

Stomaching the pain of spinal fusion: gastrointestinal discomfort is as severe as back pain in 50% of adolescent idiopathic scoliosis patients following posterior spinal fusion

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Abstract

Purpose There have been no prospective studies investigating gastrointestinal (GI) symptoms of patients with adolescent idiopathic scoliosis (AIS) following posterior spinal fusion (PSF). The purpose of this study was to evaluate the incidence and severity of self-reported GI symptoms following PSF.

Methods In all, 40 AIS patients undergoing PSF were prospectively enrolled between March 2015 and October 2016. Patients completed a survey on each postoperative, inpatient day regarding nausea, emesis, constipation, abdominal pain and back pain, rating their pain on a scale of 1 to 10.

Results Abdominal pain (50%), emesis (63%), nausea (65%) and constipation (68%) were experienced by the majority of patients. Of those reporting back pain, the mean pain level during the postoperative period was 5.1 (0.2 to 9.6). Of those reporting abdominal pain, the mean pain level during the postoperative period was 5.5 (1.4 to 8.6), which was not different than the severity of their back-pain levels (mean = 6.0, $p = 0.31$).

Conclusions Gastrointestinal issues in AIS patients following PSF are common. Abdominal pain was as severe as the back pain for half of the patients.

Level of Evidence: II

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Introduction

Posterior spinal fusions (PSFs) are commonly performed for management of severe progressive adolescent idiopathic scoliosis (AIS). Well-known perioperative outcomes of this procedure include back pain,^{1,2} stiffness³ and reduced spinal movement,⁴ to name a few. Anecdotally, we have observed a range of adverse gastrointestinal (GI) outcomes in the initial postoperative period, including nausea, emesis, constipation and abdominal pain. To our knowledge, there have been no prospective studies investigating GI issues following PSF for this population. Thus, the purpose of the current study was to prospectively investigate the incidence and severity of GI symptoms following PSF of AIS patients.

Materials and methods

In all, 40 AIS patients undergoing PSF were prospectively enrolled from our centre between March 2015 and October 2016. Per standard preoperative protocol, all patients were instructed to take polyethylene glycol for two days prior to surgery. Intraoperatively, the patients were managed predominantly with 'TIVA' (total intravenous anaesthesia consisting mainly of propofol and remifentanyl) until final neuromonitoring signals were obtained.

Postoperatively, all patients received bisacodyl (oral or suppository), ondansetron, polyethylene glycol and docusate sodium. At the discretion of the physician, some patients also received metoclopramide. For pain, standard postoperative medications included morphine or

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hydromorphone (patient-controlled analgesia) on postoperative day 0, with a transition to oxycodone (PO) on postoperative day 1; ketorolac (intravenous) until postoperative day 2, with a transition to ibuprofen (PO); acetaminophen; diazepam; and gabapentin for five days following surgery. Patients' postoperative diets differed based on the preference of the surgeons. Some were instructed to be on a regular and/or high fibre diet, and others were instructed to be on a liquid diet. In addition, nursing staff facilitated ambulation twice daily on each inpatient day until the patient was cleared by physical therapy to get out of bed alone with family present.

Every inpatient day following surgery, patients were asked to complete an electronic survey regarding their experiences of nausea, emesis, constipation, abdominal pain and back pain (Fig. 1). In addition, patients were asked to rate their abdominal pain (if present) and back pain on a scale of 1 (low pain) to 10 (high pain). They were also asked about their bowel movements. Electronic surveys were sent via email. Paper surveys were administered to patients without email.

Results

Three patients reported previous GI problems prior to surgery. One patient had previously experienced weight loss due to early satiety but had normal GI functioning at the time of surgery. Another patient reported previous constipation, which had been treated with polyethylene glycol. Another patient reported previous gastroesophageal reflux, which was reported to be controlled by medication.

For the 40 AIS patients enrolled, the average duration of surgery was three hours and 40 minutes, with a mean blood loss of approximately 408 milliliters, and a mean of ten vertebral levels fused. Mean hospital stay was 3.3 days (2 to 5), during which 65% (26/40) of patients experienced nausea and 63% (25/40) of patients had at least one episode of emesis. Vomiting was most prevalent on post-operative day 1. In addition, constipation was reported by 68% (27/40) of patients. Five patients received enemas during their inpatient stay. By the third postoperative day, 55% (22/40) of patients had had at least one bowel movement. In all, 40% (16/40) of patients were discharged without reporting a bowel movement. There were no noted improvements in abdominal pain following reported bowel movements (mean pre-bowel movement stomach pain = 51.5 (25 to 86), mean post-bowel movement = 50.1 (14 to 76), $p = 0.90$).

Abdominal pain was reported by 50% of patients during their hospital stay and was most prevalent on post-operative day 2. Back pain was reported by 100% of patients. Of those reporting back pain, the mean pain level during the postoperative period was 5.1 (0.2 to 9.6). Of those

reporting abdominal pain, the mean pain level during the postoperative period was 5.5 (1.4 to 8.6), which was not significantly different from the severity of their respective back pain levels ($m = 6.0$, $p = 0.31$). Incidences of reported GI symptoms are depicted below (Fig. 2).

There was some variability in diet based on surgeon preference. An attempt was made to correlate this with the incidence or severity of abdominal pain, but this was inconclusive. In all, 28 (70%) patients were on an all-liquid diet on their first postoperative day, and 12 (30%) patients were on a regular and/or high fibre diet. For the 20 patients who did not report abdominal pain, 14 (70%) were on an all-liquid diet on their first postoperative day, and six (30%) were on a regular and/or high fibre diet. For the 20 patients who reported abdominal pain, 14 (70%) were placed on an all-liquid diet on their first postoperative day and had a mean abdominal pain score of 56 (25 to 76). The remaining six patients (30%) were placed on a regular and/or high fibre diet and had a mean abdominal pain score of 57.8 (27 to 72). The difference between mean abdominal pain scores were not significant ($p = 0.88$).

No patients were reported to have any atypical or major complications during the initial postoperative period, though three patients' discharges were delayed by one day due to GI symptoms. One patient had abdominal distention, another patient also had abdominal distention with ileus, and another patient experienced persistent nausea and vomiting. There were no readmissions or returns to the Emergency Room during the postoperative course for any of the patients in this series.

Discussion

The results of this study reveal that the incidence of GI issues in AIS patients following PSF is high. Abdominal pain (50%), emesis (63%), nausea (65%) and constipation (68%) were experienced by the majority of patients. This occurred in patients with a typical postoperative course, in the absence of any major associated complications.

For idiopathic scoliosis patients, there is a paucity of data on this topic. Modi et al⁵ investigated neuromuscular scoliosis patients in a retrospective manner and reported that GI issues were infrequently encountered. They found that only three out of 50 patients experienced gastritis and vomiting during the perioperative period and another three out of 50 were documented to have developed paralytic ileus.⁵ The striking difference between their results and the results of this study may have to do with the differences in data collection. Our study collected data on a daily, prospective basis rather than collecting data via a retrospective chart review. In addition, many of the neuromuscular scoliosis patients may have been nonverbal or limited in their ability to

communicate their symptomatology. Consequently, it is plausible that GI issues were only detected and documented in severe cases.

Though these symptoms are frequently encountered by spinal deformity surgeons, there is no prior prospective series on perioperative GI symptoms of patients with a typical postoperative course. Nevertheless, it is a frequent source of discomfort, stress and inquiry in the perioperative period for patients and their families. This study provides useful information for them regarding the very common nature of these symptoms and their typical resolution over time.

Despite the common and generally benign nature of these GI symptoms, vigilance must be maintained for more serious clinical scenarios. Prior literature reports of GI symptoms are primarily of more adverse clinical outcomes to which physicians must remain cautious. For example, acute pancreatitis has been described following posterior spinal fusion for scoliosis.^{6,7} In addition, there are case reports of patients with idiopathic scoliosis developing nausea, emesis and abdominal pain following PSF, that was subsequently diagnosed as superior mesenteric artery (SMA) syndrome.⁸⁻¹¹ While these more adverse outcomes are quite rare, there are certainly times where the abdominal pain is atypical and warrants further investigation. For example, in patients who have had a large deformity corrected and are having persistent emesis with

attempts at oral intake, consideration should be given to the possibility of SMA syndrome. Additionally, while postoperative ileus is common and associated with pain and distension, any rebound tenderness or signs of an acute abdomen should be further evaluated for bowel obstruction or other abdominal issues.

An interesting finding was that while not all patients experienced significant abdominal pain, those that did found it to be as severe as their back pain. As this significantly impacted their hospital experience and postoperative course, there is an opportunity to improve the patient experience if these symptoms can be better controlled through changes in diet or medication. In this series, it appeared that more patients experiencing abdominal pain were on a liquid diet. There was some variability in diet based on surgeon preference. An attempt was made to correlate this with the incidence or severity of back pain, but this was inconclusive. The mean difference between abdominal scores was not significant between diets ($p = 0.88$). We are concerned that as this was not protocol, there has been some selection bias in patients who were not having GI symptoms being advanced, though that may not be ideal for everyone. In the future we plan to further investigate this and try to optimize the postoperative diet to minimize GI issues.

One limitation of this study is the reliance upon self-report surveys, which is subject to some inaccuracy as

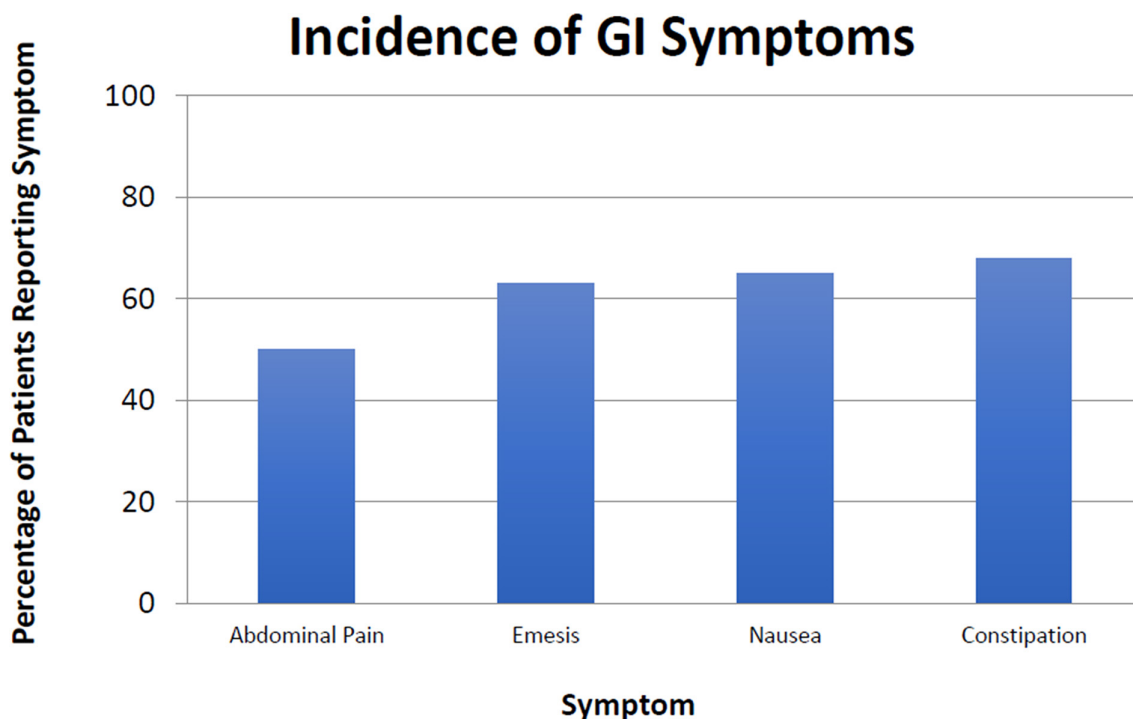


Fig. 2 Incidence of gastrointestinal (GI) symptoms reported by patients during in-patient postoperative period following posterior spinal fusion for adolescent idiopathic scoliosis.

well as variability amongst patients. An additional limitation of this study is the fact that we were unable to verify if the patients were truly the ones completing the survey. This is a limitation of all email surveys, however, and we felt it was the only practical way to perform the survey. Nevertheless, this study is the first to prospectively investigate what is a very common source of postoperative discomfort for AIS patients undergoing PSF. This information can be used to counsel patients and their families on the frequency and expected resolution of these symptoms. Additionally, it represents an area ripe for additional research to better manage GI issues and improve patients' postoperative experience.

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COMPLIANCE WITH ETHICAL STANDARDS

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ETHICAL STATEMENT

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Not required.

ICMJE CONFLICT OF INTEREST STATEMENT

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REFERENCES

1. **Pellegrino LN, Avanzi O.** Prospective evaluation of quality of life in adolescent idiopathic scoliosis before and after surgery. *J Spinal Disord Tech* 2014;27:409-414.
2. **Rodrigues JB, Saleme NA, Batista JL Jr, Cardoso IM, Jacob C Jr.** Quality of life in patients submitted to surgical treatment of idiopathic scoliosis. *Acta Ortop Bras* 2015;23:287-289.
3. **Wilk B, Karol LA, Johnston CE II, Colby S, Haideri N.** The effect of scoliosis fusion on spinal motion: a comparison of fused and nonfused patients with idiopathic scoliosis. *Spine* 2006;31:309-314.
4. **Engsberg JR, Lenke LG, Reitenbach AK, et al.** Prospective evaluation of trunk range of motion in adolescents with idiopathic scoliosis undergoing spinal fusion surgery. *Spine* 2002;27:1346-1354.
5. **Modi HN, Suh SW, Yang JH, et al.** Surgical complications in neuromuscular scoliosis operated with posterior-only approach using pedicle screw fixation. *Scoliosis* 2009;4:11.
6. **Leichtner AM, Banta JV, Etienne N, et al.** Pancreatitis following scoliosis surgery in children and young adults. *J Pediatr Orthop* 1991;11:594-598.
7. **Laplaza FJ, Widmann RF, Fealy S, et al.** Pancreatitis after surgery in adolescent idiopathic scoliosis: incidence and risk factors. *J Pediatr Orthop* 2002;22:80-83.
8. **Horn PL, Beeb AC, King DR.** A rare cause of postoperative abdominal pain in a spinal fusion patient. *Am J Orthop (Belle Mead NJ)* 2015;44:E350-E354.
9. **Louie PK, Basques BA, Bitterman A, et al.** Superior mesenteric artery syndrome as a complication of scoliosis surgery. *Am J Orthop (Belle Mead NJ)* 2017;46:E124-E130.
10. **Lam DJ, Lee JZ, Chua JH, Lee YT, Lim KB.** Superior mesenteric artery syndrome following surgery for adolescent idiopathic scoliosis: a case series, review of the literature, and an algorithm for management. *J Pediatr Orthop B* 2014;23:312-318.
11. **Ovalle-Chao C, Hinojosa-Martinez LM, Gutierrez-Castillo AG, et al.** Acute-onset of superior mesenteric artery syndrome following surgical correction of scoliosis: case report and review of literature. *J Pediatr Surg Case Rep* 2017;19:31-33.