




Management of Sigmoid Volvulus: A Literature Review

Sabri Selcuk Atamanalp¹  Esra Disci¹ Rifat Peksoz¹ Refik Selim Atamanalp²
Cansu Tatar Atamanalp³

¹ Department of General Surgery, Ataturk University Faculty of Medicine, Erzurum, Turkey

² Department of Medical Pathology, Prof. Dr. Cemil Taşçioğlu City Hospital, İstanbul, Turkey

³ Department of Pediatrics, Haseki Education and Research Hospital, İstanbul, Turkey

Address for correspondence Sabri Selçuk Atamanalp, MD, Department of General Surgery, Faculty of Medicine, Ataturk University, Erzurum 25040, Turkey (e-mail: ssa@atauni.edu.tr).

Ibnosina J Med Biomed Sci 2024;16:5–9.

Abstract

Sigmoid volvulus (SV) is a rare form of intestinal obstruction in which the sigmoid colon twists around its own base. Endoscopic detorsion is the primary treatment in uncomplicated patients, while urgent surgery is required in the cases with bowel perforation, peritonitis, and unsuccessful endoscopic detorsion. In surgery, the gangrenous sigmoid colon is managed by resection, whereas sigmoid detorsion alone or with an additional recurrence-reducing procedure is applied in patients with viable bowel. However, the risk of recurrence following endoscopic or operative detorsion alone is as high as 90% with a risk of mortality up to 35%. To prevent or reduce SV recurrence, some selected cases require emergent or elective recurrence-preventive management including sigmoidopexy, mesopexy, mesoplasty, extraperitonealization, sigmoidectomy, and endoscopic percutaneous sigmoidopexy. However, the indications, techniques, and results of the above-mentioned procedures are controversial. In this review, the treatment options of SV and patient selection criteria for recurrence-preventive treatments are discussed.

Keywords

- ▶ sigmoid volvulus
- ▶ management
- ▶ follow-up
- ▶ recurrence
- ▶ recurrence prevention

Introduction

The incidence of sigmoid volvulus (SV) is 3 to 5% within all intestinal obstructions in most western societies. This rate is 20 to 50% in the Middle East, North and South Asia, Africa, East and North Europe, and North and South America, which are known as the “volvulus belt.”^{1,2} A combination of abdominal pain, distention, and obstipation should alert the practitioners to the possibility of an SV, particularly in adult and elderly men in endemic regions.^{3,4} Although abdominal

plain X-rays generally suspect SV by revealing a “coffee bean” sign, abdominal computed tomography has high sensitivity and specificity by demonstrating “mesenteric whirl sign.”^{5,6} Resuscitation followed by endoscopic detorsion or surgery is essential in emergency treatment.^{7,8} However, SV tends to recur and despite its benign nature, it has a relatively poor prognosis particularly in patients with bowel gangrene or peritonitis.^{9,10} In this review, we discuss the urgent endoscopic and/or surgical management as well as the recurrence-preventive procedures in SV.

article published online
November 1, 2023

DOI <https://doi.org/10.1055/s-0043-1776142>.
ISSN 1947-489X.

© 2023. The Libyan Biotechnology Research Center. All rights reserved.

This is an open access article published by Thieme under the terms of the Creative Commons Attribution-NonDerivative-NonCommercial-License, permitting copying and reproduction so long as the original work is given appropriate credit. Contents may not be used for commercial purposes, or adapted, remixed, transformed or built upon. (<https://creativecommons.org/licenses/by-nc-nd/4.0/>)

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

Urgent Management

In SV, spontaneous detorsion is expected in less than 2% of cases and the rest of the patients require urgent treatment.^{11,12} Following an early and effective resuscitation, current guidelines strongly recommend flexible endoscopic detorsion as the first-line management in the cases in which bowel gangrene, perforation, or peritonitis is not suspected or determined in clinical and radiological examinations.^{3,5,7,13} Similarly, data obtained from actual reviews and large series articles support this idea.^{2,14–20} Additionally, although randomized controlled data are sufficient to evaluate its role, the placement of a flatus tube proximal to obstruction for 24 to 72 hours is traditionally advocated to prevent an early recurrence.^{7,9,14,15} The success of endoscopic detorsion is reported to be between 55 and 96%.^{2,5,7,9,14,19,21–23} This procedure may be performed with 0 to 10% of mortality and 1 to 25% of morbidity rates.^{2,10,14,19,22,24} Following a successful endoscopic detorsion, early recurrence, during the first hospitalization, is about 5 to 25%.^{2,5,10,14,19,22} Medium-term recurrence, within about 1 month, is 15 to 30%, while long-term recurrence rises up to 43 to 90% with a mean of 4.4 (range: 2–25) volvulus attacks.^{1–3,5,7–9,12–14,18,23–27}

Urgent surgery is required in about 25% of SV patients in whom endoscopic detorsion is unsuccessful or bowel gangrene and/or peritonitis are present.^{2,5,10} If the bowel is viable, as the fastest and simplest surgical procedure, operative detorsion alone is weakly recommended in high operative risk patients with 1 to 10% mortality, 2 to 25% morbidity, and 40 to 60% recurrence rates.^{2,5,9,19} Urgent sigmoid resection is strongly recommended in the cases with gangrenous or perforated bowel to prevent mortality arising from endotoxin release and shock. The procedure is required in 5 to 20% of SV patients.^{2,5,10,13,17,19} Following resection, bowel continuity is provided via primary anastomosis or stoma with 5 to 10% or 20 to 30% mortality and 10 to 30% or 30 to 60% morbidity rates, respectively, in addition to 0 to 1% recurrence rates in both.^{2,5,9,10,13,17,19,20,24,27,28}

Recurrence

An elongated and dilated sigmoid colon with a long mesentery, dolichosigmoid, is the main factor in the development of both primary and recurrent SV.^{15,23,28–32} Other factors affecting recurrence are advanced age, male gender, early onset, high-fiber diet, high altitude, and chronic constipation.²⁹ Although the extension of the sigmoid colon to the subphrenic space and the decrease of left lateral hepatic section volume are suspected as recurrence-augmentative findings in computed tomography, increased maximal sigmoid colon distention is the most effective precursor relating to dolichosigmoid.^{29,33,34} The expected recurrence rates of each treatment options are given in the above- and below-mentioned sections.

Recurrence-Preventive Management

Sigmoidopexy (colopexy) is the fixation of the antimesenteric edge of the sigmoid colon to the abdominal wall with

sutures (►Fig. 1A).^{32,35} This procedure is generally used in emergent surgery in bedridden patients, whereas it is less recommended in open or laparoscopic elective surgery due to its relatively high recurrence rate.^{2,10,13} Although single-point fixation is possible, it allows for re-rotation of the sigmoid colon around apical basal line resulting in SV recurrence. For this reason, multiple-point fixation is preferred to reduce recurrence risk, which may cause increased risk of leakage.^{32,35} Internal hernia through sigmoid colon and abdominal wall is another rare complication.^{2,10} Expected mortality, morbidity, and recurrence rates of this technique are 1 to 8%, 10 to 20%, and 10 to 35%, respectively.^{1,2,5,10,19,36}

In mesopexy (mesosigmoidopexy), sigmoid mesentery is fixed parietal peritoneum by using sutures (►Fig. 1B).^{32,37} Similar to sigmoidopexy, mesopexy is generally used as an urgent procedure in ill-conditioned patients.^{2,10} To reduce recurrence risk, a horseshoe-shaped suturing is preferred. However, fixation must be performed carefully to avoid blocking mesenteric vessels.^{32,37} The prognosis of this technique is similar to sigmoidopexy with 1 to 8% mortality, 10 to 20% morbidity, and 10 to 25% recurrence rates.^{1,2,10,19,37}

Mesoplasty (mesosigmoidoplasty) is a relatively onerous procedure, in which the sigmoid mesentery is cut longitudinally and sutured transversely to distort the dolichosigmoid (►Fig. 1C).^{32,37} It is also a less recommended technique in the cases with moderate general situation, particularly in urgent surgery.^{2,10,13} It takes longer time in addition to its

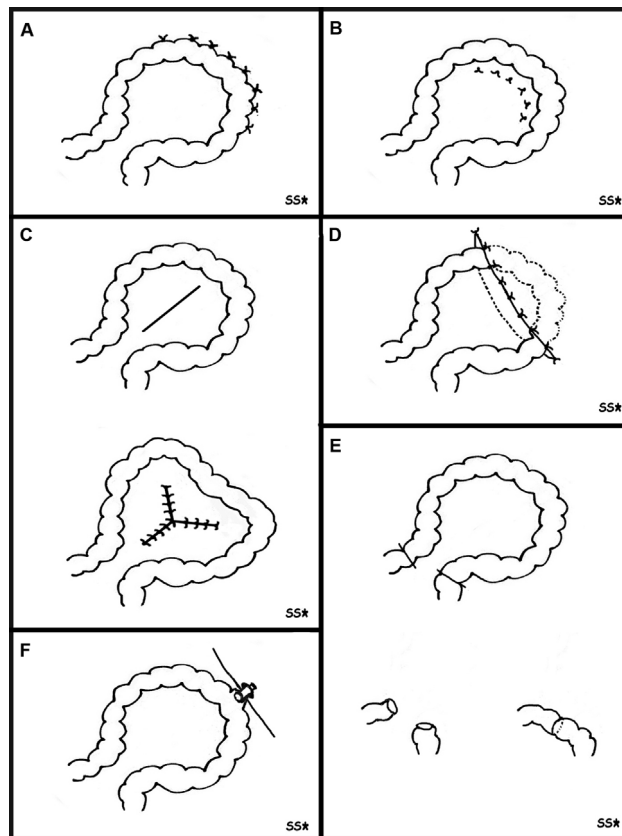


Fig. 1 Recurrence-reducing procedures in sigmoid volvulus. (A) Sigmoidopexy. (B) Mesopexy. (C) Mesoplasty. (D) Extraperitonealization. (E) Sigmoidectomy. (F) Tube sigmoidopexy.

mesenteric devascularization risk.^{32,37} This procedure carries 1 to 10% mortality, 10 to 30% morbidity, and 5 to 15% recurrence risks.^{2,5,10,19,37-39}

In extraperitonealization, the apical part of the sigmoid colon is fixed to the parietal peritoneum by using a peritoneal flap (►Fig. 1D), which may be performed by open or laparoscopic surgery.^{40,41} It is rarely recommended in emergency surgeries in patients in poor health.^{10,19,40,41} The results of this procedure are also similar to sigmoidopexy with 1 to 8% mortality, 10 to 20% morbidity, and 10 to 25% recurrence rates.^{5,10,19,40,41}

In sigmoidectomy, resection of the maximal sigmoid colon length without left colon mobilization that allows for a tension-free anastomosis is the main point to consider (►Fig. 1E).^{10,19,42,43} As an elective procedure, it is strongly recommended in well-conditioned and nonelderly patients to prevent SV recurrence.^{3,5,7,10,13,19} Sigmoidectomy may be performed by open surgery or preferably laparoscopy, and following resection, stoma or preferably primary anastomosis is added.^{3,5,7,10,13,19,27,36} The mortality is 0 to 2%, the morbidity is 10 to 25%, and the recurrence is 0 to 1%.^{1,3,5,10,19,24,26,36,42,43} In this field, the best innovation of the recent time is natural orifice specimen extraction with laparoscopic sigmoidectomy and primary anastomosis.⁴⁴⁻⁴⁶

Percutaneous endoscopic sigmoidopexy (PES; or PE colopexy or PE colostomy [PEC]) is the fixation of the apex of the sigmoid colon to the anterior abdominal wall by using endoscopic stoma kits (►Fig. 1F).^{32,36,47-50} Although this procedure is technically a colostomy, its main purpose is colopexy, which is less recommended in selected patients in whom operative intervention presents a prohibitive risk.^{1,13,19,32} The mortality, morbidity, and recurrence rates of this technique are 8 to 15%, 15 to 30%, and 10 to 35%, respectively.^{5,19,32,47,48}

Observation without any surgical or endoscopic intervention is the last ditch in high operative risk and elderly cases with high mortality rates up to 10% in early, 20% in medium, and 35% in late periods due to its recurrence rates as high as 90%.^{5,10,14,24,26}

Patient Selection Criteria for Recurrence-Preventive Management

In the utilization of the recurrence-preventive procedures in SV, almost of the current guidelines, reviews, and large series articles use two important criteria for case selection: general performance status (well-conditioned or poor-conditioned) and age (elderly or nonelderly).^{2,3,5,7,13-20,22-24,26-28} However, as objective criteria, the American Society of Anesthesiologists (ASA) scoring system is a better parameter in the evaluation of the general status, and life expectancy is superior to age limit when elderliness is taken into consideration.¹⁹ Therefore, we offer elective laparoscopic sigmoid colectomy with primary anastomosis in patients with ASA scores of 1 to 3 and younger than life expectancy, while patients with ASA scores greater than 3 and older than the above-mentioned life expectancy limit are potential individuals for other minimal invasive procedures including

sigmoidopexy, mesopexy, mesoplasty, extraperitonealization, and preferably endoscopic percutaneous sigmoidopexy.

Sigmoid Volvulus in Childhood

SV is rare and recurrent SV is extremely rare in childhood.^{2,25,29,51,52} The first-line treatment is endoscopic detorsion in children with uncomplicated SV, but it requires pediatric endoscope and expertise.⁵³ However, recurrence is common in adults and elders with childhood-onset SV, which is reported at a mean of 25 to 35% and up to 100%.^{7,29} For this reason, following endoscopic detorsion, elective surgery including sigmoidectomy with primary anastomosis, preferably laparoscopic procedure, is mandatory in children.^{53,54}

Sigmoid Volvulus in Pregnancy

SV is rare in females, but pregnancy is a precipitating factor in the development of SV.^{2,5,55,56} A little more than 110 patients with SV complicating pregnancy have been reported to date and the number of the recurrent cases can be counted on the fingers of one hand. Endoscopic detorsion is the optimal choice in uncomplicated patients in all trimesters.^{2,55,56} In the first trimester, elective surgery is delayed to the second trimester, in which sigmoidectomy may be performed safely. Endoscopic decompression is the prescribed treatment in the third trimester as well until delivery and given the complexities of operating on a postgravid uterus, surgery is generally delayed to a few weeks postpartum.^{20,55,56}

Sigmoid Volvulus in Elderliness

Both primary and recurrent SV are common in elders accompanied by relatively poor prognosis.^{2,57,58} For this reason, following endoscopic decompression, elective surgery is recommended in selected well-conditioned cases, while PES and observation alone are other alternatives for patients with high operative risks.^{2,57-60}

Clinical Experience

Although SV is a rare disease, it is relatively common in Eastern Anatolia. For this reason, the experience of Ataturk University including 1,071 cases treated over 57 years (from June 1966 to June 2023) involves the most comprehensive single-center SV series over the world.^{2,14} In this series, nonoperative detorsion was tried in 790 patients with 83.2% success rate, 0.6% mortality, 2.2% morbidity, and 5.3% early recurrence rates. Emergency surgery was required in 486 cases, and the mortality, morbidity, and early recurrence rates were 17.3, 34.2, and 0.6%, respectively. Elective sigmoid colectomy (95 open and 20 laparoscopic, with the latter being the preferred procedure in recent years) was applied in 115 patients with 0% mortality and 11.3% morbidity rates, while recurrence was not observed during follow-up in 57 cases at a mean of follow-up period of 22.7 years.

Regarding the special considerations, due to the absence of pediatric endoscope, 12 children required emergency surgery. In the pediatric population, the mortality and morbidity rates were 33.3%. On the other hand, endoscopic detorsion was tried in 7 of 11 pregnant patients with 85.7% success rate, while emergency surgery was performed in 5 patients. Among pregnant patients, the mortality and morbidity rates were 9.1%. Finally, 182 patients were older than 70 years, while 101 and 11 patients were older than 80 and 90 years, respectively. As expected, 65 (77.4%) decedent cases were older than 60 years.

Conclusions

In SV, flexible endoscopic detorsion is the first-line management in uncomplicated patients (without bowel gangrene, perforation or peritonitis), while emergency surgery is needed in some patients with adverse conditions discussed earlier or in cases of unsuccessful endoscopic detorsion. The risk of SV recurrence is as high as 90% with a risk of mortality of up to 35% in patients treated with detorsion alone. Although sigmoidopexy, mesopexy, mesoplasty, extraperitonealization, and percutaneous endoscopic sigmoidopexy are known as recurrence-reducing procedures, sigmoidectomy is a champion in recurrence prevention.

Authors' Contribution

S.S.A. proposed the study, performed the literature searches, and drafted the manuscript. All the authors reviewed the whole document for intellectual content. All the authors approved the final version of the manuscript.

Compliance with Ethical Principles

No ethical approval is required for this type of study (review article).

Funding and Sponsorship

None.

Conflict of Interest

None declared.

References

- Lai SH, Vogel JD. Diagnosis and management of colonic volvulus. *Dis Colon Rectum* 2021;64(04):375–378
- Atamanalp SS, Peksoz R, Dişçi E. Sigmoid volvulus and ileosigmoid knotting: An update. *Eurasian J Med* 2022;54(Suppl 1):91–96
- Miller AS, Boyce K, Box B, et al. The Association of Coloproctology of Great Britain and Ireland consensus guidelines in emergency colorectal surgery. *Colorectal Dis* 2021;23(02):476–547
- Atamanalp SS. Sigmoid volvulus: diagnosis in 938 patients over 45.5 years. *Tech Coloproctol* 2013;17(04):419–424
- Tian BWCA, Vigutto G, Tan E, et al. WSES consensus guidelines on sigmoid volvulus management. *World J Emerg Surg* 2023;18(01):34
- Atamanalp SS, Disci E. Sigmoid volvulus: diagnostic modalities and sigmoid gangrene. *Eurasian J Med* 2021;53(02):166–167
- Naveed M, Jamil LH, Fujii-Lau LL, et al. American Society for Gastrointestinal Endoscopy guideline on the role of endoscopy in the management of acute colonic pseudo-obstruction and colonic volvulus. *Gastrointest Endosc* 2020;91(02):228–235
- Atamanalp SS, Peksoz R. Sigmoid volvulus: treatment options and volvulus recurrence. *Emerg Care J* 2021;17(04):10294
- Rajan R, Clark DA. Current management of large bowel obstruction: a narrative review. *Ann Laparosc Endosc Surg* 2022;7(23):21–45
- Atamanalp SS. Treatment of sigmoid volvulus: a single-center experience of 952 patients over 46.5 years. *Tech Coloproctol* 2013;17(05):561–569
- Pattanaik SM. Emergency management of sigmoid colon volvulus in a volvulus belt population and review of literature. *Indian J Surg* 2018;80(06):599–605
- Atamanalp SS, Disci E, Atamanalp CT, Atamanalp RS. Spontaneous detorsion of sigmoid volvulus in a patient with nineteen-volvulus episode history: a rare outcome of an extremely rare clinical entity. *Pak J Med Sci* 2021;37(07):2029–2031
- Alavi K, Poylin V, Davids JS, et al; Prepared on behalf of the Clinical Practice Guidelines Committee of the American Society of Colon and Rectal Surgeons. The American Society of Colon and Rectal Surgeons clinical practice guidelines for the management of colonic volvulus and colonic pseudo-obstruction. *Dis Colon Rectum* 2021;64(09):1046–1057
- Atamanalp SS. Endoscopic decompression of sigmoid volvulus: review of 748 patients. *J Laparoendosc Adv Surg Tech A* 2022;32(07):763–767
- Atamanalp SS, Dişçi E, Peksoz R, et al. Recurrence-preventive role of flatus tubes following endoscopic decompression in sigmoid volvulus. *Turk J Gastroenterol* 2023;34(04):371–377
- Bauman ZM, Evans CH. Volvulus. *Surg Clin North Am* 2018;98(05):973–993
- Atamanalp SS. Expert commentary on the diagnosis and management of colonic volvulus. *Dis Colon Rectum* 2021;64(04):378–379
- Kapadia MR. Volvulus of the small bowel and colon. *Clin Colon Rectal Surg* 2017;30(01):40–45
- Atamanalp SS. Sigmoid volvulus: an update for Atamanalp classification. *Pak J Med Sci* 2020;36(05):1137–1139
- Perrot L, Fohlen A, Alves A, Lubrano J. Management of the colonic volvulus in 2016. *J Visc Surg* 2016;153(03):183–192
- Atamanalp SS, Atamanalp RS. The role of sigmoidoscopy in the diagnosis and treatment of sigmoid volvulus. *Pak J Med Sci* 2016;32(01):244–248
- Quénéhervé L, Dagouat C, Le Rhun M, et al. Outcomes of first-line endoscopic management for patients with sigmoid volvulus. *Dig Liver Dis* 2019;51(03):386–390
- Johansson N, Rosemar A, Angenete E. Risk of recurrence of sigmoid volvulus: a single-centre cohort study. *Colorectal Dis* 2018;20(06):529–535
- Loria A, Jacobson T, Melucci AD, et al. Sigmoid volvulus: evaluating identification strategies and contemporary multicenter outcomes. *Am J Surg* 2023;225(01):191–197
- Lofgran T, Koury R. A twist on adolescent abdominal pain in the emergency department. *Cureus* 2022;14(07):e27371
- Moro-Valdezate D, Martín-Arévalo J, Pla-Martí V, et al. Sigmoid volvulus: outcomes of treatment and predictors of morbidity and mortality. *Langenbecks Arch Surg* 2022;407(03):1161–1171
- Hardy NP, McEntee PD, McCormick PH, Mehigan BJ, Larkin JO. Sigmoid volvulus: definitive surgery is safe and should be considered in all instances. *Ir J Med Sci* 2022;191(03):1291–1295
- Emna T, Atef M, Sarra S. Management of acute sigmoid volvulus: a Tunisian experience. *Asian J Surg* 2022;45(01):148–153
- Korkut E, Peksoz R, Disci E, Atamanalp SS. Factors affecting recurrence in sigmoid volvulus. *Pak J Med Sci* 2023;39(01):150–153
- Raahave D. Dolichocolon revisited: an inborn anatomic variant with redundancies causing constipation and volvulus. *World J Gastrointest Surg* 2018;10(02):6–12

- 31 Bayeh AB, Abegaz BA. The role of sigmoid colon anatomic dimensions in the development of sigmoid volvulus, North-Western Ethiopia. *PLoS One* 2021;16(12):e0260708
- 32 Atamanalp SS, Atamanalp RS. Sigmoid volvulus: avoiding recurrence. *Tech Coloproctol* 2019;23(04):405–406
- 33 Humbert C, Grillet F, Malakhia A, et al. Stratification of sigmoid volvulus early recurrence risk using a combination of CT features. *Diagn Interv Imaging* 2022;103(02):79–85
- 34 Kusunoki R, Fujishiro H, Miyake T, et al. Initial computed tomography findings of long and distended colon are risk factors for the recurrence of sigmoid volvulus. *Dig Dis Sci* 2021;66(04):1162–1167
- 35 Atamanalp SS, Atamanalp RS. Reply to “Comment on colopexy in sigmoid volvulus recurrence.”. *Tech Coloproctol* 2019;23(09):935–936
- 36 Orban YA, Safwat K, Awad JRI, Asjour H, Yassin MA. Sigmoidopexy versus sigmoidectomy for sigmoid volvulus through left iliac incision in high-risk patients. *Egypt J Surg* 2023;41(01):135–140
- 37 Atamanalp SS, Atamanalp RS. Reply to “Comment on mesopexy and mesoplasty in sigmoid volvulus recurrence.”. *Tech Coloproctol* 2019;23(12):1179–1180
- 38 Akhtar M, Khan I. Management of viable sigmoid volvulus by mesosigmoidoplasty. *Gomal J Med Sci* 2009;7(01):7–9
- 39 Bach O, Rudloff U, Post S. Modification of mesosigmoidoplasty for nongangrenous sigmoid volvulus. *World J Surg* 2003;27(12):1329–1332
- 40 Aharoni M, Zager Y, Khalilieh S, et al. Laparoscopic fixation of volvulus by extra-peritonealization: a case series. *Tech Coloproctol* 2022;26(06):489–493
- 41 Gosavi R, Centauri S, Teoh W, Nguyen TC, Narasimhan V. Laparoscopic peritoneal flap sigmoidopexy—a video vignette. *Colorectal Dis* 2023;25(04):817–818
- 42 Ndong A, Patel B. Safety and efficacy of laparoscopic surgery in the management of sigmoid volvulus: a systematic review and meta-analysis. *Surg Open Dig Adv* 2022;6:100052
- 43 Nguyen SH, Tavares K, Chinn A, Russell D, Gillern S, Yheulon C. Is laparoscopy underutilized for sigmoid volvulus? *Surg Laparosc Endosc Percutan Tech* 2022;32(05):564–570
- 44 Uylas U, Gunes O, Kaplan K. A review of sigmoid volvulus and natural orifice specimen extraction surgery. *Ann Laparosc Endosc Surg* 2022;7(25):1–5
- 45 Seow-En I, Chang SC, Ke TW, Shen MY, Chen HC, Chen WTL, William Tzu-Liang Chen. Uncomplicated sigmoid volvulus is ideal for laparoscopic sigmoidectomy with transrectal natural orifice specimen extraction. *Dis Colon Rectum* 2021;64(05):e90–e93
- 46 Chen MZ, Cartmill J, Gilmore A. Natural orifice specimen extraction for colorectal surgery: early adoption in a Western population. *Colorectal Dis* 2021;23(04):937–943
- 47 Frank L, Moran A, Beaton C. Use of percutaneous endoscopic colostomy (PEC) to treat sigmoid volvulus: a systematic review. *Endosc Int Open* 2016;4(07):E737–E741
- 48 Coron E. Should we recommend PEC and when? *Endosc Int Open* 2016;4(07):E742–E743
- 49 Farkas N, Kenny R, Conroy M, et al. A single centre 20-year retrospective cohort study: percutaneous endoscopic colostomy. *Colorectal Dis* 2022;24(11):1390–1396
- 50 Jackson S, Hamed MO, Shabbir J. Management of sigmoid volvulus using percutaneous endoscopic colostomy. *Ann R Coll Surg Engl* 2020;102(09):654–662
- 51 Damkjaer MB, Farooqui W, Ifaoui I, Penninga L. Sigmoid volvulus in children. *BMJ Case Rep* 2021;14(5, S2):492–495
- 52 Lee B, Wu A. Pediatric sigmoid volvulus. *Pediatr Emerg Care* 2019;35(12):e232–e233
- 53 Parolini F, Orizio P, Bulotta AL, et al. Endoscopic management of sigmoid volvulus in children. *World J Gastrointest Endosc* 2016;8(12):439–443
- 54 Martin G, Montalva L, Paré S, et al. Robotic-assisted colectomy in children: a comparative study with laparoscopic surgery. *J Robot Surg* 2023;17(05):2287–2295
- 55 Bajaj M, Gillespie C, Dale J. Recurrent sigmoid volvulus in pregnancy. *ANZ J Surg* 2017;87(11):E226–E227
- 56 Cortez N, Berzosa M, Muddasani K, Ben-David K. Endoscopic decompression of sigmoid volvulus in pregnancy. *J Investig Med High Impact Case Rep* 2020;8:2324709620975939
- 57 Avots-Avotins KV, Waugh DE. Colon volvulus and the geriatric patient. *Surg Clin North Am* 1982;62(02):249–260
- 58 Dolejs SC, Guzman MJ, Fajardo AD, Holcomb BK, Robb BW, Waters JA. Contemporary management of sigmoid volvulus. *J Gastrointest Surg* 2018;22(08):1404–1411
- 59 Rajsiddharth B, Patlolla SR, Reddy BS, Sriramoju S, Palley BK, Maripeddi K. A clinical study of sigmoid volvulus. *Int J Sci Stud* 2016;3(10):158–162
- 60 Bruzzi M, Lefèvre JH, Desaint B, et al. Management of acute sigmoid volvulus: short- and long-term results. *Colorectal Dis* 2015;17(10):922–928