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Spinal anesthesia for endoscopic submucosal dissection of large rectosigmoid lesions: Feasibility study

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ABSTRACT

Background and study aims Colorectal endoscopic submucosal dissection (ESD) is often challenging and time-consuming. Prolonged sedation and general anesthesia are associated with a relevant risk of anesthesia-related adverse events (ARAEs), especially in elderly and frail patients. Spinal anesthesia (SA), a simple technique providing analgesia and motor block without systemic drug administration, has never been described in gastrointestinal endoscopy. We assessed the feasibility of SA in colorectal lesion ESD.

Patients and methods We retrospectively collected data on all consecutive patients who underwent ESD for colorectal laterally spreading tumors (LSTs) under SA in our center during the last 3 years. We evaluated the rates of technical success, i. e. ESD completion under SA without need of conversion to deep sedation or general anesthesia, and ARAEs after SA.

Results ESD under SA was performed on 20 rectosigmoid LSTs ≥ 35 mm. Technical success was achieved in 95.0% of cases (19/20), while one patient (5.0%) required conversion to deep sedation. Two patients (10.0%) experienced acute urinary retention that was successfully treated with temporary catheterization.

Conclusions Our initial experience suggests that SA for ESD of large rectosigmoid LSTs is feasible, and it may prove to be a valuable option, especially for elderly and frail patients.

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Introduction

Endoscopic submucosal dissection (ESD) of colorectal lesions provides good results in terms of en bloc resection and low adverse event (AE) rates [1, 2, 3]. However, large lesion ESD is often challenging, time-consuming, and it requires the patient to be in a still position for a long time, with significant abdominal pain frequently being reported both during and after the procedure.

Optimal sedation and analgesia are key factors for achieving technical success and minimizing AEs associated with ESD. While mild-to-moderate sedation may not provide sufficient pain relief and does not prevent involuntary movements of the patient, prolonged deep sedation with intravenous (IV) administration of opioids, benzodiazepines, and propofol may increase risk of serious anesthesia-related AEs (ARAEs), including hypoxia, hypercapnia, hypotension, and arrhythmias [4, 5]. Furthermore, for particularly long and complex endoscopic procedures, deep sedation may not be sufficient, and conversion to general anesthesia is sometimes necessary. Although a recent meta-analysis reported that desaturation and aspiration pneumonia rates are lower in patients undergoing ESD under general anesthesia than under sedation [6], orotracheal intubation may sometimes be a difficult maneuver with a relevant risk of AEs including aspiration pneumonia and pneumothorax, especially in elderly patients [7].

Spinal anesthesia (SA) is a safe, simple, and versatile neuraxial technique providing deep and fast analgesia and motor block by local anesthetic agent injection into the subarachnoid space [8], without the need for systemic drug administration. The increase in minimally invasive surgical procedures has been associated with wider use of SA, especially in endourology, inguinal hernia repairs, obstetric, gynecological, and hip surgeries [9, 10, 11]. A meta-analysis on 1 million patients who underwent major truncal or lower limb surgery showed that both length of hospital stay and incidence of respiratory AEs are lower following SA than general anesthesia [12]. Two retrospective studies reported that SA is safe and effective for transanal endoscopic microsurgery, with reduced perioperative opioid requirement and faster postoperative recovery compared with general anesthesia [13, 14]. However, use of SA has never been described in gastrointestinal endoscopy.

We aimed to assess the feasibility of SA for ESD of colorectal laterally spreading tumors (LSTs).

Patients and methods

This was an observational, retrospective analysis of data from all consecutive patients who underwent ESD for colorectal LSTs under SA, conducted in a single tertiary referral center between January 2021 and March 2024.

The decision to perform ESD using SA was made based upon discussion between the anesthetist, the endoscopist, and the patient during which risks, benefits, and possible alternative sedation options were outlined.

Inclusion criteria were patient age ≥ 18 years, American Society of Anesthesiologists (ASA) score I-IV, and ability to give informed consent. Exclusion criteria were patient age < 18 years, ASA score V, allergy to medications used for SA, pregnancy, or breastfeeding.

The study was conducted in accordance with the declaration of Helsinki.

All patients gave separate written informed consents for ESD and SA. The study was approved by the Research & Development office of our hospital and is reported following the STROBE guidelines [15].

SA technique and patient monitoring

Both SA and ESD procedures were performed in the endoscopic room of our service, in a non-operating room anesthesia setting. SA was performed by a consultant anesthetist. With the patient in sitting position, after L2-L3 intervertebral space recognition, a 25G needle was inserted with aseptic technique and correct positioning was confirmed by detecting free flow of cerebrospinal fluid. Subsequently, 10 to 12 mg of hyperbaric bupivacaine ± sufentanil 2 µg according to the decision of the anesthetist was administered intrathecally without barbotage. Finally, the patient was placed in supine position. Using the Bromage motor blockade scale, lower extremity motor block was evaluated intraoperatively and postoperatively until motor block fading was confirmed.

Patients were monitored with continuous electrocardiography (leads II + V5), continuous pulse oximetry, and noninvasive blood pressure measurement every 5 minutes intraoperatively and every 8 hours postoperatively during their hospital stay.

Pain was assessed intraoperatively and postoperatively during the hospital stay by means of a 1–10 Visual Analogic Scale (VAS) score. Every patient was reevaluated 30 days after ESD during a phone call or scheduled outpatient visit to assess for any ARAEs that could have been missed.

ESD technique

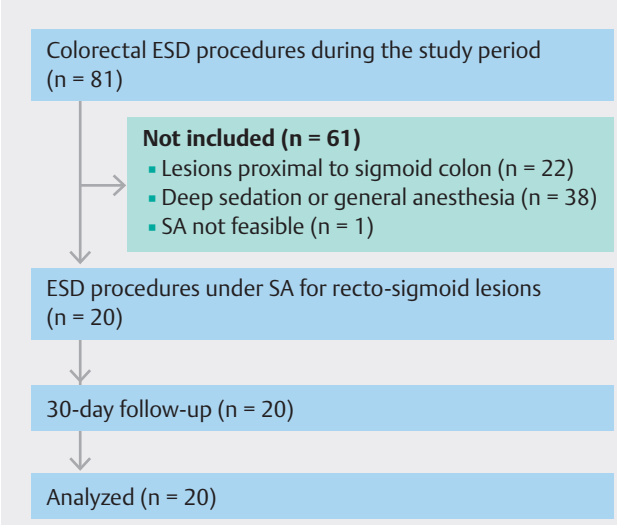
ESD was performed by a single endoscopist who had previously completed > 400 ESDs. ESD procedures were performed using carbon dioxide insufflation, Hybrid knife I-type or T-type (ERBE Elektromedizin, Tuebingen, Germany), and VIO3 D (ERBE Elektromedizin) power source for cut and coagulation currents.

Primary endpoint

The primary endpoint was evaluation of the feasibility of SA in rectosigmoid ESD by assessing rates of technical success, defined as completion of ESD under SA without need for conversion to deep sedation or general anesthesia, and ARAEs, evaluated intra-procedurally and post-procedurally for 30 days according to the consensus document from the International Sedation Task Force of the World Society of Intravenous Anaesthesia [16].

Secondary endpoints

Secondary endpoints were as follows: abdominal pain and ESD-related AEs, evaluated intra-procedurally and post-procedurally for 30 days, median SA duration (defined as time since start of the SA procedure to the start of ESD), and ESD duration and length of hospital stay.



▶ **Fig. 1** Study flowchart. ESD, endoscopic submucosal dissection; SA, spinal anesthesia.

Data collection and analysis

Continuous data were expressed as median (range). Categorical data were expressed as percentage with 95% confidence interval (CI), calculated using the Wilson method. SPSS software v.22 (IBM Corp, Armonk, New York, United States) was used for the analysis.

Results

Patient and lesion characteristics

Twenty patients (12 female, median age 68 years, range 46–92) underwent ESD under SA for rectosigmoid LSTs ≥ 35 mm during the study period (▶ **Fig. 1**). Demographic and clinical characteristics are shown in ▶ **Table 1**.

Median size of resected lesions was 40 mm (range 35–105). Eight lesions were localized in the ano-rectum, six in the rectum, three at the rectosigmoid junction, and three in the sigmoid colon. All lesions were resected en bloc. Resected lesions were adenomas with low-grade dysplasia (n = 3), adenomas with high-grade dysplasia (n = 10), and T1 adenocarcinomas (n = 7). Lesion characteristics are shown in ▶ **Table 2**. R0 was achieved in all patients. ESD was non-curative in four of 20 cases (20.0%) due to Sm > 1 level of invasion.

Primary endpoint

SA was performed with bupivacaine alone in 10 of 20 cases (50.0%), or with bupivacaine + sufentanil in 10 of 20 cases (50.0%). Overall, technical success was obtained in 19 of 20 patients (95.0%, 95% CI 76%-99%), i. e. in nine of 10 (90.0%) and 10 of 10 patients (100%) in whom SA was performed with bupivacaine alone or with bupivacaine + sufentanil, respectively. Conversion to deep sedation was required for one patient (5.0%) due to intra-procedural abdominal pain (VAS score = 7) (▶ **Fig. 2**). Conversion to general anesthesia was not needed for any patient.

▶ **Table 1** Demographic and clinical patient characteristics.

	Overall (n = 20)
Age, years, median (range)	68 (46–92)
Sex, n (%)	
▪ Female	12 (60.0)
▪ Male	8 (40.0)
Body mass index, median (range)	26.2 (18.1–31.2)
ASA score, n (%)	
▪ I	6 (30.0)
▪ II	10 (50.0)
▪ III	4 (20.0)
Mallampati score, n (%)	
▪ I	8 (40.0)
▪ II	9 (45.0)
▪ III	1 (5.0)
▪ IV	2 (10.0)
Antiplatelet or anticoagulant therapy, n (%)	
▪ Aspirin	3 (15.0)
▪ Dual antiplatelet therapy	1 (5.0)
▪ Direct oral anticoagulants	1 (5.0)
▪ None	15 (75.0)

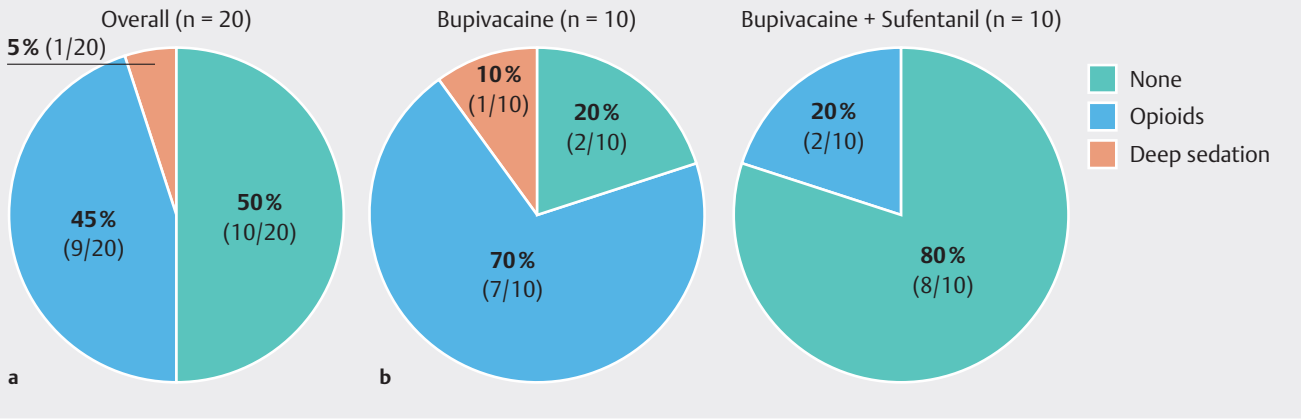
ASA, American Society of Anesthesiologists.

No severe ARAEs occurred. Minor ARAEs were observed in two of 20 patients (10.0%, 95% CI 3%-30%) in whom SA was performed with bupivacaine + sufentanil, who experienced acute urinary retention and were successfully treated with temporary catheterization.

Secondary endpoints

Except for the patient who required conversion to deep sedation, none of the patients reported intra-procedural abdominal pain with VAS score ≥ 3. Due to intra-procedural discomfort or pain with VAS score < 3, an additional 50 to 100 µg of IV fentanyl was required in nine of 20 patients (45.0%), i. e. in seven of 10 patients (70.0%) in whom SA was performed with bupivacaine alone and in two of 10 patients (20%) in whom SA was performed using bupivacaine + sufentanil (▶ **Fig. 2**).

Post-procedural abdominal pain was reported by three of 20 patients (15.0%) and it was controlled in all cases by administration of non-opioid analgesic therapy. Specifically, one patient reported abdominal pain (VAS score = 8, SA performed with bupivacaine alone) on the day of the procedure and was treated with 1 g of IV paracetamol, and two patients reported abdominal pain (VAS score = 7 and 3, SA performed with bupivacaine alone and with bupivacaine + sufentanil, respectively) on the day after the procedure and received 160 mg of ketopro-



▶ **Fig. 2** Intra-procedural need for additional opioid administration or for conversion to deep sedation **a** overall and **b** according to the medication used for spinal anesthesia.

▶ **Table 2** Rectosigmoid lesion characteristics.

	Overall (n = 20)
Lesion size, mm, median (range)	40 (35–105)
Lesion location, n (%)	
▪ Ano-rectum	8 (40.0)
▪ Rectum	6 (30.0)
▪ Rectosigmoid junction	3 (15.0)
▪ Sigmoid colon	3 (15.0)
Lesion morphology, n (%)	
▪ LST-granular type	2 (10.0)
▪ LST-granular-mixed type	14 (70.0)
▪ LST-non granular type	4 (20.0)
Lesion histology, n (%)	
▪ Adenoma	13 (65.0)
– Low-grade dysplasia	3 (15.0)
– High-grade dysplasia	10 (50.0)
▪ T1 adenocarcinoma	7 (35.0)
– Sm1	3 (15.0)
– Sm2	3 (15.0)
– Sm3	1 (5.0)

LST, laterally spreading tumor; Sm, submucosa.

fen + 3 g of IV paracetamol in total and 2 g of IV paracetamol, respectively.

ESD-related AEs occurred in two of 20 patients (10.0%). These included one intra-procedural perforation in an ESD for an 80-mm LST adjacent to the anal canal, treated with through-the-scope clips and radiologically-guided percutaneous drainage due to development of a collection, and one post-procedural bleeding episode that was successfully treated endoscopically.

Median SA duration, was 23 minutes (range 19–35). Median ESD duration time was 80 minutes (range 33–160).

Median length of hospital stay was 1 day (range 0–18). No cases of patient readmission or late complications were observed during the follow-up period.

Discussion

We evaluated the feasibility of SA in 20 consecutive patients who underwent ESD for large rectosigmoid LSTs. We observed that SA is indeed feasible, with no need for additional opioid administration in the large majority of cases, and no severe AEs.

This is the first description of neuraxial analgesia for gastrointestinal endoscopy. In our study, SA for rectosigmoid ESD was technically successful in 95% of cases, and conversion to deep sedation was required in only one of 20 patients. This is remarkable, as 40% of the lesions involved the anal canal, a highly sensitive area often requiring local anesthetic injection during ESD due to severe intra-procedural pain [17]. SA also was successful in three patients with Mallampati score III-IV, which is a difficult airway indicator, and these patients may be at higher risk of ARAEs when undergoing general anesthesia. SA was chosen for large lesions, with the aim of avoiding prolonged exposure to systemic drug administration during the expectedly long-lasting ESD. Moreover, although the whole colon is responsive to combined neuraxial techniques, SA was performed for rectosigmoid lesion ESD. This was based both on the results of previously published studies of the use of SA in transanal microsurgery and also on the fact that SA is a well-established procedure for lower abdominal surgery [13, 14].

Although our experience is limited to 20 patients, SA for rectosigmoid ESD appears to be safe, with no severe or moderate ARAEs being observed in our study. Acute urinary retention, a minor ARAE that has been described in up to 23% of patients after SA [18], occurred only in 10% of patients in our series, and was easily managed with temporary catheterization with-

out prolonging the hospital stay. Because acute urinary retention could be considered a relatively frequent ARAE in SA, in patients with preexisting risk factors (e. g. benign prostatic hyperplasia) and in procedures with anticipated duration longer than 2 hours, urinary catheter placement before the procedure may be considered. None of the patients in our study reported other AEs such as transient neurological symptoms, including pain or dysesthesia in the lower limbs, or hypotension, which may be commonly observed after SA [9].

SA was sufficient for ESD completion without need for any additional intra-procedural analgesic drug administration in half the patients. In the large majority of patients who required additional intra-procedural analgesia, as well as in the only patient who required conversion to deep sedation, SA was performed with bupivacaine alone. On the other hand, SA with bupivacaine + sufentanil was effective for completing the ESD procedure without additional intra-procedural analgesic administration in 80% of patients, with no need for conversion to deep sedation for any patient when using this combination. This reflects the observation that additional intrathecal administration of an opioid is associated with a lower pain score and rescue drug requirement during SA performed for total knee replacement surgery [19].

Regarding post-procedural observation, 85% of patients did not report any pain. It is worth noting that in two of three patients who experienced post-procedural abdominal pain, SA had been performed with bupivacaine alone. Although the sample size is very small, this finding is in keeping with the observation that adding fentanyl or sufentanil to a local anesthetic in SA is associated with reduced postoperative pain and higher overall patient satisfaction [20].

One of the strengths of our study is that we also included ASA I, ASA II and relatively young patients without significant comorbidities, because we aimed to assess SA for ESD in a real-life setting, without selecting a specific population subset. We believe that SA may be preferrable to deep sedation and general anesthesia, especially in elderly and frail patients, who are at higher risk of serious ARAEs after deep sedation. However, we believe younger and fit patients also could benefit from this technique.

Our study has several limitations. First, this was a single-center, non-randomized, retrospective analysis with no prespecified patient selection. Nevertheless, our study does evaluate the feasibility of SA for rectosigmoid LSTs in a real-life clinical setting of unselected patients. Second, the sample size was too small to draw any definitive conclusion regarding the safety of SA in colorectal ESD. Third, we restricted application of SA to rectosigmoid lesions. Although neuraxial analgesia for more proximal colonic segments is a relatively safe option for high-risk patients undergoing open surgery for intra-abdominal malignancy, this requires thoracic segmental SA which, compared with lumbar SA, is a less standardized technique and burdened by a higher risk of spinal cord injury and cardiovascular and respiratory AEs [21]. Fourth, given the retrospective design of the study, some ARAEs that did not require clinical action may have been missing. To minimize this, every patient was reevaluated 30 days after ESD during a phone call or scheduled outpatient visit to assess for additional unreported ARAEs.

Conclusions

In conclusion, our initial experience suggests that SA is feasible for ESD of large rectosigmoid LSTs, and it may be preferable particularly for elderly and frail patients. Although our results may suggest that SA with bupivacaine + sufentanil is more effective than bupivacaine alone, further investigation is required to determine the optimal protocol and medications for SA in colorectal ESD. Larger, prospective, multicenter, randomized studies are needed to fully assess the efficacy and safety of SA compared with sedation or general anesthesia in colorectal ESD.

Conflict of Interest

The authors declare that they have no conflict of interest.

Clinical trial

ClinicalTrials.gov (http://www.clinicaltrials.gov/)
NCT06316401
Observational retrospective study

References

[1] Pimentel-Nunes P, Libânio D, Bastiaansen BAJ et al. Endoscopic submucosal dissection for superficial gastrointestinal lesions: European Society of Gastrointestinal Endoscopy (ESGE) Guideline – Update 2022. Endoscopy 2022; 54: 591–622 doi:10.1055/a-1811-7025

[2] Tanaka S, Kashida H, Saito Y et al. Japan Gastroenterological Endoscopy Society guidelines for colorectal endoscopic submucosal dissection/endoscopic mucosal resection. Dig Endosc 2020; 32: 219–239 doi:10.1111/den.13545

[3] Fuccio L, Hassan C, Ponchon T et al. Clinical outcomes after endoscopic submucosal dissection for colorectal neoplasia: a systematic review and meta-analysis. Gastrointest Endosc 2017; 86: 74–86 doi:10.1016/j.gie.2017.02.024

[4] Wadhwa V, Issa D, Garg S et al. Similar Risk of cardiopulmonary adverse events between propofol and traditional anesthesia for gastrointestinal endoscopy: A systematic review and meta-analysis. Clin Gastroenterol Hepatol 2017; 15: 194–206

[5] Manno M, Deiana S, Gabbani T et al. Implementation of the European Society of Gastrontestinal Endoscopy (ESGE) and European Society of Gastroenterology and Endoscopy Nurses and Associates (ESGENA) sedation training course in a regular endoscopy unit. Endoscopy 2021; 53: 65–71

[6] Leung CM, Hui RW. Comparing general anaesthesia versus sedation for endoscopic submucosal dissection: results from a systematic review and meta-analysis. Anaesthesiol Intensive Ther 2023; 55: 9–17 doi:10.5114/ait.2023.125416

[7] Martin LD, Mhyre JM, Shanks AM et al. 3,423 emergency tracheal intubations at a university hospital: airway outcomes and complications. Anesthesiology 2011; 114: 42–48 doi:10.1097/ALN.0b013e318201c415

[8] Rattenberry W, Hertling A, Erskine R. Spinal anaesthesia for ambulatory surgery. BJA Educ 2019; 19: 321–328 doi:10.1016/j.bjae.2019.06.001

[9] Schubert AK, Wiesmann T, Wulf H et al. Spinal anesthesia in ambulatory surgery. Best Pract Res Clin Anaesthesiol 2023; 37: 109–121 doi:10.1016/j.bpa.2023.04.002

[10] Koo C-H, Ryu J-H. Anesthetic considerations for urologic surgeries. Korean J Anesthesiol 2020; 73: 92–102 doi:10.4097/kja.19437

[11] Frisch NB, Darrith B, Hansen DC et al. Single-dose lidocaine spinal anesthesia in hip and knee arthroplasty. Arthroplast Today 2018; 4: 236–239 doi:10.1016/j.artd.2018.02.011

[12] Smith LM, Cozowicz C, Uda Y et al. Neuraxial and combined neuraxial/general anesthesia compared to general anesthesia for major truncal and lower limb surgery: A systematic review and meta-analysis. Anesthesia Analgesia 2017; 125: 1931–1945 doi:10.1213/ANE.0000000000002069

[13] Cortese G, Sales G, Maiolo G et al. Effectiveness of spinal anesthesia in transanal endoscopic microsurgery: a 3-year experience. Minerva Anestesiol 2018; 84: 712–719 doi:10.23736/S0375-9393.18.12557-0

[14] Berger Y, Gingold-Belfer R, Khatib M et al. Transanal endoscopic microsurgery under spinal anaesthesia. J Minim Access Surg 2021; 17: 490–494 doi:10.4103/jmas.JMAS_144_20

[15] von Elm E, Altman DG, Egger M et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet 2007; 370: 1453–1457 doi:10.1016/j.jclinepi.2007.11.008

[16] Mason KP, Green SM. Piacevoli Q el al. Adverse event reporting tool to standardize the reporting and tracking of adverse events during procedural sedation: a consensus document from the World SIVA International Sedation Task Force. Br J Anaesth 2012; 108: 13–20

[17] Matsumoto S, Yoshida Y. Endoscopic submucosal dissection for colorectal tumors in the dentate line area and those adjacent to the dentate line. Austin J Gastroenterol 2015; 2: 1037

[18] Baldini G, Bagry H, Aprikian A et al. Postoperative urinary retention: anesthetic and perioperative considerations. Anesthesiology 2009; 110: 1139–1157 doi:10.1097/ALN.0b013e31819f7aea

[19] Khanna A, Saxena R, Dutta A et al. Comparison of ropivacaine with and without fentanyl vs bupivacaine with fentanyl for postoperative epidural analgesia in bilateral total knee replacement surgery. J Clin Anesth 2017; 37: 7–13

[20] Fonseca NM, Guimarães GMN, Pontes JPJ et al. Safety and effectiveness of adding fentanyl or sufentanil to spinal anesthesia: systematic review and meta-analysis of randomized controlled trials. Braz J Anesthesiol 2023; 73: 198–216 doi:10.1016/j.bjane.2021.10.010

[21] Ellakany MH. Thoracic spinal anesthesia is safe for patients undergoing abdominal cancer surgery. Anesth Essays Res 2014; 8: 223–228 doi:10.4103/0259-1162.134516