



A case of base rate bias, or are adolescents at a higher risk of developing complications after catheterizable urinary channel surgery?

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Summary

Objective

Adolescents are considered to be at high risk of developing complications after lower genitourinary tract reconstruction. This perception may be due to base rate bias, where clinicians favor specific information (adolescents with complications), while ignoring more general information (number of total adolescents being followed). The goal of this study was to assess whether age was a true risk factor for subfascial and stomal revisions after continent catheterizable urinary (CCU) channel procedures.

Materials and Methods

Consecutive patients aged <21 years and who underwent appendicovesicostomy and Monti surgery at the present institution were retrospectively reviewed; demographic and surgical data were collected. Time to subfascial or stomal revision was stratified by age at initial surgery (child: <8, preteen: 8–12, adolescent: 13–17, adult: ≥18 years old) and analyzed with Cox proportional-hazards regression. Secondary analyses included: different age categories at initial surgery (<8, 8–11, 12–15, 16–19, ≥20 years), analyzing age as a continuous and a time-varying covariate.

Results

Of the 510 patients with CCU channels (median age at surgery: 7.9 years), 63 (12.4%) had subfascial and 53 (10.4%) had stomal revision (median follow-up: 6.8 years). Median age at subfascial and stomal revision was 11.3 and 10.3 years, respectively. Preteens contributed 33.0% and

adolescents contributed 29.3% of the total follow-up time (3263.9 person-years). Over 80% of revisions occurred within 5 years of surgery, regardless of age at initial surgery ($P \geq 0.57$) (Summary table). On multivariate analysis, age at initial surgery was not associated with undergoing subfascial ($P \geq 0.62$) or stomal revisions ($P \geq 0.69$). Montis were 2.1 times more likely than appendicovesicostomies to undergo a subfascial revision ($P = 0.03$). No other variables were associated with the risk of subfascial or stomal revision ($P \geq 0.11$). Secondary analyses provided similar results.

Discussion

Since the median age at surgery was 8 years old and most complications occurred within the first 5 years of follow-up, it is not surprising that most revisions occurred in 8–13 year olds. Pediatric urologists appear to base their impression of adolescents being “high risk” on specific information (adolescents having complications), while subconsciously ignoring more general information (adolescents represent a large proportion of patients in follow-up).

This study had several limitations: channel complications treated non-surgically (e.g. prolonged catheterization) were not included. The findings may not be generalizable to other genitourinary reconstructive procedures or clinical settings.

Conclusions

While complications were twice as high in Monti channels than appendicovesicostomies, no single age group was at increased risk. The impression that adolescents are a high-risk group appears to represent a base rate bias.

Summary table Timing of subfascial and stomal revisions, stratified by age at surgery.

Age at initial surgery	Total revisions	Revisions within the first 5 years of follow-up
Subfascial revisions		
<8 years old	32	27 (84.4%)
8–12 years old	18	13 (72.2%)
13–17 years old	10	9 (90.0%)
≥18 years old	3	2 (66.7%)
Stomal revisions		
<8 years old	27	23 (85.2%)
8–12 years old	17	15 (88.2%)
13–17 years old	7	7 (100.0%)
≥18 years old	2	2 (100.0%)

Introduction

Adolescents have demonstrated a high risk of developing complications related to non-urological chronic health conditions [1–5], after appendectomy [6] and for recurrence of nephrolithiasis [7]. Although there is little data to support it, many consider adolescents to also be at high risk of developing complications after lower genitourinary tract reconstruction [8]. Every one of the 20 North American pediatric urologists informally surveyed by the authors at the 2014 Society of Pediatric Urology Fall Congress believed adolescents to be a high-risk group for developing complications after urinary continence surgery (results unpublished). This impression may be related to decreased compliance in this age group [9]. Recently, this notion has been challenged by reports indicating that as a group, adolescents are not at an elevated risk of developing stone complications after bladder augmentation [10,11].

When assessing whether adolescents are at a higher risk of developing complications after urological surgery, the average age at which complications occur urological surgery, we need to look beyond the average age, as this number may not necessarily represent the age of highest risk. To accurately calculate risk, the ratio incorporating both the number of patients of a particular age who develop an outcome (numerator), and the number of patients of a particular age who are at risk of developing that outcome (denominator) must be analyzed. Therefore, an appropriate assessment of risk based on age must take both of these variables into account, not just the numerator. To date, no previous reports have performed a comprehensive analysis of age during follow-up as a risk factor for complications after genitourinary reconstruction.

The impression that adolescents represent a high risk group may be due to base rate bias [12]. This subconscious phenomenon has been described in the psychology literature, but not previously reported in the surgical literature. Base rate bias describes an instance where clinicians favor specific information (e.g. numerator, or number of adolescents with complications), while unintentionally ignoring more general information (e.g. denominator, or number of adolescents being followed).

Long-term results with continent catheterizable urinary (CCU) channels using either appendicovesicostomy (APV) or Monti techniques have previously been reported [13]. The goal of the present study was to comprehensively assess whether age during follow-up was a risk factor for subfascial or stomal revisions in a previously described cohort of patients after CCU channel procedures. It was hypothesized that age was not a risk factor for complications.

Methods

Consecutive patients aged <21 years, who underwent APV and Monti surgery at the present institution (1990–2013) were retrospectively reviewed. Data on demographics and surgery were collected. No minimal follow-up was required to ensure a comprehensive assessment of early and late channel outcomes.

Outcomes

Primary outcomes were stomal and subfascial revisions. Subfascial revisions included a laparotomy for catheterization difficulties due to channel angulation or diverticulum, and/or incontinence due to inadequate tunnel length. Stomal revisions included suprafascial revisions for stomal stenosis, prolapse, or granulation tissue without a laparotomy. Time to first revision was used for analysis of patients with multiple revisions of the same channel.

Age as a potential risk factor

Age was assessed in clinically relevant pre-adolescent and post-adolescent intervals over the course of follow-up (children: <8 years old; preteens: 8–12 years; adolescents: 13–17 years; adults: ≥18 years). The number of revisions (numerator) and the cumulative follow-up contributed by all patients within each age interval (denominator, in person-years) were tabulated. Since initial age at surgery and length of follow-up varied between patients, an individual patient could contribute follow-up time to any consecutive age groups. It was anticipated that the distributions of complications (numerator) and follow-up time (denominator) would be similar.

Three secondary analyses of age were also performed. The entire analysis was repeated with five different age categories (<8, 8–11, 12–15, 16–19, ≥20 years old). Age was also analyzed as a continuous variable and a time-varying covariate. Since age changes continuously over the course of follow-up, modeling it as a time-varying covariate allowed for a more nuanced analysis of whether changing age, rather than age at baseline, predisposed to CCU complications.

Other potential risk factors

Given the previous work showing that APV channels were significantly less prone to subfascial revisions [13] than Monti channels, and spiral Monti channels with umbilical stomas are most prone [14], three groups were compared: APV, spiral umbilical Monti, and all other Monti channels. Additional risk factors selected *a priori* for the multivariate analysis included age, overall stomal location, gender, surgery date and concomitant surgeries. Stomal location was categorized as umbilical or non-umbilical. Surgery date was (arbitrarily) dichotomized to within the past 10 years or after, to attempt to adjust for changing practices and surgical techniques. Surgical techniques for each channel have been outlined elsewhere [13]. Channel type was dictated by appendix availability and surgeon preference.

Statistical analysis

First, the timing of complications for each age group was compared using a Fisher's exact test. Time periods assessed included: the first 5 years of follow-up, the second 5 years (5–9 years) and at 10 years and later. If patients operated at different ages were at a similar risk of developing CCU complications, they would all be expected to develop complications within the first 5 years of follow-up, as

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