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Original article

A histologic evaluation of the laparoscopic adjustable gastric band capsule by tissue sampling during sleeve gastrectomy performed at different time points after band removal

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Abstract

Background: Laparoscopic sleeve gastrectomy (SG) is gaining popularity as a revision option after failed laparoscopic adjustable gastric banding (LAGB). Data have shown that single stage revisions may be associated with a higher complication rate. A histologic basis for this observation has not been studied. The objective of this study was to document the histologic properties of the LAGB capsule across the gastric staple line after SG at various time points after LAGB removal.

Methods: Gastric sleeve specimens of all LAGB to SG revisions were identified from January to May 2013 and underwent histologic evaluation of the LAGB capsule. Single blinded pathologist interpretation was performed, with inflammation, fibrosis, neovascularization, foreign body (FB) reaction, and wall thickness assessed semi-quantitatively and scored from 0–3. Based on combined features, an attempt was made to predict the timing of revision surgery.

Results: The study identified 19 revisions performed for inadequate excess weight loss or weight regain. The mean age for revision was 44 (19–65). The minimum time to revision was 42 days, the longest 1,188 days. There were no surgical complications. Varying degrees of inflammation and fibrosis were common features at all times. Angiogenesis, neovascularization and FB reaction were prominent in revisions performed before 80 days. The gastric wall was thicker during early revision. The optimal time to perform revision was difficult to determine.

Conclusions: LAGB caused varying degrees of inflammatory and FB reaction that time did not fully resolve. The lower leak rates observed with delayed revisions do not appear to be attributable to gastric histology. (Surg Obes Relat Dis 2014;▮:00–00.)

Keywords: Obesity; Laparoscopic adjustable gastric band; Sleeve gastrectomy; Revision surgery; Histology

The first use of the adjustable gastric band was reported in rabbits in the 1980s [1] and first used in humans for weight loss in 1986 [2]. It was subsequently rapidly taken up in Europe, Australia, and Latin America and later

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approved by the FDA for use in the United States in 2001 [3]. Longer-term reviews of the laparoscopic adjustable gastric band (LAGB) later showed mixed results [4]. A recent long-term review by O'Brien et al. [5] revealed that revisional procedures were performed for complications of the LAGB such as proximal enlargement (26%), erosion (3.4%), and port and tubing problems (21%). Band explantation occurred in 5.6%.

Despite the established widespread use of the band and perceptions that the band is reversible [6], there have been no histologic studies that demonstrate the effect of the band on the stomach in the literature. The only studies that have been published, examined "the fragments of fibroadipose tissue in close contact with the band" [7].

Laparoscopic sleeve gastrectomy (SG) has recently gained acceptance as a stand-alone primary bariatric procedure, despite its inception as the first step of a 2-stage bariatric procedure. It is also increasingly becoming an option for revisional surgery after failed or complicated LAGB [8–11].

At our institution, we have accumulated a significant cohort of patients who have been revised from a failed band to a sleeve gastrectomy [12]. This has provided us with an opportunity to utilize the SG technique in the revision of a failed LAGB, to obtain histologic data on the effect of the band on the gastric wall. We also sought information to determine the effects of staging a revision, by analyzing the histologic properties of the SG staple line with respect to the length of time since LAGB removal.

Methods

This descriptive study is prospective in nature and before commencement, ethical approval from University of New South Wales was obtained. All patients received written and verbal information with regard to the consent process and the intended use of their gastric sleeve specimen. No formal selection process was implemented, as there was little likelihood of specimen selection bias. All LAGB to SG conversion surgeries from January to May 2013 in our bariatric unit contributed to our specimens. As a control specimen, a paragastric implant (PGI) to sleeve specimen was included for analysis, as the gastric sleeve staple line would essentially be across normal stomach. Another comparison was sent for staple line analysis in the form of a fundectomy specimen obtained during an immediate LAGB to RYGB revision.

Gastric sleeve specimens obtained, were immediately fixed in 10% neutral buffered formalin. All cases were dissected and sampled for histologic analysis using uniform methods by a single operator. In all cases, except for the PGI specimen, the band capsule was easily identified macroscopically. Two representative sections of stomach were taken from the region underlying the location of the gastric band. These were examined histologically with hematoxylin and eosin (H&E) staining and Masson's Trichome stain. One section from each stomach was examined by immunohistochemistry. Immunohistochemistry was performed on formalin fixed paraffin embedded tissue sectioned at 4 μm onto positively charged slides (Superfrost plus, Menzel-Glaser, Germany) using mouse monoclonal antibodies to collagen III (clone HWD1.1, Biogenex, CA USA, dilution 1 in 25) and to CD 31 (clone JC70 A, Dako CA USA, dilution 1 in 80). All slides were processed with an automated staining system - the Leica BondIII autostainer (Leica Biosystems, Mount Waverley, Victoria, Australia) used according to manufacturer's protocol and with the manufacturer's retrieval solutions. For collagen III enzyme based antigen retrieval was employed for 10 minutes using the manufacturers enzyme pretreatment kit (Cat: VBS Part no: AR 9551). For CD31 heat induced epitope retrieval was performed for 30 minutes in the manufacturer's acidic retrieval solution ER1 (Cat: VBS Part no: AR9961).

Slides were interpreted by a single pathologist (S.V.), blinded to all other data including the timing of surgery. The degree of chronic inflammation, acute inflammation, old fibrosis, recent fibrosis (assessed by H&E and collagen III IHC), neovascularization (assessed by H&E and CD31 immunohistochemistry), foreign body reaction, and wall thickness were all assessed semiquantitatively and scored from 0–3+. Based on combined features the pathologist also attempted to estimate whether the surgery was immediate or delayed.

Results

Table 1 represents the results obtained after single pathologist interpretation. A semiquantitative grading score was recorded for all parameters tabulated, and a blinded prediction of old or recent revision surgery was made. After this, the table was then modified to reflect time to revision, revision type, and a total numerical score to enable identification of trends with respect to revision time.

During the study time, 3 surgeons working within our bariatric unit performed 19 revisions. The mean age for revision was 44 years, and all patients had revision for inadequate excess weight loss or weight regain. Women comprised the majority of patients with 15 undergoing revision as opposed to 4 males. The youngest patient to undergo revision was 19 and the oldest was 65. No postoperative complications were encountered.

The minimum time from removal of LAGB to subsequent SG was 42 days, with the exception of the LAGB-RYGB that was performed immediately as an open procedure. The longest time to revision was just over 3 years. As expected, the PGI to SG revision acted as an appropriate control specimen, as no inflammation (acute or chronic), vascularization, angiogenesis (CD31) nor foreign body reaction was recorded at the gastric sleeve staple line.