

# Correlation of Penile and Bulbospongiosus Measurements: Implications for Artificial Urinary Sphincter Cuff Placement

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## Abbreviations and Acronyms

AU = anastomotic urethroplasty  
AUS = artificial urinary sphincter  
DB = distal bulbospongiosus  
PB = proximal bulbospongiosus  
PC = penile circumference  
SPL = stretched penile length

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Study received University of Texas Southwestern institutional review board approval.

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**Purpose:** We assessed penile and bulbospongiosus measurements to develop a quantitative guide to select the surgical approach (perineal vs transscrotal vs transcorporeal) to artificial urinary sphincter cuff placement.

**Materials and Methods:** We retrospectively reviewed the intraoperative records of 100 men who underwent artificial urinary sphincter placement (43) or anastomotic urethroplasty (57) from February 2008 to June 2009. Correlations between penile (stretched length and circumference at the shaft base) and bulbospongiosus (distal and proximal circumference) measurements were assessed. Cases were analyzed according to 2 penile circumference groups, including group 1—8.0 cm or less and group 2—8.5 or more.

**Results:** Mean proximal bulbospongiosus circumference was uniformly larger than distal bulbospongiosus circumference (4.5 vs 3.9 cm). It was about 50% of the penile shaft circumference (mean 8.9 cm,  $r = 0.70$ ). In group 1 men the average distal bulbospongiosus circumference was 3.4 cm. They were more likely to undergo transcorporeal artificial urinary sphincter cuff placement than those in group 2, who had an average distal bulbospongiosus circumference of 4.1 cm (8 of 22 or 36% vs 1 of 21 or 5%, OR 11.4). Penile length correlated less robustly with distal and proximal bulbospongiosus circumference ( $r = 0.39$  and  $0.43$ , respectively). Patients with urethroplasty had significantly larger urethral measurements than those with the artificial urinary sphincter (proximal and distal bulbospongiosus circumference 4.9 vs 3.7 and 4.1 vs 3.2, respectively) but were significantly younger (47 vs 67 years), and less likely to have erectile dysfunction (11 of 57 vs 34 of 43) or to have undergone radical prostatectomy (0 of 57 vs 37 of 43).

**Conclusions:** Bulbospongiosus circumference appears to be proportional to penile circumference. The distal bulbospongiosus is uniformly smaller than the proximal bulbospongiosus. The potential need for a perineal or transcorporeal approach to artificial urinary sphincter placement can be anticipated by penile circumference measurements and a combination of clinical factors, such as older patient age, history of radical prostatectomy and impotence.

**Key Words:** penis; urinary sphincter, artificial; urinary incontinence; prostatectomy; organ size

ALMOST 40 years after its introduction AUS remains the gold standard for post-prostatectomy urinary incontinence. Efficacy and complication rates are well established for the original perineal surgical approach to AUS cuff place-

ment<sup>1-6</sup> but in 2003 Wilson et al popularized a simplified, 1-incision transscrotal approach to install the 3 AUS components.<sup>7</sup>

Recently investigators suggested that transscrotal AUS cuff place-

ment yields inferior continence outcomes than the perineal approach.<sup>8</sup> This discrepancy is thought to be due to differences in AUS cuff placement with perineal access allowing wider access to the more robust proximal bulb, where more spongy tissue is available to be compressed by the AUS cuff. This yields better coaptation of the underlying urethral mucosa and, thus, better continence.

We have observed that smaller men who undergo AUS cuff placement through a transscrotal approach appear to be prone to incomplete mucosal coaptation and suboptimal return of continence. We hypothesized that penile and bulbospongiosus circumference measurements are proportionately related and bulbospongiosus size may be predicted by preoperative examination of penile length and girth. We examined the relationship between penile and bulbospongiosus measurements.

## MATERIALS AND METHODS

The study received University of Texas Southwestern institutional review board approval. Between February 2008 and June 2009 we analyzed 2 groups of men undergoing urethral surgery, including AU for anterior urethral stricture and AUS placement for urinary incontinence, respectively. Penile and urethral measurements were prospectively recorded intraoperatively and analyzed retrospectively.

### Study Inclusion Criteria

Incontinent men undergoing an AUS procedure were included in analysis when cuff placement was done via a perineal approach. Men with AU were included only when complete perineal urethral mobilization was done, allowing ample exposure to measure bulbospongiosus circumference in the upper and lower perineal aspects. Men undergoing complex urethroplasty, such as a ventral buccal mucosa graft or penile skin flap onlay, were excluded from study because the dorsal urethra was not mobilized and, thus, circumferential measurements were not available.

### Intraoperative Measurements

Stretched penile measurements were made after anesthesia induction and before perineal incision with the penis flaccid. SPL was measured with a metal ruler on the dorsal penile aspect from pubic bone to glans tip. PC was measured loosely at the base of the shaft just above the scrotum. In AUS cases urethral sizing tape was used and in AU cases umbilical tape was used. SPL and PC measurements were made in all patients.

Urethral measurements were made via the perineal incision after complete bulbospongiosus exposure and before bulbar urethral transection in AU cases. DB circumference was measured in the uppermost aspect of the perineal incision just below the scrotum 5 to 6 cm distal to the central tendon insertion. PB circumference was measured in the most posterior portion of the perineal incision 1 to 2 cm distal to the central tendon. In AU cases the entire urethra was mobilized to promote tension-free

anastomosis, enabling DB and PB measurements to be made.

In AUS cases the cuff was often placed via proximal urethral segmental mobilization, allowing only PB measurement to be made. DB measurements were done in AUS cases with distal bulbar dissection, including several with transcorporeal cuff placement. When wide bulbar dissection was performed in AUS cases PB and DB were measured. Extensive bulbar dissection was seldom needed in AUS cases and was done only in select reoperative or transcorporeal cases.

### Statistical Analysis

Correlation coefficients and the slope of the linear regression line between external penile and bulbar urethral measurements were calculated using SPSS®, version 17. The 2-tailed Student t test was used to compare continuous variables. The OR was used to compare noncontinuous variables.

## RESULTS

Between February 2008 and June 2009 we included 57 men with AU and 43 with AUS in this analysis. In the 100 patients average age was 55.0 years (range 18 to 83), average PC was 8.7 cm (range 7.0 to 12.5) and average SPL was 14.3 cm (range 9.0 to 18.5). The proximal bulb was uniformly larger in caliber than the distal bulb, including an average of 3.9 cm (range 3.0 to 6.5) in the 70 men with DB measurements and 4.5 cm (range 3.0 to 8.5) in the 92 with PB measurements. Of the 43 men with AUS 35 had PB and 13 had DB measurements. The AUS was placed transcorporeally in 9 patients and around the proximal bulbar urethra through a perineal incision in the other 34.

### Penile and

### Bulbospongiosus Measurement Correlation

PC closely correlated with proximal urethral circumference, more so than penile length. Proximal bulbar urethral caliber was about half that of the penile base. The correlation coefficient in 92 men with PC and PB measurements was 0.70 (95% CI 0.58–0.79,  $p < 0.001$ ) and the slope of the linear regression line was 0.50 (part A of figure). The correlation coefficient in 70 men with PC and DB measurements was 0.65 (95% CI 0.49–0.78,  $p < 0.001$ ) and the slope of the linear regression line was 0.42 (part B of figure). The correlation of SPL with DB and PB was less ( $r = 0.39$ , 95% CI 0.20–0.55 and  $r = 0.43$ , 95% CI 0.25–0.58, respectively, each  $p < 0.001$ ).

### Analysis Based on PC

Patients were divided into 2 groups, including group 1—PC 8.0 cm or less and group 2—PC 8.5 cm or greater (table 1). Eight cm was chosen as a cutoff because, based on the observed 50% correlation between PC and PB, a man with PC 8 cm or less would

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