the trocar is removed, and the endoscope is reinserted (after focus readjustment) to ensure that adequate length of the cannula is inside the peritoneal cavity.

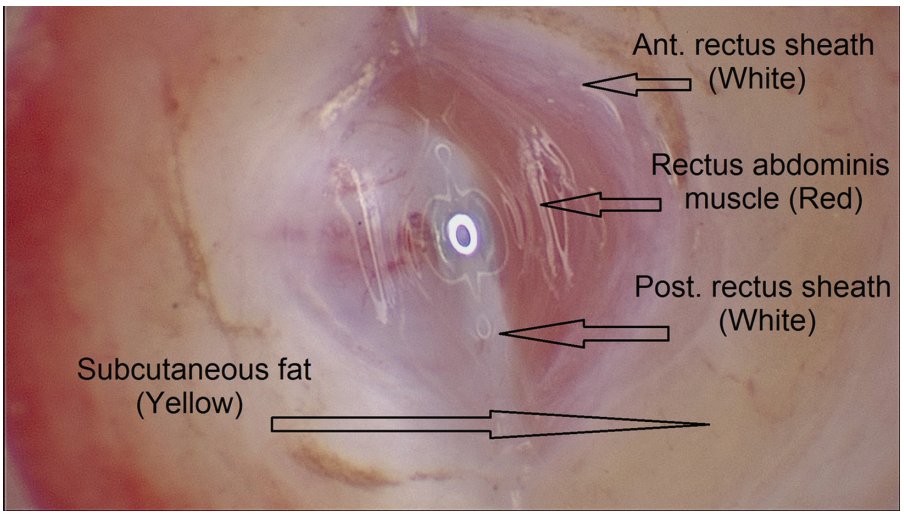
In group IB and IIB, the Hasson technique (open) was used through the same incision regarding site and width to insert the same cannula type, which was used in group IA and IIA. After the introduction and starting insufflation, purse-string suture around the trocar incision was used in cases of gas leakage or port migration. Time for peritoneal access started after skin incision and ended after ensuring access to the peritoneum. Time for purse-string suture was not included.

Figure 1



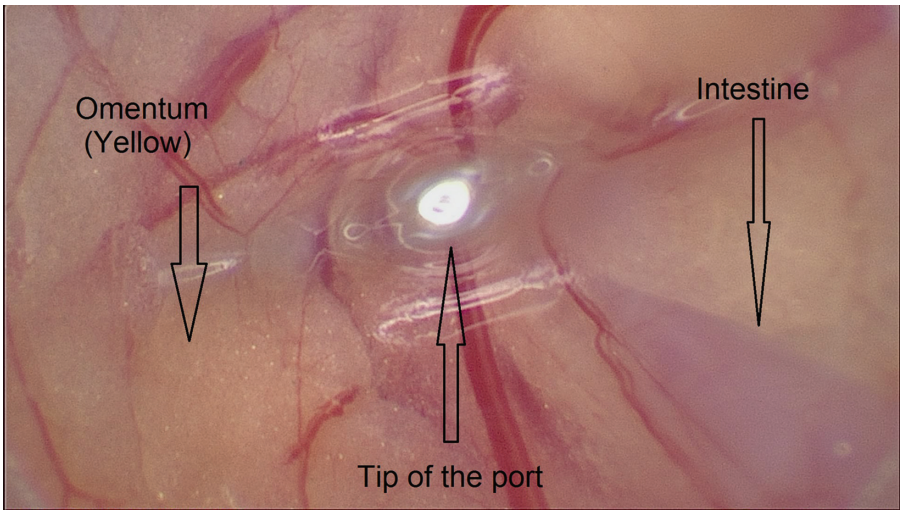
Endoscope is inserted through the hollow trocar till reaching the transparent tip.

Figure 2



Anterior abdominal wall layers could be seen clearly through optical trocar tip while traversing through it.

Figure 3



Omentum and intestine could be seen clearly through optical trocar tip ensuring peritoneal cavity access.

Table 1 Age, sex, and weight distribution

	Group I (*N*=145)		*P* value	Group II (*N*=42)		*P* value
	Group I A (*n*=73)	Group I B (*n*=72)		Group II A (*n*=19)	Group II B (*n*=23)	
Age (years)						
Mean±SD	3.8±2.05	3.7±2.1	0.7	10.01±1.7	10.07±1.7	0.9
Range	1–8	1–8		8–14	8–14	
Sex [*n* (%)]						
Male	49 (67.1)	57 (79.2)	0.1	13 (68.4)	16 (69.6)	0.9
Female	24 (32.9)	15 (20.8)		6 (31.6)	7 (30.4)	
Weight (kg)						
Mean±SD	14.8±3	15.7±4.1	0.1	31.5±4.1	32±4	0.7
Range	10–22	11–25		24–38	26–40	

Statistical analysis

All statistical tests are done by SPSS version 20 (Armonk, NY: IBM Corp.). In addition, descriptive statistical methods such as mean, SD, and range were used for quantitative variables, and frequency and percentage for qualitative variables. An independent samples *t*-test was used for comparison of quantitative variables between groups, whereas χ^2 test and Fisher's exact test were used for comparison of qualitative variables between groups. Statistical significance was defined as a *P* value less than 0.05.

Results

Demographic data

The study included 187 patients divided into two groups according to age. Group I included 145 patients (age from 1 to age of 8 years) which was subdivided into two subgroups. Group IA (for optical access) included 73 patients and group IB (for open access) included 72 patients. Group II included 42 patients (age from 8 to 16 years) and was subdivided into two subgroups. Group IIA (for optical access) included 19 patients and group IIB (for open access) included 23 patients. Data regarding age, sex, and weight in each subgroup are shown in Table 1.

Types of operations

The study included herniotomy, first- and second-stage lap. orchiopexy, appendectomy, splenectomy, cholecystectomy, and laparoscopic-assisted transanal endorectal pull-through operation for Hirschsprung disease. Data for the operation types are shown in Table 2.

Access time

The mean time for initial port placement in optical access subgroups was 58.06 s. for group IA and 49.7 s for group IIA, whereas in open access subgroups, it was 175.7 s for group IB and 169.3 s for group IIB (Table 3).

Complications

No major complications were reported in the study. All reported complications were related to endoscope port

Table 2 Types of operations

Operation type	Group I (*N*=145)		*P* value	Group II (*N*=42)		*P* value
	Group I A (*n*=73)	Group I B (*n*=72)		Group II A (*n*=19)	Group II B (*n*=23)	
Hernia	37 (50.7)	35 (48.6)		5 (26.3)	5 (21.7)	
Empty scrotum	16 (21.9)	15 (20.8)		2 (10.5)	3 (13)	
Appendectomy	13 (17.8)	14 (19.4)	0.9	6 (31.6)	8 (34.8)	0.9
Splenectomy	2 (2.7)	2 (2.8)		3 (15.8)	4 (17.4)	
Cholecystectomy	3 (4.1)	4 (5.6)		3 (15.8)	3 (13)	
Hirschsprung disease	2 (2.7)	2 (2.8)		0	0	

Table 3 Time for initial port insertion

Initial port placement time	Group I (*N*=145)		*P* value	Group II (*N*=42)		*P* value
	Group I A (*n*=73)	Group I B (*n*=72)		Group II A (*n*=19)	Group II B (*n*=23)	
Mean±SD	58.06±16.1	175.7±54.7	0.0001*	49.7±9.4	169.3±38.3	0.0001*
Range	30–150	100–400		35–65	125–256	

Table 4 Complications of first port insertion

	Group I (*N*=145)		*P* value	Group II (*N*=42)		*P* value
	Group I A (*n*=73)	Group I B (*n*=72)		Group II A (*n*=19)	Group II B (*n*=23)	
In/out port migration	2 (2.7)	50 (69.4)	0.0001*	1 (5.3)	16 (69.5)	0.0001*
Gas leakage	2 (2.7)	52 (72.2)	0.0001*	1 (5.3)	16 (69.5)	0.0001*
Visceral and/or vessels injury	0	0		0	0	

(initial port) insertion, and complications of other ports were not reported. Port migration occurred in three cases in optical access subgroups and 66 cases in open access subgroups. Gas leakage through endoscope port was reported in three cases of optical access subgroups, whereas occurred in 68 cases of open access subgroups (Table 4).

Discussion

Many complications arise when attempting to gain access to the peritoneal cavity especially with blind access [1]. Complications related to the use of blind access limit its use among the pediatric surgeons, and the open technique has been more popular [4]. In 1994, optical-access trocars were introduced as an alternative to the blind insertion which allows laparoscopists to see the cutting tip as it traverses through abdominal wall layers. So, optical-access trocars may provide some protection over blind insertion [5]. Unfortunately, inadequate experience with optical trocar access in children has been reported [6]. In our study, we aimed to compare open access and optical trocar access regarding time factors (access time and related access consequences that need time for correction like gas leakage and port migration) and related major complications in the pediatric population.

As a primary study to evaluate the technique, patients with challenging factors like previous open abdominal surgery, abdominal masses in the periumbilical region, and/or traumatic abdominal injury, which are anticipated to increase the incidence of complications, were excluded from the study. In our study, included patients were divided into two groups according to age to minimize the effect of intra-abdominal space as a confounder. Other possible confounders like the site, size of the port incision, and type of the port were the same to abolish the effect of these factors on results. The study was designed to include both obese and nonobese children to allow an appropriate sample size, and there was no significant difference in the mean weight of each subgroup and its opposite one.

Livesey and Jones [7] designed a study to evaluate the safety of optical trocar access in overweight and obese children and cases with previous laparotomy and huge splenomegaly with successful access without complications in such cases, whereas Billington and Desai [8] described visiport (optical access) access as a classic method for initial port insertion in sleeve gastrectomy for morbidly obese children.

In terms of speed, there was a significant difference in access time in favor of optical access. In concordance with our results, Minervini *et al.* [9] designed a study to compare optical access time and open access time in both adult and pediatric patients. The mean time for optical access was 125 s. and for open access was 443 s (*P*=0.0001*).

No visceral or major vascular injuries were reported in the study, denoting that optical access safety is comparable to open access safety. In concordance with that, Nelson *et al.* [10] evaluated closed access in pediatric urologic laparoscopy, including optical trocar access (visiport), and concluded that it is safe with minimal minor complications. In discordance with that, Catarci *et al.* [11] analyzed a multicenter questionnaire survey of general surgeons and reported relatively higher major injuries with optical trocars (0.27%) in comparison with open technique (0.09%).

Port migration and/or gas leakage incidence was significantly higher in open access than optical access (P=0.0001*), which necessitated purse-string suture around the port site to narrow the incision and stabilize the port in its site. This may be attributed to the widening of the port site during dissection in open access, whereas in optical access, the port site incision is exactly fit to port size. Nabil and Shabaan [12] reported the same event with open technique, and it was controlled using Allis forceps or towel clips to narrow the incision around the port instead of the purse-string suture.

Conclusion

In selected cases, optical trocar access is feasible, safe, and time-saving and avoids many technical problems in initial port insertion in pediatric laparoscopy.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest

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