Original Article

Transcutaneous Hitching Sutures in Paediatric Minimally Invasive Surgery: A Novel Technique of "Assistant Without Port"

Sanat Kumar Khanna, Kamal Kishore, Gaurav Panchal[1]

Department of Paediatric Surgery, Army Hospital Research and Referral Hospital, New Delhi, [1]Department of Paediatric Surgery, Military Hospital, Meerut, Uttar Pradesh, India

Abstract

Background: Transcutaneous hitching sutures in paediatric minimally invasive surgery (MIS) is a unique and rare technique. This technique has been used previously in adult patients undergoing gastric resections and laparoscopic cholecystectomy; however, its use in paediatric population has never been reported in the world literature. The primary objective of this study was to bring out the advantages and feasibility of this technique in minimally invasive gastrointestinal, hepatobiliary, urological and thoracoscopic surgeries on paediatric patients. **Materials and Methods:** This retrospective observational study was conducted on 167 paediatric patients who underwent MIS surgery for different indications between April 2016 and March 2020 at two paediatric surgery tertiary care centres. **Results:** A total of 167 patients, including 91 boys and 76 girl patients between the age group of new-born period to 12 years were operated. The mean hospital stay was 4 days. Five out of 167 cases (3%) had post-operative surgical emphysema, which resolved spontaneously. At 6-month follow-up, parental satisfaction was 100%, and in 99% of patients, scars were imperceptible. **Conclusion:** This versatile technique is of exemplary utility, especially in paediatric patients where there is a paucity of working space at low intra-abdominal pressure, and eases the dissection even in narrow and closed spaces with a better functional and cosmetic outcome.

Keywords: Advanced laparoscopy, hitching suture, intra-abdominal pressure, minimally invasive surgery, transabdominal, transcutaneous, transthoracic

Introduction

The increased number of access ports used in laparoscopic surgery may impair the ability of the surgeon to achieve an adequate retraction and exposure, and stabilise 'moving targets' while operating on non-fixed organs. Adding more ports has the disadvantages of being more invasive and creating a hazardous situation of multiple instruments in a limited working space leading to sword fighting of instruments.[1] An increase in intra-abdominal pressure (IAP) in paediatric patients primarily induces changes in venous return leading to a significant decrease in cerebral oxygen saturation after insufflation.[2] Although the insufflation pressure and volume are lower in paediatric patients because of the small size of the abdomen, the associated increase of IAP along with the absorption of CO_2 and surgical positioning may lead to neuroendocrine and mechanical effects, which can compromise cardiopulmonary function.[3] The above issues are practically faced in paediatric minimally invasive surgery (MIS) since the abdominal or chest cavity has a much smaller space, and the IAP also cannot exceed the safety range.

We describe a unique technique wherein a particular organ or structure is hitched by a suture to the anterior abdominal wall through transcutaneous, transabdominal or transthoracic route to facilitate easy movements of laparoscopic instruments and improve vision of the field of dissection. Frequently, an organ needs to be fixed in place for some period until a procedure is accomplished, and in doing so, additional ports may be needed. The use of additional ports and instruments in the paediatric abdomen limits their use for the procedure itself apart from the disadvantage of creating more incisions. The

Received: 07-08-2022 **Revised:** 30-09-2022 **Accepted:** 10-10-2022 **Available Online:** 19-01-2023

Access this article online

Quick Response Code:

Website: https://journals.lww.com/AJPS

DOI: 10.4103/ajps.ajps_103_22

Address for correspondence: Dr. Gaurav Panchal, Military Hospital, Meerut, Uttar Pradesh, India.
E-mail: gauravpanchalafmc@gmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Khanna SK, Kishore K, Panchal G. Transcutaneous hitching sutures in paediatric minimally invasive surgery: A novel technique of "assistant without port". Afr J Paediatr Surg 2024;21:81-4.

use of many instruments also may limit the ease of movement and manipulation inside the abdominal cavity. Hand-assisted surgery, which had become popular in adult laparoscopy, may simplify manoeuvres such as retraction and stabilisation, but at a price of an additional larger incision.[4] More so, the option of hand port is neither practical nor feasible in paediatric MIS.

Our technique is aimed at stabilising a certain organ or structure, which could be megaureter, dilated common bile duct, multicystic dysplastic kidney or an intestinal cyst using one or more transcutaneous, transabdominal or transthoracic hitching suture to retract it towards the anterior abdominal wall. This is an index study wherein we have successfully accomplished advanced minimally invasive surgeries in paediatric patients using this technique which is extremely surgeon-friendly, and laparoscopic surgeons will find it very useful for a variety of applications as need for retraction may be a limiting factor in the performance of advanced MIS.

Materials and Methods

This retrospective observational study was conducted on 167 paediatric patients who underwent MIS for different indications between April 2016 and March 2020 at two paediatric surgery tertiary care centres by a single surgeon with more than 10 years of experience in the paediatric laparoscopic surgery.

We used 2/0 or 3/0 non-absorbable braided silk suture on — circle round body needle, which is passed either through transabdominal route [Figures 1 and 2] or through transthoracic route, and needle passed through the organ or structure to be retracted (hitching suture). Site of hitching suture and organ to be fixed by is depicted in Table 1. Furthermore, in transthoracic surgeries, this suture is introduced through the chest wall under a careful thoracoscopic vision [Figure 3]. Care must be taken in handling the needle while entry in the abdomen or chest in paediatric patients where there is a limited space for this manoeuvre under a safe IAP. Pulling up the suture and clamping near the abdominal wall increases the amount of retraction, and release of the tension, when needed, is quick and simple. In some surgeries like laparoscopic upper-pole nephroureterectomy, multiple hitching sutures are taken in a staged manner along the dilated ureter for ease of dissection and safely reach the upper pole [Figure 4].

In all the surgeries, pneumoperitoneum was created by closed technique using Veress needle through intraumbilical incision for a better cosmesis with IAP kept between 6 and 12 cm H_2O.[5] In all surgeries, 0° lens through 5-mm port and three working 5-mm ports were used with hitching suture acting as the fourth port assistant. In some cases of laparoscopic pyeloplasty and laparoscopic-assisted anorectoplasty (LAARP), both 0° and 30° lens were used through 5-mm port. In all abdominal surgeries, 16 Fr drain was placed using one of the working 5-mm ports as the site of the drain, and 8-Fr chest drain was placed in all transthoracic surgeries through 5-mm port.

Results

A total of 167 patients including 91 boys and 76 girls between age group of new-born period to 12 years were operated. Hitching sutures were taken in all abdominal and transthoracic surgeries as per the type of surgery [Table 1]. The mean hospital stay was 4 days. Five out of 167 patients (3%) developed minimal subcutaneous emphysema, who underwent laparoscopic upper-pole nephroureterectomy due to multiple sequential hitching sutures along dilated megaureter and subsequently had an uneventful resolution by post-operative day 2. At post-operative follow-up by 6 months, the average scar size was 4-mm scar (3.5–5.5 mm) at 5-mm port, and the umbilical scar was not discernible, port being placed intraumbilically. There were no port-site hernias, and the patient and parental satisfaction was 100%, and in 99% of patients, scars were imperceptible. There was no mortality in the study.

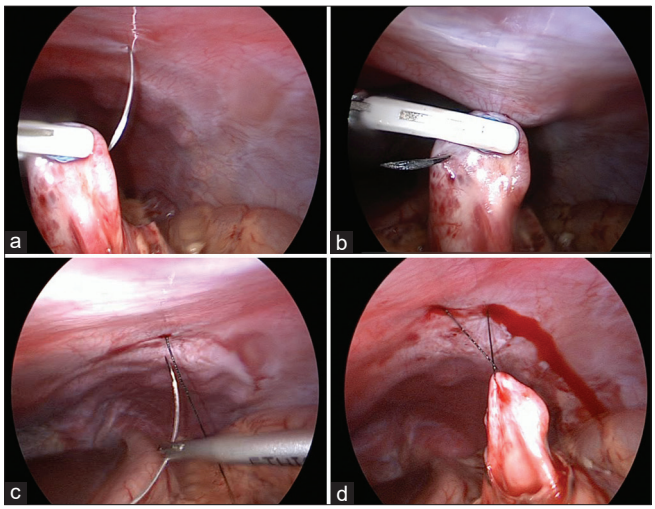


Figure 1: Transabdominal hitching suture (a and b) during laparoscopic pyeloplasty retracting dilated renal pelvis (c and d)

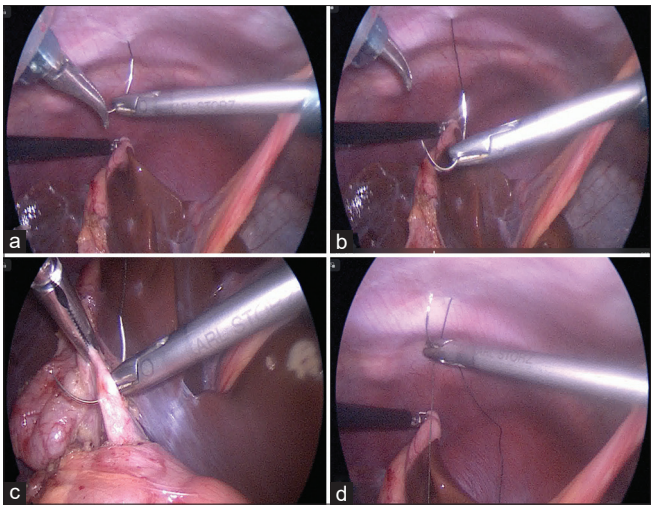


Figure 2: Transabdominal hitching suture (a and b) during laparoscopic choledochal cyst surgery retracting dilated CBD (c and d). CBD: Common bile duct

Table 1: Surgeries performed using transcutaneous hitching suture

MIS performed	Organ/structure hitched	Total surgeries	Age	Male	Female
GI and hepatobiliary surgery					
Choledochal cyst excision and hepaticojejunostomy	Dilated common bile duct	21	15 months-9 years	6	15
Duplication cyst excision	Duplication cyst	7	3-8 years	6	1
Mesenteric cyst excision	Mesenteric cyst	7	4-10 years	Nil	7
Omental cyst excision	Omental cyst	2	2-7 years	2	Nil
Laparoscopic cholecystectomy	Gall bladder	7	4-10 years	4	3
Urology					
Laparoscopic pyeloplasty	Dilated pelvis	70	6 months-12 years	43	27
Laparoscopic upper-pole nephroureterectomy	Dilated ureter	14	16 months-4 years	6	8
Laparoscopic nephroureterectomy	MCDK kidney	16	3-7 years	10	6
Pelvic surgery					
Laparoscopic-assisted anorectoplasty	Urinary bladder	11	11 months-2 years	11	Nil
Ovarian torsion	Uterus or ovary	3	6-10 years	Nil	3
Laparoscopic ovarian cyst	Uterus and/or cyst	5	8-10 years	Nil	5
Thoracic					
Lung biopsy	Diseased lung	2	4-12 years	1	1
Congenital diaphragmatic hernia repair	diaphragm	2	New born	2	Nil
Total		167	New born baby to 12 years	91	76

MIS: Minimally invasive surgery, GI: Gastrointestinal, MCDK: Multi cystic dysplastic kidney

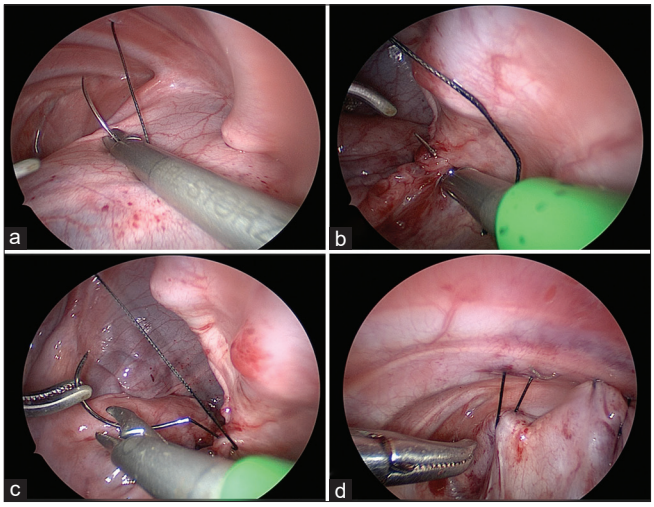


Figure 3: Transthoracic hitching suture (a and b) during laparoscopic congenital diaphragmatic hernia repair with suture passing through diaphragm (c and d)

Discussion

Paediatric laparoscopy has become widely popular in the era of MIS; careful management in paediatric laparoscopic surgery has taken an important place in paediatric surgery. The anaesthetic management in these cases poses special problems due to pneumoperitoneum created and extremes of position adopted for a better exposure of desired organ which itself poses a greater anaesthetic challenge.[5] The pressure of pneumoperitoneum needs to be kept between 6 and 12 cm H_2O with flow of gas to be kept about 0.9 L.[5] Increase in IAP is associated with increase in mechanical effects like diaphragm splinting, and increase in end-tidal carbon dioxide, leading to decrease in regional cerebral perfusion and cardiovascular

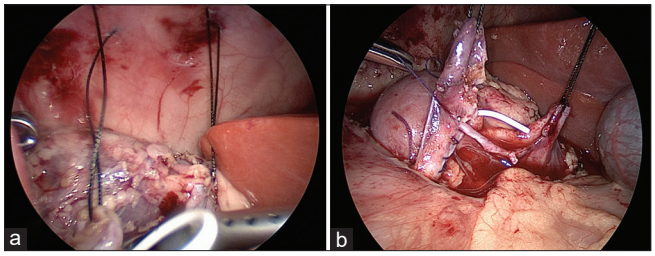


Figure 4: Transabdominal multiple hitching sutures (a and b)

compromise, especially in paediatric patients with small abdominal cavity and lax abdominal wall.[2] Furthermore, in some urological surgeries, diaphragmatic injury is common which needs an immediate diagnosis and repair.[6] Therefore, use of transcutaneous, transabdominal or transthoracic hitching sutures gives a better working space in the limited field of dissection reducing the chances of intraoperative injuries by making manoeuvre of instruments easier leading to successful completion of advanced laparoscopic as witnessed in our study.

Although use of hitching or suspension sutures has been used previously in adult population for gastric resections and laparoscopic cholecystectomy,[7-10] there are no data available in the world literature where this technique has been incorporated for use in paediatric MIS. This study brings out a novel technique which can be easily practiced and applied by paediatric laparoscopic surgeons.

The advantage of these hitching sutures apart from above is their flexibility of the placement anywhere on the anterior abdominal wall extending from one flank across to the other side as per the requirement by the surgeon according to operative circumstances encountered. Moreover, if any change or adjustment in the direction of traction is needed, this suture

can be easily removed and replaced with another one at a selected different site of entry. This flexibility is not possible in case of siting of an additional trocar. However, due care must be taken not to have multiple such changes which may result in post-operative surgical emphysema which resolves in time.

Furthermore, all the young paediatric surgeons may not have the luxury of having entire paraphernalia of instruments like 30° lens in 5-mm or 10-mm sizes, which are sometimes needed in paediatric MIS, especially while dealing with LAARP, laparoscopic choledochal cyst surgery and laparoscopic pyeloplasty. The authors have observed that in case of availability of only zero-degree lens of any size (5 mm or 10 mm), completion of these advanced surgeries can still be accomplished by use of these hitching sutures as the angle of traction, and manoeuvrability is determined by the site of entry point of the suture.

This is an index study which defines the successful outcome using this technique. Results of this study can be adopted by all paediatric surgeons for use in advanced laparoscopy.

Conclusion

This technique is useful and extremely surgeon-friendly with its versatility and easily reproducible in paediatric patients where there is a paucity of working space due to low IAP, which avoids infighting amongst instruments and simplifies the dissection even in a limited space for a better outcome of advanced paediatric laparoscopic surgery. This is an index study conducted for minimal access surgery in paediatric population and includes almost all gastrointestinal, colorectal, hepatobiliary, urological and thoracoscopic surgeries that can be performed by minimal access route.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Rosin D, Kuriansky J, Rosenthal RJ, Brasesco O, Ayalon A. Laparoscopic transabdominal suspension sutures. Surg Endosc 2001;15:761-3.
2. Pelizzo G, Bernardi L, Carlini V, Pasqua N, Mencherini S, Maggio G, *et al*. Laparoscopy in children and its impact on brain oxygenation during routine inguinal hernia repair. J Minim Access Surg 2017;13:51-6.
3. Spinelli G, Vargas M, Aprea G, Cortese G, Servillo G. Pediatric anesthesia for minimally invasive surgery in pediatric urology. Transl Pediatr 2016;5:214-21.
4. Targarona EM, Gracia E, Rodriguez M, Cerdán G, Balagué C, Garriga J, *et al.* Hand-assisted laparoscopic surgery. Arch Surg 2003;138:133-41.
5. Gupta R, Singh S. Challenges in paediatric laparoscopic surgeries. Indian J Anaesth 2009;53:560-6.
6. Mulholland TL, Kropp BP, Wong C. Laparoscopic renal surgery in infants 10 kg or less. J Endourol 2005;19:397-400.
7. Asencio-Arana F. Laparoscopic access to the lesser sac in gastric cancer staging. Surg Laparosc Endosc 1994;4:438-40.
8. Ballesta-Lopez C, Bastida-Vila X, Catarci M, Mato R, Ruggiero R. Laparoscopic Billroth II distal subtotal gastrectomy with gastric stump suspension for gastric malignancies. Am J Surg 1996;171:289-92.
9. Nathanson LK, Cuschieri A. The falciform lift: A simple method for retraction of the falciform ligament during laparoscopic cholecystectomy. Surg Endosc 1990;4:186.
10. Ramachandran CS, Arora V. Two-port laparoscopic cholecystectomy: An innovative new method for gallbladder removal. J Laparoendosc Adv Surg Tech A 1998;8:303-8.