
Development, Feasibility, Validity, and Reliability of a Scale for Objective Assessment of Operative Performance in Laparoscopic Gastric Bypass Surgery

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BACKGROUND: There is no objective scale for assessment of operative skill in laparoscopic gastric bypass (LGBP). The objective of this study was to develop and demonstrate feasibility of use, validity, and reliability of a Bariatric Objective Structured Assessment of Technical Skill (BOSATS) scale.

STUDY DESIGN: The BOSATS scale was developed using a hierarchical task analysis (HTA), a Delphi questionnaire, and a panel of international experts in bariatric surgery. The feasibility of use, reliability, and validity of the developed scale were demonstrated by reviewing 52 prospectively collected video recordings of LGBP performed by novice and experienced surgeons.

RESULTS: A total of 214 discrete steps were identified in HTA. A total of 12 and 17 panel members completed the first and second round of the Delphi questionnaire, respectively. Consensus among the panel was achieved after the second round (Cronbach's alpha = 0.85). The BOSATS scale demonstrated high inter-rater (intraclass correlation coefficient [ICC] = 0.954; $p < 0.001$) and test-retest reliability (ICC = 0.99; $p < 0.001$). Significant differences between BOSATS scores of experienced and novice surgeon groups were noted for the creation of jejunojejunostomy (JJ), gastric pouch, linear stapled gastrojejunostomy (GJ), circular stapled GJ, and hand-sewn GJ. Moderate to high correlations between BOSATS scale and Objective Structured Assessment of Technical Skills Global Rating Scale (OSATS GRS) were seen for JJ ($\rho = 0.59$; $p = 0.001$), gastric pouch ($\rho = 0.48$; $p = 0.0004$), linear stapled GJ ($\rho = 0.70$; $p = 0.0001$), and hand-sewn GJ ($\rho = 0.96$; $p < 0.0001$).

CONCLUSIONS: The BOSATS scale is a feasible to use, reliable, and valid instrument for objective assessment of operative performance in LGBP. Implementation of this scale is expected to facilitate deliberate practice and provide a means for future certification in bariatric surgery. (*J Am Coll Surg* 2013;216:955–965. © 2013 by the American College of Surgeons)

Over the past 2 decades, laparoscopic Roux-en-Y gastric bypass (LGBP) has gained increasing popularity in North America as the procedure of choice for morbid obesity. More than 50,000 LGBP operations were performed in

the United States in 2006.¹ Achieving proficiency in this advanced laparoscopic procedure remains a challenge for both surgical residents and practicing surgeons. With a learning curve of 50 to 100 cases,² surgeons' technical

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Abbreviations and Acronyms

BOSATS	= Bariatric Objective Structured Assessment of Technical Skill
GJ	= gastrojejunostomy
GOALS	= Global Operative Assessment of Laparoscopic Skills
HTA	= hierarchical task analysis
ICC	= intraclass correlation coefficient
JJ	= jejunojunostomy
LGBP	= laparoscopic gastric bypass
OSATS GRS	= Objective Structured Assessment of Technical Skills Global Rating Scale

skill has been shown to correlate strongly with complication rates in bariatric surgery.³

Declaration of proficiency in LGBP is currently based on the number of cases performed as a primary surgeon and/or on a subjective opinion of a senior preceptor⁴; however, both of these methods are unreliable and imprecise.^{5,6} In an effort to move toward objective measures of surgical proficiency, several evaluation scales have been designed and validated for use in open and laparoscopic surgery. Examples of such scales include the Objective Structured Assessment of Technical Skills Global Rating Scale (OSATS GRS),⁷ modified OSATS GRS,⁸ Global Operative Assessment of Laparoscopic Skills (GOALS),⁹ as well as procedure-specific assessment scales for laparoscopic Nissen fundoplication¹⁰ and laparoscopic right and sigmoid colectomies.¹¹ None of these scales has been developed or validated for use in LGBP.

The OSATS GRS, developed by Reznick and colleagues,⁷ is probably the most widely used form of objective assessment of technical skill in surgery. It was developed and validated for use with a specific set of surgical tasks (bowel anastomosis, vascular anastomosis, etc) performed on bench top models.⁷ The GOALS and modified OSATS GRS scales were developed as alternatives to OSATS GRS for laparoscopic surgery; however, both scales were validated only for use in laparoscopic cholecystectomy. The OSATS GRS, modified OSATS GRS, and GOALS are examples of global rating scales. Such scales, unlike procedure-specific scales, are designed to provide trainees with a global assessment of their operative performance (respect for tissue, time and motion, etc). Unfortunately, global rating scales do not provide a trainee with any information on specific parts of an operation that need the most improvement.⁵

At present, there is no objective scale to assess operative performance in LGBP. Aggarwal and colleagues¹² were the only group that attempted to address this deficiency by designing and validating a global and procedure-specific assessment scale for the operative step of

laparoscopic jejunojunostomy (JJ). Albeit an excellent start, that scale was designed to assess only 1 component of the LGBP operation. Furthermore, it is of limited benefit in live surgery because it was validated only for use on cadaveric porcine models.

An ideal scale for assessment of surgical proficiency in LGBP should be comprehensive, feasible to use, internationally relevant, reliable, and valid for live and recorded surgery. It should include all common surgical approaches to the LGBP, enabling its use in different institutions and enabling comparability between surgeons. Use of such a scale would not only allow for an objective evaluation of a surgeon's technical proficiency in LGBP, but would also provide a basis for constructive feedback and deliberate practice.

This study had 3 objectives. The first objective was to deconstruct the LGBP procedure into its component steps. The second objective was to use the Delphi method and an international panel of experts in bariatric surgery to select the steps of LGBP that were considered important for inclusion into a Bariatric Objective Structured Assessment of Technical Skill (BOSATS) scale. The third objective was to demonstrate feasibility of use, inter-rater and test-retest reliability, as well as construct and concurrent validity for the developed scale.

METHODS

Hierarchical task analysis

A hierarchical task analysis (HTA) of LGBP was carried out to deconstruct the operation into its component steps. A similar approach has been used in the past to define steps for some basic and intermediate laparoscopic procedures.^{10,13} Ten full-length video recordings of LGBP performed using various surgical approaches (linear stapled JJ, linear stapled gastrojejunostomy [GJ], circular stapled GJ, hand-sewn GJ, antecolic antegastric and retrocolic retrogastric Roux limb placement) were reviewed independently by 2 experienced laparoscopic surgeons (RA and TG). Each reviewer listed all consecutive steps required for completion of each operation. An in-person meeting was organized between the reviewers to resolve any disparities in regard to the generated steps. The list of steps for triple-stapled technique for JJ anastomosis and retrocolic antegastric approach to Roux limb placement was generated by reviewing videos from 2 online video databases (www.sages.org; www.websurg.com).

Selection of steps for inclusion into the BOSATS scale

Study design

The Delphi method and an online questionnaire were used to achieve consensus among a panel of international

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