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When body mass index fails to measure up: perinephric and periumbilical fat as predictors of operative risk

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Abstract

BACKGROUND: Obesity has been associated with worse outcomes and increased surgical technical difficulty. Perinephric fat (PNF) and periumbilical fat (PUF) are alternative metrics to body mass index. We hypothesized that PUF and PNF would offer improved prediction of perioperative risk.

METHODS: 249 patients were retrospectively reviewed after elective, pelvic colorectal resections. PNF and PUF were collected using axial imaging. Operative risk measurements included estimated blood loss (EBL) and operative time (OT).

RESULTS: In multivariate analyses of women, PUF and PNF were significant predictors of EBL; PNF was a significant predictor of OT. A 4.7-mm increase in PNF predicted a 15-minute increase in OT and 55-cc increase in EBL. An 8.6-mm increase in PUF predicted a 55-cc increase in EBL. In men, no metric was predictive.

CONCLUSIONS: In women, PNF and PUF may offer improved metrics for risk stratification, which can have important clinical and financial implications.

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In colorectal surgery, obesity has been associated with increased technical difficulty and worse clinical outcomes.[1,2] As a component of perioperative risk assessment, obesity is most commonly evaluated using body mass index (BMI). Calculations for BMI are easily obtained from the medical record, but using this measurement for prediction has a number of important limitations. First, adipose tissue distribution is not represented by BMI.[3] The distribution of fat is an important consideration in perioperative risk assessment, as visceral adiposity has been more closely associated with increased technical difficulty and worse clinical outcomes.[1,4–8] BMI has yielded inconsistent results as a metric of obesity impacting clinical outcomes.[9–13] Second, BMI and the World Health Organization (WHO)

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obesity classifications do not adequately represent ethnic, sex, and age differences of obesity.[14,15]

To overcome the limitations associated with BMI, a number of other metrics have been proposed including visceral adipose area (VAA), total visceral fat (TVF), and the ratio of VFA to body surface area.[3,15,16] Unlike BMI, these measures reflect body fat distribution and differentiate subcutaneous vs visceral fat. However, VAA and TVF are limited in their practical utility, as they require complex software, computed tomography (CT) imaging, and complex calculations, which are notable limitations.[1,6] Quickly and easily measured alternative metrics for adipose tissue distribution are periumbilical fat (PUF) and perinephric fat (PNF). These surrogates, PUF and PNF, have been studied in upper abdominal surgery and were found to be more useful in risk assessment than BMI.[17]

We hypothesized that PUF and PNF would offer improved metrics of perioperative risk assessment over BMI in patients undergoing a colorectal surgical procedure. In addition, we hypothesized that these metrics could be easily obtained from any axial imaging study without the need for additional software or complex measurements.

Methods

A retrospective, cohort design study was proposed, and IRB approval was obtained. The local American College of Surgeons-National Surgical Quality Improvement Project (ACS-NSQIP) data set was queried for consecutive patients at a single, tertiary care academic hospital who underwent an elective, pelvic colorectal resection from January 2008 through December 2014. Charts for patients with NSQIP primary operative procedure current procedural terminology codes 45397, 45395, 45119, 45113, 45112, 45110, 44212, 44211, 44208, 44207, 44204, 44188, 44158, 44146, 44145, and 44140 were queried. For inclusion, a pelvic component to the operation (eg, low anterior resection, abdominoperineal resection, or ileoanal pouch) was required and was verified by examining the dictated operative report (n = 323). A manual review of the medical record was then completed and cross-sectional abdominal imaging (CT, magnetic resonance, positron emission tomography/CT) completed for any reason and before their date of operation was linked to the ACS-NSQIP data set (n = 266). Patients without cross-sectional imaging or with imaging completed before 180 days of their operation were excluded (n = 16). Patients undergoing a concurrent major procedure (eg, hepatic resection, abdominal wall reconstruction) were excluded. A single patient was excluded for massive (21L) intra-operative blood loss. A total of 249 patients were included in the analysis. Operative reports were reviewed by 2 general surgeons and scored for complexity of the pelvic dissection (3 categories). Operations that involved a limited pelvic dissection, such as a resection for a low sigmoid or high rectal cancer were classified as "limited" (category A). Operations that involved a more extensive pelvic dissection but that were not overly complex, such as a low anterior resection or a Hartman's reversal were classified as "moderate" (category B). In addition, operations that involved an extensive pelvic dissection and a more complex procedure such as a proctectomy with ileal pouch anal anastomosis were classified as "complex" (category C). Supervised by an abdominal-imaging fellowship–trained attending radiologist, a 4th year medical student and radiology resident, blinded to patient outcomes, measured visceral fat as bilateral posterior PNF and subcutaneous fat as bilateral PUF fat (Fig. 1). The PUF was measured as the greatest perpendicular distance between the external abdominal wall and overlying skin, within 5 cm of midline, at the level of the widest diameter of the umbilicus. The

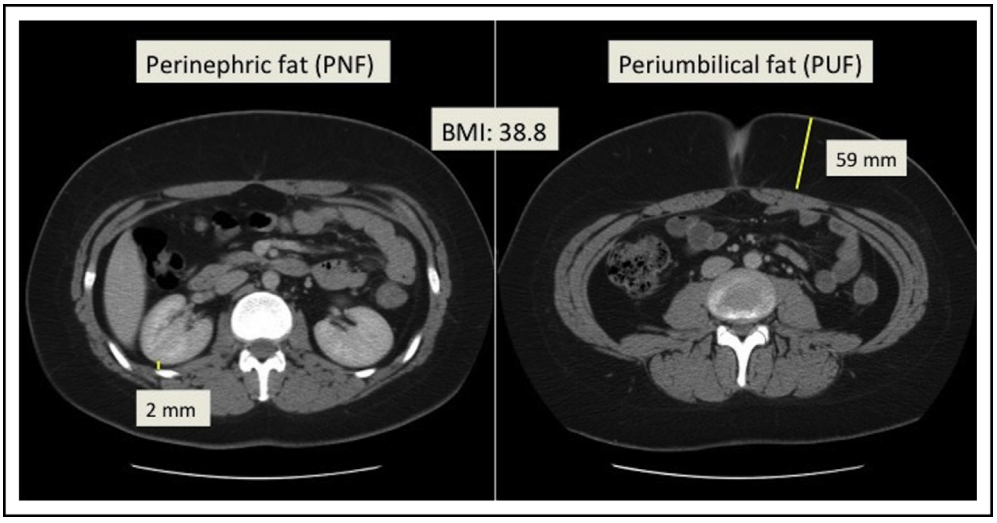

Figure 1 How to measure PNF and PUF on axial imaging. PNF is measured posteriorly between the kidney and the abdominal wall. PUF is measured anteriorly at the level of the umbilicus.