

Surgical Techniques for Prevention of Recurrence After Total Enterolysis in Encapsulating Peritoneal Sclerosis

Hideki Kawanishi, Kentaro Ide, Masahiko Yamashita, Manabu Shimomura, Misaki Moriishi, Shinichiro Tsuchiya, Kiyohiko Dohi

We performed total enterolysis in 130 patients with encapsulating peritoneal sclerosis (EPS) between 1993 and 2007. The postoperative survival rate was 93.1%. However, 33 of the patients (25.4%) required additional surgery for recurrent bowel obstruction. To prevent recurrent bowel obstruction, we investigated various techniques following total enterolysis.

In 7 patients, we employed the splinting method, in which the intestinal tract is fixed for 1 week after surgery by the insertion of a long intestinal tube. In 3 of the patients, recurrence was detected within 6 months after surgery. We therefore ceased using splinting. From April 2007, we performed the Noble plication procedure, in which intestine-to-intestine suturing is performed to prevent recurrent bowel obstruction, in 17 patients. None of those patients experienced a recurrence during 8 months of follow-up. In 7 patients showing marked calcification or repeated recurrence, we performed anastomosis of the superior jejunum and transverse colon after adhesiotomy. In 5 patients, excluding 2 with recurrence, improvement was achieved.

Total enterolysis for EPS relieved bowel obstruction in most patients. However, after surgery, bowel obstruction recurred in some cases. Thus, strategies to reduce recurrence should be established. Currently, we use total enterolysis and Noble plication as our standard techniques. Further basic and clinical studies regarding EPS prevention and treatment should be conducted.

Key words

Encapsulating peritoneal sclerosis, EPS, surgery

Introduction

Encapsulating peritoneal sclerosis (EPS) is manifested as bowel obstruction syndrome, in which intraperitoneal inflammation leads to adhesive and inflammatory encapsulation of the intestinal tract, causing bowel obstructive symptoms. With the widespread use of peritoneal dialysis (PD), the number of patients with EPS as a fatal PD-related complication has increased (1,2). Some investigators have recommended that PD therapy be avoided. However, recent clinical studies have clarified the pathogenesis of EPS and have proposed therapeutic strategies (3).

In particular, the surgical option was previously contraindicated in patients with EPS. However, since our clinical trial, total enterolysis has been established as a viable treatment for EPS (4–6). Previous studies showed that intestinal adhesiotomy makes postoperative oral ingestion possible in most patients. However, adhesion-related intestinal obstruction recurs in approximately 25% of patients, requiring additional surgery (6). For these patients, EPS is still a fatal complication; management strategies should be established as soon as possible.

In the present study, we examined techniques to prevent recurrent adhesion and intestinal obstruction following enterolysis in patients experiencing recurrence after surgery for EPS.

Methods

Surgical procedure

Considering the mechanism of development of EPS, the surgical technique is simple, involving only the division of peritoneal adhesions by repeated lysis of fibrin membranes with a sharp instrument (4–6). The main point of the surgery is to start with the adhesions that can be easily lysed; thus, in many cases,

adhesiolysis of the mesenteric side is performed first and encapsulated intestinal loops are lysed last. If the latter task is difficult, a simple longitudinal incision of the capsules on the intestinal surface can be made, but the lesions causing the intestinal obstruction must be removed. (Recently, to identify the site of stenosis, we have been inserting a Miller–Abbott ileus tube with an inflated balloon to the end of the ileum once enterolysis is complete.) However, because the fibrin membranes are continuous with the altered peritoneum, no serosa is present, making it difficult to identify the plane of separation. Subsequent development of severe peritoneal calcification makes the adhesiolysis more difficult. Errors in adhesiolysis procedures or careless intestinal traction easily results in intestinal perforation. Attention should also be paid to the possibility of delayed perforation in thinned-out portions of intestine from increased peristalsis 2–3 days after surgery.

If degeneration of the perforated portion is marked, serosal suturing is impossible, and even if the perforation is sutured, intestinal perforation may recur, which poses a challenge regarding whether to surgically create a jejunostomy. In addition, in some patients, adequate peristalsis does not occur even after adhesiolysis. No surgical techniques for these patients have been established to date, and an error in judgment leads to a fatal outcome. However, these severe functional deteriorations should not create hesitation in performing surgery.

Technique to prevent recurrent bowel obstruction

Surgery can reverse the bowel obstruction, but it does not improve the peritoneal deterioration, leading to reformation of capsules and recurrence of EPS in some patients 6–12 months later. In addition, adhesions also occur as a result of surgical injury to the intestinal wall and mesenteric serosa. Some patients cannot be relieved of bowel obstruction resulting from the failure to perform a complete adhesiolysis, which further emphasizes that EPS is a serious complication of PD.

Recently, we have been using several procedures to try to prevent recurrent small-bowel obstruction resulting from adhesions after total enterolysis:

- Splinting: a long Miller–Abbott intestinal tube is passed into the small bowel to the point of obstruction and is left to indwell for 1 week after surgery.

- Noble plication: Intestine-to-intestine suturing is performed to prevent re-obstruction of the bowel. This procedure prevents not only passage disturbance resulting from kinking and adhesion of the small intestine, but also escape of the bowel into the pelvic cavity and formation of further adhesions. Usually, the entire small intestine is fixed between the mesenteric and antimesenteric borders from the ileum end proximally.
- Bypass anastomosis: Patients experiencing recurrence or those presenting difficulties in complete adhesiolysis because of intestinal wall calcification require bypass between the oral site jejunum and large intestine.

Statistics

Categorical data are expressed as numbers and percentages. The recurrence rate during follow-up was estimated by the Kaplan–Meier method. A difference was considered significant when the *p* value was less than 0.05.

Results

Our first encounter with a patient with EPS who underwent surgical enterolysis and was completely cured occurred in 1993. Since that time (to the end of 2007), we have performed 178 enterolysis procedures in 130 patients and observed improvement in all of them, except 9 who died after surgery.

Table I lists the surgical EPS patients seen by us to date. All were withdrawn from PD after a mean period on therapy of 124.3 months (range: 28.7–224.2 months), and 124 (95.4%) of them developed EPS after withdrawal from PD. Of the 124 patients who developed EPS after PD withdrawal, 58 (46.8%) underwent peritoneal lavage after PD withdrawal, and of all 130 EPS patients, 94 (72.3%) received steroids after development of the condition. The mean time from development of EPS to surgery was 12.8 months (range: 1–84 months). Nine patients (6.9%) died postoperatively of sepsis resulting from intestinal perforation. Another 3 long-term deaths occurred because of malnutrition and sepsis resulting from recurrent EPS.

Table II summarizes the techniques performed in our series. In 106 patients (including 7 who died) and 144 surgeries, intestinal procedures were not added after enterolysis. In 24 patients, additional surgery was required; in 1, intestinal degeneration was less marked, and resection of the small intestine was performed

TABLE I Surgical cases of peritoneal dialysis (PD)-related encapsulating peritoneal sclerosis (EPS), 1993 to 2007

| | |
|--|--------------------------|
| Total cases (<i>n</i>) | 130 |
| Total surgeries (<i>n</i>) | 178 |
| Mean PD duration [months (range)] | 124.3 (28.7–224.2) |
| EPS onset after withdrawal from PD [<i>n</i> (%)] | 124 (95) |
| Mean PD withdrawal to EPS onset [months (range)] | 12.7 (0–64) ^a |
| Mean EPS onset to surgery [months (range)] | 12.8 (1.0–84.0) |
| Received post-PD peritoneal lavage [<i>n</i> (%)] | 58 (46.8) ^a |
| Corticosteroids administered after EPS onset [<i>n</i> (%)] | 94 (72.3) |
| Postsurgical death [<i>n</i> (%)] | 9 (6.9) |
| Re-surgery cases [<i>n</i> (%)] | 33 (25.4) |
| Surgeries in re-surgery cases (<i>n</i>) | |
| 2 surgeries | 22 |
| 3 surgeries | 9 |
| 4 surgeries | 1 |
| 6 surgeries | 1 |

^a Excludes patients with EPS onset during peritoneal dialysis.

and achieved improvement. From November 2006, we employed the splinting method in 7 patients. In 3 of the 7, recurrence was detected within 6 months after surgery. We therefore abandoned the splinting method thereafter. From April 2007, we performed Noble plication in 17 patients. In all 17 patients, no recurrence was observed. In 7 patients showing marked calcification or repeated recurrence, we performed anastomosis of the superior jejunum and transverse colon after adhesiotomy. In 5 patients, improvement was achieved; 2 others recurred.

As shown in Figure 1, we compared the course of relapse between patients who underwent Noble plication procedure and those who underwent all other procedures for their initial surgery. During the 8-month follow-up, we observed no cases of relapse in the Noble procedure patients.

Discussion

Previously, the literature contained only case reports of the use of the surgical option for EPS (7–9). However, recent advances in clinical research have established pathogenesis, course, and a treatment strategy (3). Surgery was previously contraindicated in patients with EPS, and most patients treated surgically died of peritonitis as a postoperative complication. These deaths occurred because the pathogenesis of EPS was not well understood, and in many cases, simple resection of adherent intestinal loops with entero-anastomosis was performed by surgeons who had never been involved in PD. We developed a surgical technique involving total intestinal enterolysis without enterectomy, and since then, we have treated patients in the

TABLE II Surgical techniques for encapsulating peritoneal sclerosis (EPS), from among 178 total surgeries

| <i>Surgical technique</i> | <i>Surgeries (n)</i> | <i>Recurrence [n (%)]</i> |
|-----------------------------------|----------------------|---------------------------|
| Enterolysis | 144 | 38 (26.4) |
| with Noble plication | 17 | 0 |
| with splinting | 7 | 3 (42.9) |
| with jejunocolostomy | 7 | 2 (28.6) |
| with jejunoleostomy | 2 | 1 (50) |
| with ileostomy and ileo-ileostomy | 1 | 0 |

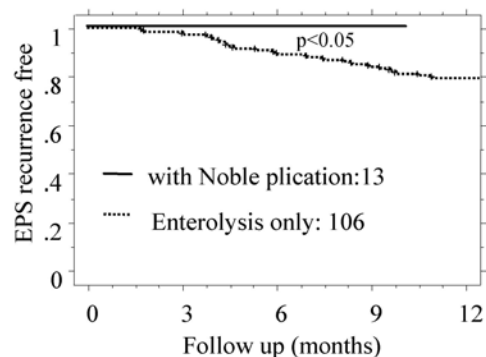


FIGURE 1 Probability of remaining encapsulating peritoneal sclerosis (EPS)-recurrence free after first surgery.

belief that surgical therapy is the only curative treatment for established EPS (4–6). In the period between 1993 and the end of 2007, we performed enterolysis in 130 patients and achieved improvement in all except 9 patients who died after surgery (mortality rate: 6.9%).

However, some patients experienced a recurrence several months after surgery and required a second (and sometimes a third) surgery. These patients were diagnosed with EPS recurrence because of new encapsulation. Of the 130 patients who have undergone surgery to date, 33 required re-surgery—some requiring up to 6 operations.

We noted that the number of microvessels was significantly higher in recurrent patients (6). Vascular hyperplasia of this kind may be closely involved in EPS development, requiring confirmatory peritoneal biopsy, investigation of the mechanisms, and improvement in methods. However, during surgery, the pathology findings were unclear, and we observed no marked differences in the state of PD nor in the laparotomy findings between recurrent and nonrecurrent patients. Intraoperative evaluation is therefore difficult.

Total enterolysis results in injury to the intestinal wall and mesentery, leading to adhesion. Since 2006, we have developed a positive technique to prevent recurrent bowel obstruction related to adhesions. In the field of gastroenterologic surgery, many procedures to prevent recurrent small bowel obstruction have been designed. However, no single procedure has been established.

Noble developed the plication procedure in 1937 (10). In the original procedure, continuous interval-locked suturing involving the small bowel and mesentery is performed, and a “lazy” loop is prepared. Since then, various modifications have been designed (11). We fix the intestinal tract by interrupted suturing at several points, believing that continuous interval-locked suturing may lead to intestinal injury because of the fragility of the intestinal wall in the presence of EPS.

White designed the splinting method in 1956 (12). In the splinting method, a long intestinal tube (Miller–Abbott type) is passed into the small intestine to the point of the obstruction, and internal fixation of the intestinal tract is performed for a few weeks after surgery. Munro and Jones developed a modified method in 1997, using insertion of a Jones tube (13,14). In the United Kingdom, this technique has been tried during surgical treatment of EPS (15).

We employed the splinting method using an intestinal tube (Miller–Abbott type) in 7 patients. However, splinting was not effective, and we did not use splinting thereafter. We performed Noble plication in 17 patients. Although the follow-up period has been short, no recurrence has been detected in any Noble

plication case, suggesting the usefulness of the procedure. However, neither an accepted method for small-intestine fixation nor criteria regarding the extent of fixation have been established, and no long-term results have been obtained. Further investigation is therefore needed before this procedure becomes a standard technique.

In patients in whom complete small-intestine lysis is difficult because of marked calcification or recurrent adhesions or in whom intestinal obstruction persists even when lysis is possible, no procedure other than jejunocolostomy is available. However, not only the small intestine but also the large intestine shows degeneration; suture failure may occur. Careful technique is needed. Furthermore, the risk of short-intestine syndrome must be considered. We performed jejunocolostomy in 7 patients, and suture failure did not occur in any of them. In 2 patients, passage disturbance was not relieved, and percutaneous endoscopic gastrostomy was required for long-term total parenteral nutrition and intestinal decompression.

Conclusions

We have performed total enterolysis for EPS with positive results, and relief of bowel obstruction has been achieved in a large number of patients. However, after surgery, symptoms recurred in some patients. Preventive strategies should be established in the future. Currently, we use total enterolysis and Noble plication as standard techniques. However, these approaches require long-term assessment. In addition, in some patients, the absence of complete healing has led to a fatal outcome. Further basic and clinical studies regarding EPS prevention and treatment should be conducted.

References

- 1 Nomoto Y, Kawaguchi Y, Kubo H, Hirano H, Sakai S, Kurokawa K. Sclerosing encapsulating peritonitis in patients undergoing continuous ambulatory peritoneal dialysis: a report of the Japanese Sclerosing Encapsulating Peritonitis Study Group. *Am J Kidney Dis* 1996;28:420–7.
- 2 Rigby RJ, Hawley CM. Sclerosing peritonitis: the experience in Australia. *Nephrol Dial Transplant* 1998;13:154–9.
- 3 Kawaguchi Y, Saito A, Kawanishi H, *et al.* Recommendations on the management of encapsulating peritoneal sclerosis in Japan, 2005: diagnosis, predictive markers, treatment, and preventive measures. *Perit*

- Dial Int 2005;25(suppl 4):S83–95.
- 4 Kawanishi H, Harada Y, Sakikubo E, Moriishi M, Nagai T, Tsuchiya S. Surgical treatment for sclerosing encapsulating peritonitis. *Adv Perit Dial* 2000;16:252–6.
 - 5 Kawanishi H, Watanabe H, Moriishi M, Tsuchiya S. Successful surgical management of encapsulating peritoneal sclerosis. *Perit Dial Int* 2005;25(suppl 4):S39–47.
 - 6 Kawanishi H, Moriishi M, Tsuchiya S. Experience of 100 surgical cases of encapsulating peritoneal sclerosis: investigation of recurrent cases after surgery. *Adv Perit Dial* 2006;22:60–4.
 - 7 Jackson BT. Surgical treatment of sclerosing peritonitis caused by practolol. *Br J Surg* 1977;64:255–7.
 - 8 Smith L, Collins J, Morris M, Teele R. Sclerosing encapsulating peritonitis associated with continuous ambulatory peritoneal dialysis: surgical management. *Am J Kidney Dis* 1997;29:456–60.
 - 9 Assalia A, Schein M, Hashmonai M. Problems in the surgical management of sclerosing encapsulating peritonitis. *Isr J Med Sci* 1993;29:686–8.
 - 10 Noble TB. Plication of small intestine as prophylaxis against adhesions. *Am J Surg* 1937;35:41–4.
 - 11 Seabrook DB, Wilson ND. Prevention and treatment of intestinal obstruction by use of the Noble procedure. *Am J Surg* 1954;88:186–93.
 - 12 White RR. Prevention of recurrent small bowel obstruction due to adhesions. *Ann Surg* 1956;143:714–19.
 - 13 Munro A, Jones PF. Operative intubation in the treatment of complicated small bowel obstruction. *Br J Surg* 1978;65:123–7.
 - 14 DeFriend DJ, Klimack OE, Humphrey CS, Schraibman IG. Intraluminal stenting in the management of adhesional intestinal obstruction. *J R Soc Med* 1997;90:132–5.
 - 15 Devulapally P, Lam FT, Stein A. Encapsulating peritoneal sclerosis—a life-threatening condition treated successfully with adhesiolysis and Jones tube insertion [letter]. *NDT Plus* 2008;1:190.

Corresponding author:

Hideki Kawanishi, MD, Tsuchiya General Hospital, 3-30 Nakajima-cho, Naka-ku, Hiroshima 730-8655, Japan.

E-mail:

h-kawanishi@tsuchiya-hp.jp