



# Effect of baseline obesity and postoperative weight gain on the risk of channel revision following continent catheterizable urinary channel surgery

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## Summary

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## Objective

Prior studies suggest that obese patients are at increased risk for complications following continent catheterizable urinary (CCU) channel surgery. We hypothesized that postoperative weight gain increases the risk of channel angulation, difficulty catheterizing, and possible channel perforation requiring subfascial revision. The purpose of this study was to evaluate whether baseline obesity or becoming overweight/obese postoperatively was associated with a greater risk of subfascial revision.

## Results

Of the patients, 328/501 (65.5%) had baseline and post-baseline BMI data available: 53.4% male, 90.6% white, median age 7.4 years; median follow-up 76.4 months. Of the 328 patients, 38 (11.6%) had subfascial revisions. Baseline BMI data were available for 378 patients, and, of these, 130 (34.4%) were overweight/obese at baseline. Overweight/obese patients were more likely to undergo umbilical Monti (10% vs. 8.1%), non-umbilical spiral Monti (33.8% vs. 13.7%), and spiral umbilical Monti channels (13.8% vs. 7.3%) versus normal/underweight patients ( $p < 0.0001$ ). From a multivariable Cox proportional hazard model controlling for age, BMI category, diagnosis, and ambulatory status, the hazard of subfascial revision for spiral umbilical Monti channels was 2.1× that of other channels (hazard ratio (HR) 2.1 [95% CI 1.2–3.8],  $p = 0.01$ ). Fifty-one out of 328 patients (15.6%) became overweight/obese postoperatively, with 7.8% having a subfascial revision vs. 12.3% of those whose weight category decreased or remained stable ( $p = 0.3$ ) (Table 1).

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## Method

We reviewed retrospectively an institutional database of patients who underwent CCU channel surgery between the ages of  $\geq 2$  and  $< 20$  years from January 1990 to May 2013, excluding those with continent urinary reservoirs, continent vesicostomies, and those without body mass index (BMI) data. We collected data on patient/procedure characteristics, baseline/most recent BMI, and subfascial revision(s). We used Cox proportional hazard multivariable regression to assess the association of being overweight/obese at baseline ( $\geq 85\%$  BMI) with time to first subfascial revision, and Fisher's exact test to compare rates of subfascial revision between those who became overweight/obese and those who did not.

## Conclusions

Patients who were overweight/obese at baseline were more likely to have channels constructed that are at the highest risk of subfascial revision. Patients who became overweight/obese postoperatively were not at greater risk of subfascial revision. Limitations include potential bias because of differential follow-up and inaccuracy of BMI percentile as a measurement of obesity.

**Keywords**  
Obesity; Urinary bladder; Neurogenic; Postoperative complications

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## Introduction

A number of postoperative complications have been reported after creation of continent catheterizable urinary (CCU) channels, and these can be categorized into either stomal complications (e.g., stenosis or prolapse) or subfascial complications (e.g., channel angulation, diverticulum, or incontinence) [1–4]. We previously reported that the increased risk of subfascial revision in Monti channels, particularly the longer spiral umbilical Monti channels, is believed to be secondary to a longer, unsupported extravesical channel [5].

Prior studies have suggested that baseline obesity may increase the risk of postoperative complications following lower urinary tract reconstruction [6,7]. In a study of myelodysplasia patients undergoing lower urinary tract reconstruction, Donovan et al. noted a significant association between baseline obesity and the presence of any medical or surgical postoperative complication [7]. Clark et al. noted an association between percentile weight and stomal stenosis rate following CCU channel procedures, although the differences did not reach statistical significance [6]. To our knowledge there are no prior studies on the effects of postoperative weight gain in children undergoing lower urinary tract reconstruction.

We hypothesized that patients with CCU channels who gain weight in the postoperative period may increase the distance from the bladder to the skin (particularly with non-umbilical stomas) resulting in channel angulation, difficulty catheterizing, and possible channel perforation. This type of suprafascial issue may require channel revision including subfascial repair. The purpose of this study was to examine whether patients who are obese at the time of surgery or who become overweight or develop obesity postoperatively, have an increased risk of subfascial channel revision.

## Materials and methods

We included all patients  $\geq 2$  years of age and  $< 20$  years of age from our retrospective institutional database who underwent CCU channels at our institution between January 1990 and May 2013. The database was constructed from a combination of billing data, review of electronic medical records, and paper charts. Patients with continent urinary reservoirs and channels constructed of tissue other than appendix or ileum (e.g., colon or ureter or continent vesicostomies) were excluded from the database. We also excluded those with missing height or weight data as their body mass index (BMI) could not be calculated. Patients  $< 2$  years of age and  $\geq 20$  years of age at the time of surgery were excluded from the study as it is not possible to calculate BMI in these age groups using the Centers for Disease Control (CDC) pediatric criteria [8].

The primary outcome was the need for at least one subfascial revision, defined as a need for laparotomy to correct difficult catheterization because of issues such as channel angulation, perforation, diverticulum, false passage, or stenosis. Demographics, clinical and CCU channel

characteristics (e.g., stomal location), and follow-up duration were abstracted from the institutional database and patient charts. Height and weight data were identified from retrospective review of hospital records. Preoperative or “baseline” BMI was defined as a patient’s BMI measured at the closest time point within 1 year of the date of CCU channel surgery. Postoperative BMI was defined as the BMI at the most recent postoperative visit or within 1 year of subfascial revision or channel excision. The 1-year perioperative timeframe was chosen to maximize the number of patients with available BMI data, while minimizing inaccuracies of BMI data that are not representative of true baseline or postoperative BMI.

BMI was calculated according to the standard formula,  $BMI = kg/m^2$ . Weight categories were defined for pediatric patients  $\geq 2$  years and  $< 20$  years based on an age- and gender-specific BMI percentile according to CDC criteria [8]. BMI percentile, equivalent to the BMI z-score, was used because children’s body composition varies by age and between boys and girls [9]. Patients were categorized as low/normal weight ( $< 85$ th BMI percentile) and overweight/obese ( $\geq 85$ th BMI percentile) [8]. A categorical variable was created for all patients in the cohort using the following categories: a) became overweight/obese, b) maintained stable low/normal BMI, c) maintained overweight/obese BMI, and d) became low/normal (overweight/obese at baseline). We used Fisher’s exact test to examine the association between baseline BMI percentile category and channel type.

## Data analysis of baseline obesity

Demographic and clinical data were compared between those with and without a first revision by use of Fisher’s exact and chi-square tests, to elucidate risk factors for subfascial revisions. Continuous characteristics were analyzed using an analysis of variance model or Wilcoxon rank sum test as appropriate based on data characteristics. We examined the association between BMI percentile category and channel type using Fisher’s exact test. We also compared demographic and clinical data between different BMI percentile categories including: a) missing BMI percentile vs. underweight/healthy BMI percentile, and b) overweight/obese BMI percentile vs. underweight/healthy BMI percentile. We assessed the association of the baseline BMI percentile category with time to the first subfascial revision, our primary outcome, controlling for demographic and clinical characteristics, using Cox proportional hazards regression. Patient characteristics of age, gender, race, BMI percentile category, presence or absence of myelomeningocele, ambulatory status, channel type, and stomal location were thought to be clinically important. These variables were selected, a priori, for inclusion in the model of time to first subfascial revision. The proportional hazards assumption was assessed for each covariate by graphical means. Variables (gender and race) for which the assumption did not hold were removed from the multivariable model. The final Cox model included age, BMI percentile category, spiral Monti channel at the umbilicus, myelomeningocele diagnosis, and ambulatory status.

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