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Long-term outcomes of catheterizable continent urinary channels: What do you use, where you put it, and does it matter?

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Summary

Introduction
Appendicovesicostomy (APV) and Monti ileovesicostomy (Monti) are commonly used catheterizable channels with similar outcomes on short-term follow-up. Their relative long-term results have not been previously published.

Objective
Our goal was to assess long-term durability of APV and Monti channels in a large patient cohort.

Study design
In this retrospective cohort study, we retrospectively reviewed consecutive patients ≤21 years old undergoing APV and Monti surgery at our institution (1990–2013). We collected data on demographics, channel type, location, continence and stomal and subfascial revisions. Kaplan–Meier survival and Cox proportional hazards analysis were used.

Results
Of 510 patients meeting inclusion criteria, 214 patients had an APV and 296 had a Monti (50.5% spiral Monti). Median age at surgery was 7.4 years for APV (median follow-up: 5.7 years) and 8.7 years for Monti (follow-up: 7.7 years). Stomal stenosis, overall stomal revisions and channel continence were similar for APV and Monti ($p \geq 0.26$). Fourteen APVs (6.5%) had subfascial revisions compared to 49 Montis (16.6%, $p = 0.001$). On survival analysis, subfascial revision risk at 10 years for APV was 8.6%, Monti channels excluding spiral umbilical Monti: 15.5% and spiral umbilical Monti: 32.3% ($p < 0.0001$, Figure). On multivariate regression, Monti was 2.09 times more likely than APV to undergo revision ($p = 0.03$). The spiral Monti to the umbilicus, in particular, was 4.23 times more likely than APV to undergo revision ($p < 0.001$). Concomitant surgery, gender, age and surgery date were not significant predictors of subfascial revision ($p \geq 0.17$). Stomal location was significant only for spiral Montis.

Discussion
Our study has several limitations. Although controlling for surgery date was a limited way of adjusting for changing surgical techniques, residual confounding by surgical technique is unlikely, as channel implantation technique was typically unrelated to channel type. We did not include complications managed conservatively or endoscopically. In addition, while we did not capture patients who were lost to follow-up, we attempted to control for this through survival analysis.

Conclusions
We demonstrate, durable long-term results with the APV and Monti techniques. The risk of channel complications continues over the channel's lifetime, with no difference in stomal complications between channels. At 10 years after initial surgery, Monti channels were twice as likely to undergo a subfascial revision (1 in 6) than APV (1 in 12). The risk is even higher in for the spiral umbilical Monti (1 in 3).

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Introduction

Since first being described in 1980, the appendix has played an integral role in the creation of continent catheterizable channels using the Mitrofanoff principle [1]. When it is not usable or available for an appendicovesicostomy (APV), other tissue may be used, particularly the transversely tubularized continent ileovesicostomy described by Yang [2] and Monti et al. [3] (Monti), and later modified by Casale [4] (spiral Monti). We have recently reported long-term results from a large cohort of patients after a Monti procedure, noting an increased risk of subfascial revisions among spiral Monti channels to the umbilicus, likely due to a long, unsupported extravesical segment [5].

When comparing APV and Monti techniques, at least 10 small series reported similar short-term rates of subfascial revisions [6—15]. Our initial series of urinary channels demonstrated more complications among APV than Monti channels, but the APV group had much longer follow-up [16]. Despite several decades of use, no direct comparison of long-term results of APV and Monti channels exists. The goal of this study was to assess the durability of the APV compared with the Monti channel, focusing on stomal and subfascial revisions.

Methods

Patient selection and data collection

We performed a retrospective review of consecutive patients ≤21 years old undergoing APV or Monti surgery at our institution (1990—2013). Those with continent urinary reservoirs, double Montis, and channels made of tissue other than appendix or ileum were excluded. To ensure a comprehensive assessment of channel outcomes and not ignore early complications, no minimum follow-up was required. We collected data on demographics and surgery, including channel type and stomal location.

Study outcomes

Primary outcomes were subfascial and stomal revisions. Indications for reoperation were secondary outcomes. Suprafascial revisions for stomal stenosis, prolapse, or granulation tissue were categorized as stomal revisions. Subfascial revisions included a laparotomy for channel angulation or diverticulum resulting in catheterization difficulties, and incontinence due to inadequate tunnel length. Among patients with multiple subfascial revisions of the same channel, time to first revision was used for analysis.

Risk factors

Given our previous work indicating that spiral Monti channels with umbilical stomas have a higher risk of subfascial revisions [5], we compared three groups: APV, spiral umbilical Monti, and all other Monti channels. Risk factors selected for the multivariate analysis included stomal location, concomitant surgeries, gender, and age at and date of surgery. Stomal location was categorized as umbilical or non-umbilical (right or left lower quadrants). Age at surgery was categorized into three clinically meaningful groups: <8, 8 to <16 and ≥16 years. To adjust for changing practices and surgical techniques, date of surgery was dichotomized as occurring within the last 10 years or before, a relatively arbitrary cut-off. Although exact surgical technique details were unavailable for each case, over the last decade channels were typically made with a 4-cm submucosal tunnel in the anterior bladder wall and a V-skin flap stoma. Intravesical implantation was typically favored if the bladder was opened (i.e., concomitant bladder augmentation) and an extravesical channel was favored if it was the only procedure preformed. Channel type was dictated by surgeon preference and appendix availability.

Statistical analysis

Categorical variables were analyzed by Fisher's exact test, continuous ones by the Mann—Whitney U test. Kaplan—Meier analysis and Cox proportional hazards modeling were used, with proportional hazards assumptions verified by log—log plots and the non-zero slope test of the scaled Schoenfeld residuals. The final model did not include the diagnosis of spinal dysraphism, because it did not satisfy the proportional hazards assumption. Spinal dysraphism was not associated with the risk of a subfascial revision and the overall results did not change when it was included.

To assess changes in risk between the first 5 years of follow-up and the second 5 years (5—10 years), we calculated the difference in risk at 5- and 10-year time points from the survival analysis. Although other time points could be chosen, these are helpful in counseling and our previous work indicates risk may decrease after 5 years [5]. Statistical analyses were performed with a critical $p = 0.05$ using Stata (v.10.1).

Results

Population characteristics

Of 510 patients meeting inclusion criteria, 214 patients had an APV (40.4% were split appendix, using proximal appendix for a concomitant antegrade continence enema procedure). The remaining 296 patients had a Monti, of whom half (50.5%) had a spiral Monti. The two groups had similar rates of concomitant bladder augmentation (53.7% vs. 54.7%, $p = 0.86$) and Malone antegrade continence enema procedures (59.8% vs. 55.4%, $p = 0.36$) (Table 1). The two groups differed in several regards. Patients undergoing an APV were less likely to have a concomitant bladder neck procedure (33.6% vs. 44.9%, $p = 0.01$), but were more likely to be male (62.1% vs. 46.0% male, $p < 0.001$). Median age at surgery for patients with an APV was 7.4 years (range 1.9—20.5 years) compared with 8.7 years (range 0.8—20.9 years) for a Monti ($p = 0.003$).

Median follow-up for patients with an APV was about 2 years shorter than for a Monti (5.7 vs. 7.7 years, $p = 0.01$).