



# Simplified video-assisted one-trocar diverting colostomy in pediatric patients

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## ABSTRACT

**Background:** In pediatric age colostomy is mainly temporary and totally diverting, the major indication being neonatal anorectal malformation for which a specific double separated stoma route has been widely popularized. Out of newborn age the reasons for colon diversion in children are less common and the procedures are quite similar to the techniques employed in adults. Laparoscopy for pediatric colostomy has a short history and the original recommended procedure for newborns has been achieved only very recently with a two-trocars technique.

**Methods:** We describe an original one-trocar method to create a double or single totally diverting colostomy avoiding any other abdominal wound at risk for complications. The procedure has been performed on newborns with anorectal malformations as well as on a teenager through minor technical variants.

**Results:** This one-trocar method allowed a quick and safe totally diverting colostomy in every treated patient. There was no complication during surgery and no skin infection in the whole postoperative period; at the end of treatment scars were minimal.

**Conclusions:** This technique is suitable for the specific neonatal double separated colostomy and virtually for every indication of fecal stream diversion in any kind of patient.

## 1. Introduction

Colostomy in pediatric age is mainly temporary, aimed to release an obstruction and/or to keep clean perineal area for surgical procedures.

Anorectal malformation (ARM) in the newborn is the paradigmatic indication and in such cases a specific double totally diverting colostomy has been proposed together with malformation reconstructive methods [1]. Other indications at a later stage of growth are less frequent and are treated similarly to techniques applied on adults.

Implementation of laparoscopy has improved also colostomy surgery by avoiding as much as possible abdominal wounds. Video-assisted colon diversions have been performed in adults since 1997 [2], more profitably with a reduced number of accesses employed or with single multiport devices [3–5].

In children, laparoscopic colostomies emerged with years of delay [6]. In 2011 a comprehensive review of pediatric single trocar procedures still did not include colostomy [7], while in 2013 the first one-

trocar colostomy technique has been described for newborns with ARM producing two contiguous stomas enclosed in the trocar circular wound [8], far differently from the recommended arrangement. More recently a double separated stomas procedure has been performed through a two-trocar route [9].

Being in favour of parted stomas in newborns diagnosed with ARM [10], we propose a one-trocar method for double diverting colostomy on the sigmoid that avoids any abdominal wound beside the stomas. Such a procedure is suitable also for virtually any other indication of single totally diverting stoma in any kind of patients.

## 2. Materials and methods

The simplified technique of one-trocar diverting colostomy was applied in 4 patients. Three of them were newborns with ARM: a male with a recto-urethral fistula and two females, one with a rectal atresia and a Down syndrome and one with a recto-vaginal fistula. The same

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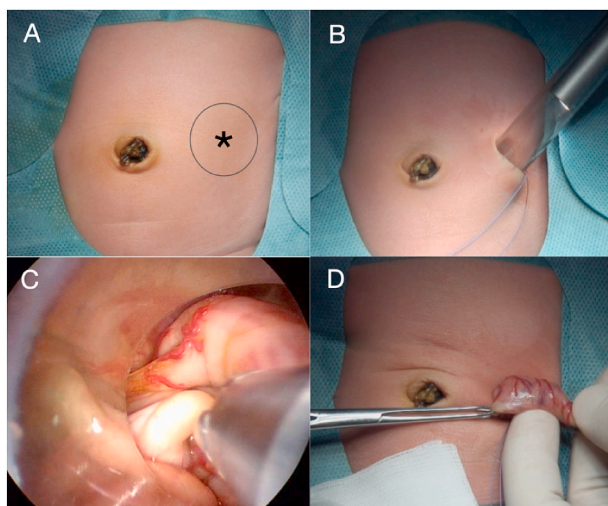
method was adopted for opening a single stoma in a girl of 14 years of age diagnosed with spina bifida waiting for buttocks plastic surgery because of a deep sacral decubitus impending on a vertebral stabilizing system for scoliosis.

Procedure started with open placement of a trocar at left hypocondrium in the site previously elected for stoma, taken into account also its forthcoming dressing (Fig. 1 A, B). The access was a simple linear incision following the skin lines with gentle muscles spreading fitting a 12mm trocar.

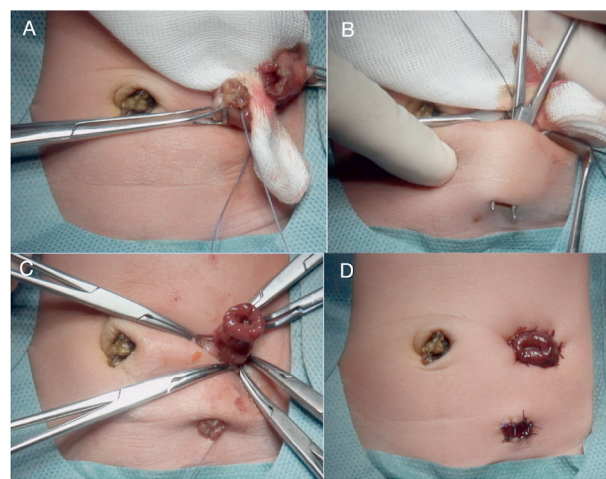
The capnoperitoneum was created at 12 mmHg and an operative laparoscope (KARL STORZ®, Tuttlingen, Germany) was used with a grasper inserted.

After an overall inspection of the abdominal cavity, looking for other possible abnormalities, the appropriate sigmoid tract was chosen negotiating the lowest level of colon release with an adequate distal length for subsequent reconstructive surgery. During the exploration of the peritoneal cavity the ideal point for the distal stoma was identified, taking care of both bladder and abdominal wall structures, namely vessels and ligaments.

The sigmoid tract was picked with the grasper near the colo-sigmoid junction to prevent prolapse, and raised from the abdomen with trocar withdrawing (Fig. 1 C, D). Outside the peritoneal cavity it was freed



**Fig. 1.** Operative technique - I. A. The stoma site is elected previewing also its forthcoming dressing. B. 12mm trocar placement in the site elected for diverting stoma. C. The chosen sigmoid tract is grasped near the colo-sigmoid junction (see the ligament on the left) to prevent prolapse. D. The chosen sigmoid tract exteriorized with trocar withdrawn.



**Fig. 2.** Operative technique - II. A. The sigmoid loop is divided extra corporally and the distal end temporarily closed. B. Opening for the colo-cutaneous fistula. C. The distal end is passed through the opening for colo-cutaneous fistula. The proximal loop is prepared for everting colostomy. D. Everted colostomy with distal colo-cutaneous fistula.

from its most distal vessels along about 3cm, temporary closed distally and divided (Fig. 2 A).

In the three newborns the closed end of sigmoid colon was exteriorized through a small opening in the site previously identified for the distal stoma, to create a colo-cutaneous fistula (Fig. 2 B, C, D), while in the teen-ager girl, needing only a stoma, it was left sealed just below the peritoneum level.

An everted colostomy was performed at the trocar site matching exactly the trocar wound; the older patient required a small tailoring of the incision just to fit the size of her colon.

At the end of the procedure the diverting stoma was definitely arranged with an appropriated bag.

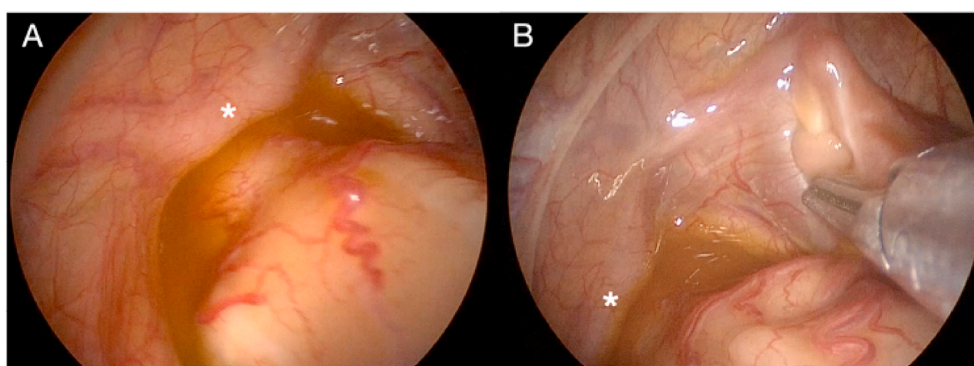
### 3. Results

The whole procedure did not require more than an hour. Every patient had a quick recovery as well as the restoration of bowel transit; feeding *per os* was allowed less than 24h from surgery.

No stoma-related complication was observed in the early postoperative period nor during follow up (2–30 months).

As an adjunctive result, the laparoscopic exploration revealed in a female newborn an ARM associated hypoplastic didelphys uterus (Fig. 3).

At stoma closure the distal fistula was abated, the distal colon withdrawn and the anastomosis was safely performed through the proximal



**Fig. 3.** Laparoscopy in a female with ARM and Mullerian malformation. A. Hypoplastic dydelphys uterus anterior to the sigmoid. B. Normal annexia on the right side (near the grasper). \* = hypoplastic didelphys uterus.

stoma wound. The older patient and her caregivers felt more comfortable with her diverting stoma and decided to carry on with it.

#### 4. Discussion

Laparoscopic technique for colostomy surgery is rewarding also in pediatrics.

The avoidance of abdominal wall sutures near the stoma reduces infections accountable for the majority of early complications [11,12] while the untouched peristomal skin tolerates an immediate dressing for a timely management of the fecal diversion.

Moreover, in newborns affected by ARM, the benefits of minimal access surgery include also a more accurate assessment of possible associated diseases. In those patients the previously described one-trocar method [8] did not reach the same outcome as in the recommended open procedure [1,10], looking and acting more similarly to a common loop colostomy. Though it is considered clever, this method creates two stomas difficult to be arranged separately and the thin skin bridge in between could still be liable to infection and to conflict with dressing.

The goal of getting two widely separated colostomies without any other abdominal wounds have been firstly described by Gine [9] using two 5mm trocars, with a swapping position of camera and surgical tool.

Our technique achieves the same optimal outcome with just a single 12mm trocar and gives the additional benefit of easier and smarter movements working in the same direction of the camera and not against it. Moreover, it allows to preview from inside the site of the distal fistula, and even to avoid unnecessary further wounds in cases eventually requiring only one diverting stoma.

Based on our experience, in newborns a simple linear incision with gentle muscle spreading for a 12mm trocar fits perfectly a full diameter proximal colostomy. A circular incision with removal of soft tissues was worthless also in grown-up patient which required adjustment of the trocar opening to exactly contain the colon size. Through this same wound the anastomosis can be comfortably performed at the moment of colostomy closure with a satisfactory cosmetic outcome.

#### 5. Conclusion

Our technique of one-trocar totally diverting colostomy appears suitable both for the double widely separated stomas recommended in newborns with ARM, as well as for virtually any other indication of bowel stoma in pediatric patients. Compared to traditional open surgery the simplified one-trocar technique offers all the advantages of laparoscopy already highlighted in the previous literature, including the superior evaluation of the malformative disease [6,9], and is a worthy alternative to other video-assisted methods for an accurate and efficient diverting colostomy.

#### Patient consent

Consent to publish the case report was not obtained. This report does not contain any personal information that could lead to the identification of the patient.

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#### Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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