Journal of Pediatric Surgery 53 (2018) 477–482

Contents lists available at ScienceDirect

Journal of Pediatric Surgery

journal homepage: www.elsevier.com/locate/jpedsurg

Reduced paraspinous muscle area is associated with post-colectomy complications in children with ulcerative colitis

Priya H. Dedhia [a,*], Yasmine White [a], Jonathan R. Dillman [b,1], Jeremy Adler [c,d], Marcus D. Jarboe [e], Daniel H. Teitelbaum [e], Ronald B. Hirschl [e], Samir K. Gadepalli [d,e]

[a] Department of Surgery, Division of General Surgery, University of Michigan, Ann Arbor, MI
[b] Department of Radiology, University of Michigan Ann Arbor, MI
[c] Department of Pediatrics and Communicable Diseases, Division of Pediatric Gastroenterology, University of Michigan, Ann Arbor, MI
[d] Children's Health Evaluation and Research Unit, University of Michigan, Ann Arbor, MI
[e] Department of Surgery, Division of Pediatric Surgery, University of Michigan, Ann Arbor, MI

ARTICLE INFO

Article history:
Received 22 January 2017
Received in revised form 6 September 2017
Accepted 6 September 2017

Key words:
Morphometrics
Inflammatory bowel disease
Sarcopenia
Ulcerative colitis
Colectomy

ABSTRACT

Background and objectives: Sarcopenia, defined as reduced muscle mass, is typically assessed by CT scans, which are infrequently performed in children. Using MRI to measure sarcopenia, we determined the association with postoperative complications after colectomy for ulcerative colitis (UC).
Methods: Clinical and preoperative MRI data for 13–18-year-old UC patients who underwent colectomy were retrospectively reviewed. Bilateral paraspinous muscle area (PSMA) and psoas muscle area (PMA) at L3 vertebra were measured and averaged. Composite complications were infection, wound dehiscence, postoperative leak/abscess, prolonged ileus, pulmonary embolism, venous thromboembolism, or readmission.
Results: Twenty-nine patients with average age 15.9 ± 1.36 years and weight 61.5 ± 19.8 kg had a preoperative MRI. The 18/29(62%) with complications had significantly reduced PSMA (4.71 ± 1.44 vs 5.64 ± 1.38 cm2, p = 0.04) and PMA (7.16 ± 2.60 vs 8.93 ± 2.44, p = 0.04). When stratified and compared to highest PSMA, patients with lowest PSMA had increased complication rates (88% vs 29%, p = 0.04). There were no differences in age, BMI, albumin, CRP, ESR, or preoperative steroid or anti-TNFα use. Odds of complication in the lowest tertile were 25.0-fold higher than the highest tertile (p = 0.04, 95% CI = 1.2–520.73).
Conclusion: This is the first study to show low PSMA on MRI is associated with complications and increased hospital stay after colectomy in children with UC.
Levels of evidence: Level III retrospective comparative study.

Pediatric surgical risk assessment scoring systems have been developed to identify children at risk for postoperative complications and death [1–3]. These tools are useful in patients younger than 36 weeks of gestation, with American Society of Anesthesiologists score greater than 3, undergoing a cardiovascular or neurosurgical procedure, receiving intraoperative albumin or with high risk of mortality, but are not applicable to children with inflammatory bowel disease (IBD). Predicting postoperative complications after a colectomy for ulcerative colitis is also challenging due to variability in disease severity that is difficult to measure, diverging patient factors such as weight loss or obesity, and heterogenous treatment strategies such as steroids and biologics.

Increasing evidence suggests that loss of skeletal muscle is detrimental. Multiple studies in adults have demonstrated that decreased core muscle size is an independent risk factor for complications and mortality [4–8]. These studies assessed core muscle size by measuring lean psoas muscle size on preoperative computed tomography (CT). Because CT is less frequently performed in the pediatric population, we sought to determine if core muscle mass assessed by MRI is similarly associated with complications in pediatric ulcerative colitis (UC) patients.

To date, no study has yet used MRI to define sarcopenia, and no study has established the value of sarcopenia in children. We hypothesized that sarcopenia, as measured by low paraspinous muscle area (PSMA) or psoas muscle area (PMA) on MRI, would be associated with postoperative complications in pediatric UC patients undergoing colectomy.

Abbreviations: BMI, body mass index; CT, computed tomography; CPT, Current Procedural Terminology; CRP, C-reactive protein; DVT, deep vein thrombosis; ESR, erythrocyte sedimentation rate; IBD, inflammatory bowel disease; MRI, magnetic resonance imaging; PE, pulmonary embolism; PMA, psoas muscle area; PMSA, paraspinous muscle area; TNFα, tumor necrosis alpha; UC, ulcerative colitis; UTI, urinary tract infection.

* Corresponding author at: Section of General Surgery, 2110 TC, SPC 5346, 1500 E. Medical Center Drive, Ann Arbor, MI 48109. Tel.: +1 734 936 5733.
E-mail address: pdedhia@med.umich.edu (P.H. Dedhia).
[1] Present: Department of Radiology and Medical Imaging, Section of Pediatric Radiology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH.

https://doi.org/10.1016/j.jpedsurg.2017.09.006
0022-3468/

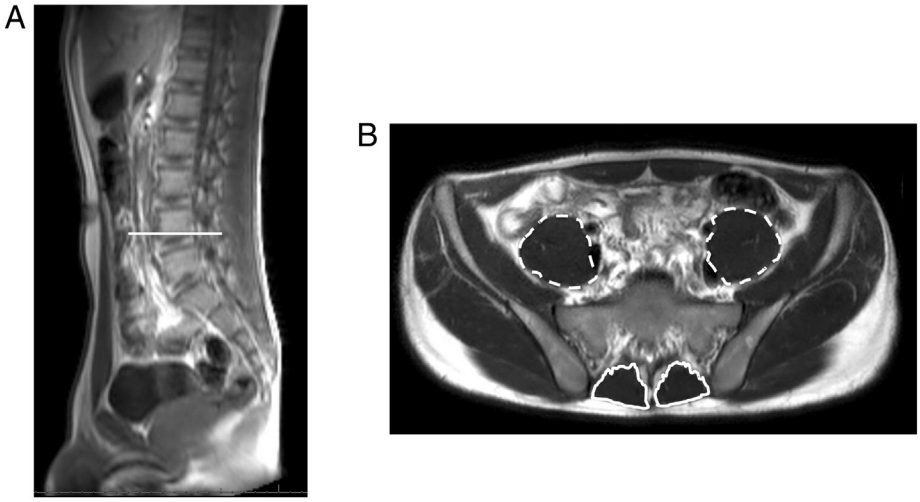

Fig. 1. Measurement of psoas and paraspinous muscle area. A, Sagittal image with white line through L3. B, Psoas (white dashed line) and paraspinous (white line) muscle areas were measured at L3 on T2-weighted MR images.

1. Methods

1.1. Study population

The University of Michigan Institutional Review Board approved this study. This is a retrospective analysis of pediatric patients under 18 years old with UC that underwent colectomy between December 2006 and June 2015 at the University of Michigan. We used the Current Procedural Terminology (CPT) codes for colectomy to identify patients less than 18 years of age with a diagnosis of ulcerative colitis. We included patients who underwent 1) colectomy with end ileostomy 2) colectomy with ileal pouch anal anastomosis (IPAA) and diverting ileostomy or 3) colectomy with IPAA and no diverting ileostomy. At our institution, pediatric patients with UC generally undergo IPAA unless the patient requires an emergency operation due to the presence of hemodynamic instability, free air, or toxic megacolon or the patient has a severe comorbidity (such as portal hypertension or congenital heart disease. Patients without a preoperative MRI and age under 13 were excluded to create a more uniform population. MRIs were performed in conjuction with endoscopy to rule out Crohn's disease or due to changes in clinical status or failure of medical management.

1.2. Data collection

Data collected includes demographics, clinical and surgical variables, and outcomes. Demographics including age, sex, weight and body mass index (BMI), were obtained using chart review of electronic medical records at the time of a preoperative MRI study and at surgery. Surgical records were reviewed to confirm surgical indication and type of surgery performed, including an ostomy. Clinical variables such as albumin, C-reactive protein, erythrocyte sedimentation rate, anti-tumor necrosis alpha (TNFα) use, and steroid use, were acquired by chart review. Anti-TNFα therapy was considered active if patients were exposed to infliximab, adalimumab, or certolizumab within 1 week of surgery. High dose steroid use greater than 10 mg of oral prednisone or any use of intravenous methylprednisone was assessed within 1 week of surgery. Primary outcomes recorded included any 90-day postoperative complications including death, unplanned return to surgery, 90-day hospital readmission, surgical site infection, anastomotic leak, intraabdominal abscess, wound dehiscence, prolonged ileus beyond postoperative day 6, deep vein thrombosis (DVT), pulmonary embolism (PE), urinary tract infection (UTI), and hospital-acquired pneumonia. Postoperative complications and hospital readmission together were defined as composite complications.

1.3. Analytical morphometrics

We adapted methods described by Englesbe et al. to calculate paraspinous and psoas muscle size using CT scan to preoperative MRI [4,5]. Briefly, the cross-sectional areas of bilateral paraspinous and psoas muscles were measured at the third lumbar (L3) vertebral body on high-resolution axial T2-weighted single-shot fast spin-echo MRI sequences (Fig. 1) by 2 observers who were blinded to outcomes (P.D. and Y.W.). Muscle area calculated in cubic centimeters was recorded for each patient. Right and left PSMAs or PMAs measured by each reviewer was averaged in order to determine bilateral average PSMA or PMA.

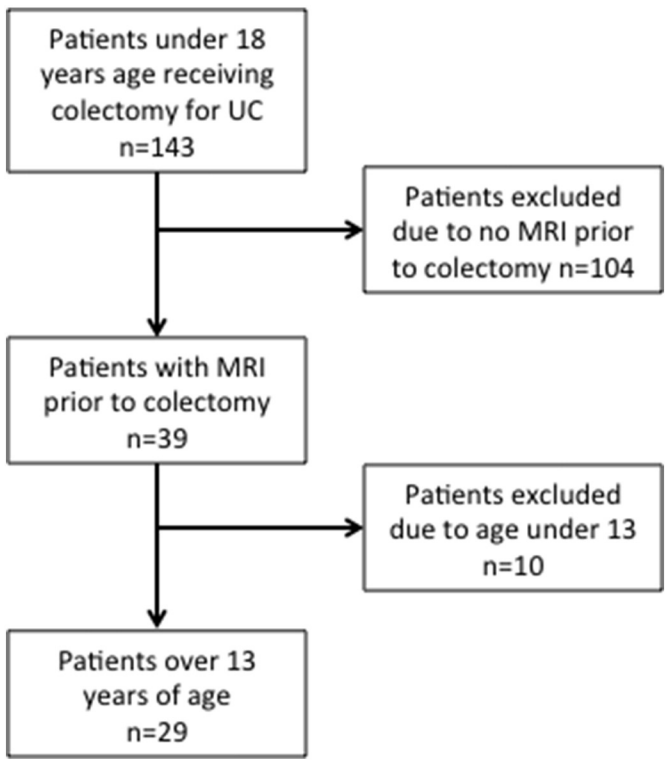

Fig. 2. Scheme of patient selection.