

High-pressure oxygen insufflation to facilitate submucosal dissection in Soave's operation*

E. Balık, G. Özok, A. Avanoğlu, İ. Ulman, C. Taneli, and Ö. Herek

Department of Pediatric Surgery, Ege University Faculty of Medicine, İzmir, Turkey

Accepted 22 November 1993

Abstract. The aim of the present study is to demonstrate a new, simple method of facilitating the submucosal dissection that is the most difficult and time-consuming part of Soave's operation. For rectal submucosal dissection, oxygen under high pressure is insufflated via a needle inserted into the submucosal space at a level just above the peritoneal reflection of the rectum down to the anal canal. The technique has been successfully used in 35 cases of Hirschsprung's disease. A considerable reduction in the operating time and the incidence of iatrogenic mucosal perforations could be achieved. We conclude that the method is time-saving and provides safety during a period of the operation where scrupulous care is needed.

Key words: Hirschsprung's disease – Children – Treatment – Soave's operation – Surgical technique

Introduction

In patients with Hirschsprung's disease (HD) a number of elegant surgical methods have been used for definitive treatment. Among these, Soave's operation is one of the most commonly preferred [3]. Together with its modifications, it has gained increasing popularity in the last 2 decades. However,

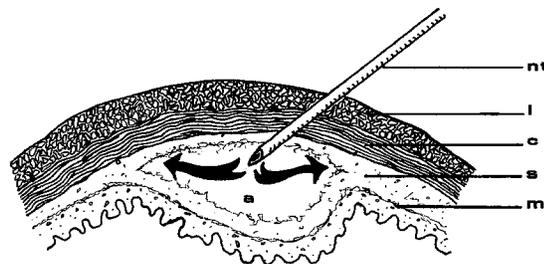


Fig. 1. Correct placement of needle tip in bowel wall (*nt*, needle tip; *l*, longitudinal muscle layer; *c*, circular muscle layer; *s*, submucosal layer; *m*, submucosal muscle layer; *a*, closed air space created by oxygen insufflation)

the procedure includes a maneuver that requires particular care and skill: this part, where rectal submucosal dissection is performed and a seromuscular cuff prepared, is highly prone to technical errors. Cuff abscess has been a major specific complication of the Soave procedure, and one cause of abscess formation is perforation of the mucosa during stripping. In this study, we demonstrate a new and simple method to facilitate submucosal dissection in the Soave procedure that was performed and proved effective in 35 children with HD.

Materials and methods

Between 1988 and 1992, 35 children with HD were admitted. The mean age (\pm SEM) at the time of admission was 2.1 ± 0.5 years (2 days–10 years). The male/female ratio was 27/8 (3.4/1). Ten patients (29%) had previously had one or more episodes of enterocolitis. A preliminary transverse colostomy was performed in 18 (51%) patients. All patients underwent an endorectal pull-through (Boley modification of the Soave procedure). The operations were performed by, or under the supervision of, the same surgeon (EB) during the whole series.

The bowel is prepared by ligating vessels for the pull-through along the aganglionic segment as confirmed by frozen-section biopsies. To prevent the invasion of oxygen (O_2) under high pressure along the intestine, the bowel is clamped between the fingers or compressed with a Penrose drain just proxi-

mal to the needle insertion point. A 21–23 G scalp-vein needle is inserted into the submucosal space. The thickness of the seromuscular layer of the rectum at this level (peritoneal reflection) is 1–3 mm, depending on the age of the patient and the duration of the disease process (Fig. 1). Correct placement of the needle tip in the submucosal space is assured by the observation of a whitish color change produced by pressure of the compressed O_2 on the perforating vessels traversing the submucosal and muscular layers. This also helps to stop bleeding from these veins during the subsequent dissection. Insufflation is completed circumferentially (Fig. 2); O_2 at maximum 80 cm H_2O pressure is derived from the anesthetic system. Oxygen at high pressure separates the mucosa from the muscular layers, leaving only the perforating vessels. Usually two or three insertions accomplish sufficient detachment down to the dentate line.

Manual dissection of the mucosal tube is begun through a circumferential incision above the peritoneal reflection of the rectum down to the anal canal. Oxygen insufflation helps to locate the submucosal plane while blunt dissection is carried out. By this means, safe and quick dissection can be performed without hemorrhage or perforation (Fig. 3). The mobilized rectum is prolapsed outside the anus by passing a large Pezzer catheter from the anus up into the lumen that is tied at its upper end externally in the abdomen and withdrawing the bowel over the catheter. The prolapsed bowel mucosa is cleaned with antiseptic solution. The pulled-through colon is then divided and a colorectal anastomosis is performed outside the anus, 1 cm above the dentate line. After completion of the anastomosis, the upper end of the muscular cuff is

* Presented at the 12th Annual Congress of Turkish Association of Pediatric Surgeons, Kuşadası, Turkey, November 3–6, 1992

Correspondence to: E. Balık, Department of Pediatric Surgery, Ege University Faculty of Medicine, 35100 Bornova, İzmir, Turkey

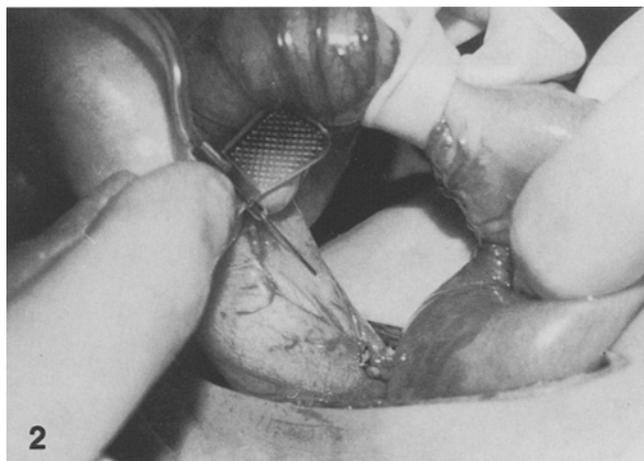


Fig. 2. Oxygen insufflation with a flexible needle

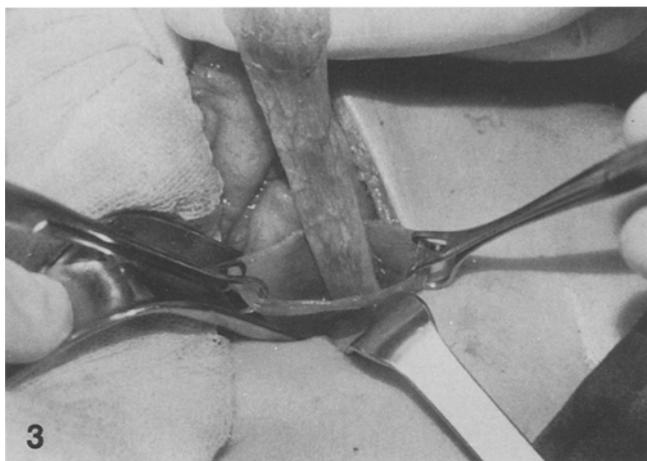


Fig. 3. Completed cuff dissection

loosely approximated to the enclosed colon with interrupted sutures.

Results

The operating time was 1.5 to 3.0 (mean 1.9) h. Using high-pressure O₂ insufflation, the rectal submucosal dissection and preparation of the muscular cuff did not last more than 15 min in any of the 35 operations. Iatrogenic mucosal perforations occurred in 3 patients during dissection; 1 of them was a patient who had had previous enterocolitis attacks. Postoperative complications included wound infections in 3 patients that resolved without any problems. Cuff abscesses occurred in 3 patients; all of them closed in the early postoperative period, one spontaneously and two after surgical drainage. One of these patients died of enterocolitis and sepsis that developed during the late postoperative period. The mean length of hospital stay was 12.6 ± 3.2 days. Follow-up (mean 3.5 years) revealed no specific problems related to the technique.

Discussion

The endorectal pull-through procedure described by Soave involves removal of the mucosa of the distal bowel by submucosal dissection to the anus and passage of the normally innervated colon through the remaining rectosigmoid muscular cuff [3]. The procedure prepares a segment of pulled-through colon protruding well beyond the anal skin margin for removal at a second stage 2 weeks later. This procedure was modified by Boley to a one-stage operation by primary ana-

stomosis of the pulled-through colon to the muscular cuff at the anal verge [1]. This was a significant improvement in the technique with regard to the length of hospital stay.

The submucosal dissection is the most time-consuming portion of this operation and requires scrupulous care [2]. In his original description of the technique, Soave infiltrated precaine 0.5% into the seromuscular coat of the rectosigmoid segment, taking care to avoid involvement of the mucosal coat [3]. In doing this, he probably meant to facilitate dissection. Instead of procaine, we used O₂ under high pressure for dissection of a larger rectal segment. Oxygen at 80 cm H₂O maximum pressure is easily obtained from the anesthetic system.

Gas embolism is a potential complication of O₂ insufflation, but never occurred in our series. The pressure used for dissection is not sufficiently high, and at the time of insufflation, the vessels proximal to the area of needle insertion have already been ligated. By clamping the bowel between the fingers or encircling it with a Penrose drain, the gas is prevented from moving proximally during insufflation (Fig. 2). Therefore, the only vessels in close contact with the high-pressure O₂ will be the tiny perforating veins in the submucosal space. These are hardly ever more than 0.5 mm in diameter, and there is minimal if any chance of puncturing and entering one of these with a 23 G needle. These veins are not disrupted before manual dissection, and during dissection the closed submucosal space is opened to the air,

lowering the pressure as depicted in the schematic drawing (Fig. 1). The open ends of these veins are then no more than small bleeding points easily managed by coagulation. Moreover, a period of air compression of these vessels facilitates hemostasis.

Mucosal dissection is very simple in infants, but rather difficult in older patients, especially those who have previously had enterocolitis. Oxygen insufflation at least facilitated the stripping in our patients by better exposing the adhered areas even if it did not reduce the operating time. Also, there were no significant differences between the incidences of iatrogenic mucosal perforation in cases who had had previous enterocolitis and those who had not.

In conclusion, the submucosal high-pressure insufflation technique is easy to apply and is an elegant procedure that requires no special equipment. A significant reduction in operating time is attained and the number of iatrogenic perforations is reduced. Therefore, the technique is recommended in the surgical treatment of patients with HD for whom endorectal pull-through is considered desirable.

References

1. Boley SJ (1964) New modification of the surgical treatment of Hirschsprung's disease. *Surgery* 56: 1015
2. Coran AG, Weintraub WH (1976) Modification of the endorectal procedure for Hirschsprung's disease. *Surg Gynecol Obst* 143: 277
3. Soave F (1964) A new surgical technique for treatment of Hirschsprung's disease. *Surgery* 56: 1007