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Comparison of complication rates related to male urethral slings and artificial urinary sphincters for urinary incontinence: national multi-institutional analysis of ACS-NSQIP database

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Abstract

Purpose Male stress urinary incontinence (SUI) can significantly diminish quality of life and lead to embarrassment and social withdrawal. Surgical therapies, such as male urethral slings and artificial urinary sphincters (AUS), are considered effective and safe treatments for male SUI. Our objective is to evaluate 30-day complications in patients undergoing male slings and AUS placement from a national multicenter database.

Methods Data from the American College of Surgeons National Surgical Quality of Improvement Program for 2008–2013 were used to identify patients who underwent male slings and AUS implantation. Trained coders abstracted complication data from the patient record independent of the surgical team. We compared 30-day postoperative complications for male slings and AUS. We examined the relationship between patient factors and complication rates for each procedure type.

Results Overall, 1205 incontinence surgeries in men were identified: 597 male sling placements and 608 AUS implantations. Male sling placement had a lower 30-day postoperative complication rate compared to AUS (2.8 vs. 5.1 %, $p = 0.046$). Compared to AUS, male sling was associated with fewer urinary tract infections (0.3 vs. 2.0 %, $p = 0.020$) and return trips to the operating room (1.0 vs.

3.0 %, $p < 0.001$). Patients with higher BMI were more likely to have a complication, while age, race and Charlson comorbidity index were not associated with higher or lower complication rates.

Conclusions Complications rates for both male sling and AUS are low. Male sling is associated with a lower rate of complications than AUS. These findings allow for better patient perioperative counseling regarding 30-day perioperative complications.

Keywords ACS-NSQIP · Artificial urinary sphincter · Complications · Male urethral sling · Urinary incontinence

Introduction

Male urinary incontinence is defined as the involuntary loss of urine that is a social and hygienic problem [1]. Stress urinary incontinence (SUI) can have a devastating effect on the patient's quality of life leading to embarrassment, social withdrawal and high patient costs for pads and diapers [2]. Nearly 10–20 % of men develop severe SUI after radical prostatectomy (RP), a primary treatment for prostate cancer [3]. An estimated 6 % of men who had a RP undergo surgical intervention for treatment of SUI [3]. Several surgical options are available for SUI in men including male urethral sling and artificial urinary sphincter (AUS) [2]. AUS is considered the gold standard for moderate to severe SUI treatment in men [4] and has been utilized for over 30 years, despite modest drawbacks, such as high long-term reoperation rates [5, 6]. There is a growing trend to utilize male slings with the introduction of the transobturator sling, due to the ease of the operation, reduced financial cost, and the lack of need to operate a device to void [6, 7]. Although male slings have

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traditionally been reserved for mild SUI, some clinicians report success with slings treating moderate to severe SUI [8]. Little data exist directly comparing male sling and AUS outcomes given their use in relatively distinct populations. Furthermore, while AUS has not changed substantially over the past 30 years, male slings have continued to evolve [8, 9], providing fewer data for direct comparison of outcomes.

Understanding relative rates of male slings and AUS complications can help clinicians better counsel SUI patients of surgical risks, thus promoting informed decision making and appropriate patient expectations. Furthermore, identifying specific patient characteristics associated with perioperative male sling and AUS morbidity may help promote improved patient selection for SUI treatment. Complications data can also be utilized by individual surgeons as a standard with which to compare their practice-specific complication rates. It can serve as a quality metric that may allow surgeons to identify areas of potential improvement in their practice. Data regarding male slings and AUS implantation complications have typically come from retrospectively reviewed large single-institution cases series [10, 11] and identified from administrative billing data that have inherent limitations [12].

Our objective is to identify and compare 30-day complication rates for patients undergoing male sling and AUS placement and to determine patient characteristics associated with these complications. This is the largest multi-institutional study of its kind that directly compares sling and AUS 30-day surgical complication rates utilizing a high-quality outcomes registry (ACS-NSQIP) abstracted from patient clinical charts.

Methods

Data source

We utilized the American College of Surgeons National Surgical Quality Improvement Program dataset (ACS-NSQIP), which was established in 2004 and is the first nationally validated, outcome-oriented and risk-adjusted program for improvement of surgical procedures. ACS-NSQIP methods have been previously described [13]. ACS-NSQIP measures several demographic and outcome variables related to 30-day postoperative outcomes. The data are prospectively collected directly from patient charts and entered into a dataset in a standardized format by trained surgical clinical reviewers, who are intermittently audited for inter-rater reliability. ACS-NSQIP data are mandated to improve surgical quality and are given in a de-identified format for research purposes [14].

Predictors and outcomes

We reviewed data from January 1, 2008–December 31, 2013. We selected all patients who underwent male sling placement using current procedural terminology (CPT) code (53440) and those who underwent AUS placement using CPT code (53445). Our primary outcome was the prevalence of overall and procedure-specific complications during the 30-day postoperative period. We also identified the prevalence of specific complications: pneumonia, wound dehiscence, surgical site infection, prosthesis failure, myocardial infarction/cardiac arrest, unplanned intubation, pulmonary embolism, deep vein thrombosis/thrombophlebitis, stroke with neurological deficit, acute renal failure, urinary tract infection (UTI), bleeding with transfusions, sepsis, return to the operating room, and mortality. In addition, we abstracted demographic data including patient age (grouped as patients aged 18–64 and ≥ 65 years), race (white, black, and other/unknown), calculated Charlson comorbidity index (CCI) score (<3 , 3, 4, and ≥ 5 comorbidities) [15], body mass index (BMI) (≤ 18.5 –30, 30.1–35, 35.1–40, and >40), and number of medical comorbidities.

Statistics

Data analysis was performed using Stata (version 13.1, StataCorp, College Station, TX). Categorical variables were summarized using frequencies and percentages and analyzed using the Chi-squared test. Continuous variables were analyzed using means, medians, and standard deviations. We examined continuous variables used Student's *t* test and One-way analysis of variance adjusted for multiple comparisons, if necessary. The Wilcoxon test was used to analyze variables with non-normal distributions. All tests were two-sided, and *p* values less than 0.05 were considered statistically significant. A binary logistic model including all significant covariates was used to validate the results.

Results

We identified a total of 608 patients who underwent AUS insertion, and 597 patients who underwent male sling insertion during the study period. All patients enrolled had complete 30-day follow-up data. Male sling and AUS patients were similar across various demographic and comorbidity variables (Table 1). Compared to patients who underwent AUS, sling patients were less likely to be White (67 vs. 82 %), have a BMI of ≤ 18.5 –30 (13 vs. 19 %), have hypertension (62 vs. 70 %), have a bleeding disorder (1.7 vs. 3.6 %), and have a history of disseminated cancer (0.2 vs. 1.5 %). The overall health of the patient did not appear

Table 1 Comparison of patient characteristics between AUS and MUS from 2006 to 2013

Characteristic	MUS <i>n</i> (%)	AUS <i>n</i> (%)	<i>p</i> value*
Age			
18–65	160 (26.8)	165 (27.1)	0.900
65+	437 (73.2)	443 (72.9)	
Race			
White	401 (67.2)	497 (81.7)	<0.001
Black	56 (9.4)	40 (6.6)	
Other/unknown	140 (23.4)	71 (11.7)	
Charlson index			
<3	63 (10.6)	75 (12.3)	0.631
3	211 (35.3)	199 (32.7)	
4	250 (41.9)	253 (41.7)	
>5	73 (12.2)	81 (13.3)	
BMI			
≤18.5–30	76 (12.7)	116 (19.1)	0.030
30.1–35	279 (46.8)	282 (46.4)	
35.1–40	166 (27.8)	135 (22.2)	
>40	76 (12.7)	75 (12.3)	
Comorbidity			
Hypertension	368 (61.6)	427 (70.2)	0.002
Diabetes mellitus	101 (16.9)	121 (19.9)	0.100
Pulmonary comorbidity	31 (5.2)	35 (5.8)	0.240
Renal failure	0 (0)	1 (0.2)	0.510
Alcohol abuse	12 (2)	8 (1.3)	0.240
Bleeding disorder	10 (1.7)	22 (3.6)	0.036
Disseminated cancer	1 (0.2)	9 (1.5)	0.011
Current smoking	45 (7.5)	54 (8.9)	0.400
Chronic steroid use	9 (1.5)	18 (3)	0.120
Neurological comorbidity	18 (3)	25 (4.1)	0.320

Bold values indicate statistically significant

MUS male urethral sling, AUS artificial urinary sphincter, BMI body mass index

* Chi-squared test

to affect the choice of procedure, as the CCI was not significantly different between sling and AUS (3.56 ± 0.98 vs. 3.61 ± 1.15 , $p = 0.425$, respectively).

While the overall complication rate was low, sling placement was associated with a lower 30-day complication rate compared to AUS (2.8 vs. 5.1 %, $p = 0.046$). Male sling patients had statistically fewer UTIs (0.3 vs. 2.0 %, $p = 0.020$) and return trips to the operating room (1.0 vs. 3.0 %, $p = 0.001$) (Table 2). Compared to AUS patients, sling patients experienced a trend toward fewer surgical site infections, prosthesis failure, cardiac complications, unplanned intubation, deep vein thrombosis, acute renal failure, bleeding requiring a transfusion, and sepsis.

Table 2 30-day complications of male incontinence surgery from 2006 to 2013

Complication	MUS <i>n</i> (%)	AUS <i>n</i> (%)	<i>p</i> value*
Overall	17 (2.8)	31 (5.1)	0.046
Pneumonia	2 (0.3)	1 (0.2)	0.490
Wound dehiscence	1 (0.2)	1 (0.2)	0.990
SSI	6 (1)	7 (1.2)	0.810
Prosthesis failure	0 (0)	1 (0.2)	0.320
MI/Cardiac arrest	0 (0)	3 (0.5)	0.090
Unplanned intubation	0 (0)	1 (0.2)	0.320
Pulmonary embolism	1 (0.2)	0 (0)	0.310
DVT/thrombophlebitis	1 (0.2)	3 (0.5)	0.330
Stroke with neurological deficit	1 (0.2)	0 (0)	0.310
Acute renal failure	0 (0)	2 (0.3)	0.160
Urinary tract infection	2 (0.3)	11 (2)	0.020
Bleeding transfusions	0 (0)	2 (0.3)	0.160
Sepsis	1 (0.2)	5 (0.8)	0.110
Return to OR	3 (1)	18 (3)	0.001

Bold values indicate statistically significant

MUS male urethral sling, AUS artificial urinary sphincter, SSI surgical site infection, MI myocardial infarction, DVT deep vein thrombosis, OR operating room

* Chi-squared test

In both sling and AUS patients, increased BMI was associated with a greater likelihood of developing a 30-day postoperative complication ($p = 0.0003$). No other demographic or comorbidity variables were associated with an increased likelihood of developing a 30-day postoperative complication in the two groups (Table 3). Out of 1205 patients, there was one 30-day mortality death of an AUS patient. In a binary logistic model controlling for BMI, hypertension, bleeding disorders, and disseminated cancer, the odds of a complication in sling versus AUS remained significant (OR 1.72, 95 % CI 1.001–2.963, $p = 0.049$), but no other covariates reached statistical significance.

Discussion

In this national analysis of male sling and AUS, we demonstrate the safety of both procedures in the 30-day postoperative period. We recognize that the incontinence status after implantation of either device is not assessed in this dataset. Although we show a higher complication rate in the AUS group, we believe that the long-term benefit for AUS in terms of continence outcome likely outweighs its higher complication rate, particularly since AUS is typically used for more severe incontinence and male slings'

Table 3 Patient characteristics and complication rates for incontinence procedures from 2006 to 2013

Characteristic	MUS complications n (%)	AUS complications n (%)	p value*
Age			
18–65	4 (2.5)	18 (10.9)	0.500
65+	13 (3)	13 (2.9)	
Race			
White	10 (2.5)	26 (5.2)	0.450
Black	3 (5.4)	1 (2.5)	
Other/unknown	4 (2.9)	4 (5.6)	
CCI			
<3	0 (0)	8 (10.7)	0.240
3	9 (4.3)	10 (5)	
4	6 (2.4)	11 (4.4)	
>5	2 (2.7)	2 (2.5)	
BMI			
≤18.5–30	3 (4)	3 (2.6)	0.0003
30.1–35	3 (1.1)	12 (4.3)	
35.1–40	2 (1.2)	5 (3.7)	
>40	9 (11.8)	11 (14.7)	
Comorbidity			
Hypertension	8 (2.2)	14 (3.3)	0.195
Diabetes mellitus	3 (3.0)	4 (3.3)	0.207
Pulmonary comorbidity	1 (3.2)	0 (0.0)	0.433
Renal failure	0 (0.0)	1 (2.9)	0.480
Alcohol abuse	0 (0.0)	0 (0.0)	0.989
Bleeding disorder	1 (10.0)	1 (4.6)	0.687
Disseminated cancer	0 (0.0)	0 (0.0)	0.964
Current smoking	0 (0.0)	0 (0.0)	0.988
Chronic steroid use	1 (11.1)	0 (0.0)	0.195
Neurological comorbidity	0 (0.0)	0 (0.0)	0.965

Bold values indicate statistically significant

MUS male urethral sling, AUS artificial urinary sphincter, CCI Charlson comorbidity index, BMI body mass index

* Chi-squared test

long-term outcomes are unknown [7]. Aside from BMI, we did not find any differences in comorbid conditions when stratified by device type. Although our findings provide little guidance to help determine who is at risk for a complication, we clearly demonstrate the safety of male slings and AUS in the treatment of incontinence. The ACS-NSQIP data have the advantage of being prospectively abstracted from the patient chart by an independent reviewer without

bias. The ACS-NSQIP dataset has been found to be more accurate than administrative claims data, identifying 61 % more complications and 97 % more surgical site infections in one study [12].

We found only one study by Chughtai et al. [16] that compared SUI treatment complications from a national sample of 1246 Medicare beneficiaries. The 90-day complication rate was low for both slings and AUS with fewer complications related to slings than AUS and slightly higher complication rates than our series. Urologic complications were found in 3.1 % of sling patients and 6.0 % of AUS patients. UTI occurred at a rate of 5.3 % in slings and 8.5 % in AUS [16]. Interestingly, no statistically significant differences between the treatment groups were seen except for higher obesity in male sling patients, which is a finding similar to ours. It is unclear why there is a preference to implant slings in obese men. A possible explanation is that surgeons want to avoid implanting the AUS pressure-regulating balloon in an obese patient for the perceived technical difficulty.

The AUS has been utilized since 1972. It underwent a significant improvement through the introduction of Narrow Back Cuff (NBC) AMS800® device in 1987 (American Medical Systems, Minnetonka, MN, USA) [17]. Throughout its existence, AUS has been considered the standard of care for surgical treatment for SUI, with a 5- and 10-year device survival rate of 75 and 65 %, respectively [5, 18–20]. In a recent meta-analysis by Van der Aa et al. [5] looking at 12 reports of 623 patients with a minimum follow-up of 2 years, AUS achieved a continence rate (defined as 0–1 pad/day) of 61–100 %. Their pooled analysis demonstrated 8.5 % infection and erosion rate, 6.2 % mechanical failure, 7.9 % urethral atrophy, and 26 % reoperation rate. More recently in a retrospective analysis examining 179 primary AUS implantations over a 2-year period, Linder et al. [11] showed an overall complication rate of 35 % in the immediate 6 weeks following surgery. Complications include urinary retention (31 %), device infection (2 %), urethral erosion (2 %), and cellulitis (1 %). This series identified the highest complications related to urinary retention which is the ACS-NSQIP dataset does not capture. However, our rates of surgical site infection (1.2 %) and return to the operating room (3 %) are comparable.

Male slings have been introduced more recently for mild to moderate SUI, and the device has continued to evolve with time. Several articles showed the success rate of primary male sling placement to be 56–90 % [21–24]. A large series of 230 patients with SUI who underwent AdVance sling placement showed an overall complication rate of 23.9 %, with urinary retention being the most common complication (21.3 %) [10]. In a multicenter prospective study by Rehder et al. [25], AdVance sling had a 76.8 %

maintained cure or improved rate of SUI at 3 years in 156 patients. In 2014, Lin et al. compared Argus sling with AUS in 33 patients with moderate SUI (20 Argus and 13 AUS). The mean follow-up period was 24.7 ± 11.8 months in the Argus group and 29.8 ± 14.9 months in the AUS group. The success rate was 85 % in the Argus group and 72.7 % AUS group ($p = 0.557$). Postoperative complications were not significantly different between the two groups (15 and 7.7 % for Argus and AUS, respectively, $p = 0.822$) [26].

We did not identify a correlation between patient age or overall health status, measured here using CCI, in the choice of SUI procedure or complication rate. In agreement with Chughtai et al. [16], we identified a slightly increased preference for the use of slings in patients with higher BMI ($p = 0.030$). Comorbidity analysis revealed an increased prevalence of hypertension, bleeding disorders and disseminated cancer (most likely metastatic prostate cancer) in the AUS group. The significance of this finding is not entirely clear. Similar to the above-mentioned Chughtai et al. study, both procedures are safe with a low 30-day overall complication rate, though slightly higher in the AUS group (2.8 % in slings, 5.1 % in AUS, $p = 0.046$). In addition, there is a higher likelihood for UTI and in the AUS group (2 %) compared to slings (0.3 %). As would be expected with the more complex device nature of AUS, the risk for return to OR was higher with this procedure (3 %).

There are several limitations to our study. ACS-NSQIP thoroughly captures complications, but does not contain potential complicating factors such as history of radiation beyond the preoperative 3 months, history of strictures, or history of incontinence procedures. The severity of complications is not captured in this database; therefore, we were not able to use a standardized evaluation of complication rates like e.g., Clavien Dindo. ACS-NSQIP also does not capture degree of preoperative incontinence, and so we are unable to analyze this as a selection factor for procedure type. The type of slings is also not captured in ACS-NSQIP, and so we are unable to evaluate differences between male sling types. Details of complications specific to incontinence procedures such as urinary retention or erosion are not available in ACS-NSQIP, but may be recorded under a less-specific complication category such as prosthesis failure. In addition, functional and long-term outcomes are not examined in our study, and many device complications such as infections and erosions can occur well beyond the 30-day post-op period.

As these results come from a surgical quality registry, providers or patients may in some way be systematically different from nonparticipants making the results less generalizable. On the other hand, this is a very large collection of male SUI surgical patients from multiple sites, which likely enhances the generalizability of our results. To our knowledge, this is the largest multi-institutional

study comparing the 30-day morbidity of male slings and AUS, using a high-quality prospectively collected database. These results will be useful for patient counseling regarding perioperative complications of male slings and AUS. Our data provide complication rates and demonstrate the safety of male incontinence procedures, but are not useful in determining the best type of incontinence procedure.

AUS and male slings are both safe procedures for male SUI in the short term, with AUS having a slightly higher complication rate. These findings from a national multi-institutional database are useful for better patient perioperative counseling. Large clinical trials are needed to directly compare long-term complication rate for both procedures and their functional outcomes.

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Compliance with ethical standards

Conflict of interest BNB is an advisor to American Medical Systems.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors. This article uses ACS-NSQIP database, in which patient data are de-identified.

References

1. Abrams P, Andersson KE, Birdier L, Brubaker L, Cardozo L, Chapple C et al (2010) Fourth International Consultation on Incontinence Recommendations of the International Scientific Committee: evaluation and treatment of urinary incontinence, pelvic organ prolapse, and fecal incontinence. *Neurourol Urodyn* 29:213–240
2. Cornu JN, Peyrat L, Haab F (2013) Update in management of male urinary incontinence: injectables, balloons, minimally invasive approaches. *Curr Opin Urol* 23(6):536–539
3. Kim PH, Pinheiro LC, Atoria CL, Eastham JA, Sandhu JS, Elkin EB (2013) Trends in the use of incontinence procedures after radical prostatectomy: a population based analysis. *J Urol* 189(2):602–608
4. Lucas MG, Bosch RJ, Burkhard FC, Cruz F, Madden TB, Nambiar AK et al (2012) EAU guidelines on surgical treatment of urinary incontinence. *Eur Urol* 62(6):1118–1129
5. Van der Aa F, Drake MJ, Kasyan GR, Petrolekas A, Cornu JN, Group YAUFU (2013) The artificial urinary sphincter after a quarter of a century: a critical systematic review of its use in male non-neurogenic incontinence. *Eur Urol* 63(4):681–689
6. Siska VB, Frank VDA, de Ridder D (2014) Review: the use of sling versus sphincter in postprostatectomy urinary incontinence. *BJU Int* 116(3):330–342
7. Kim JC, Cho KJ (2012) Current trends in the management of post-prostatectomy incontinence. *Korean J Urol* 53(8):511–518
8. Rehder P, Haab F, Cornu JN, Gozzi C, Bauer RM (2012) Treatment of postprostatectomy male urinary incontinence with the transobturator retroluminal repositioning sling suspension: 3-year follow-up. *Eur Urol* 62(1):140–145
9. de Leval J, Waltregny D (2008) The inside-out trans-obturator sling: a novel surgical technique for the treatment of male urinary incontinence. *Eur Urol* 54(5):1051–1065

10. Bauer RM, Mayer ME, May F, Gratzke C, Buchner A, Soljanik I et al (2010) Complications of the AdVance transobturator male sling in the treatment of male stress urinary incontinence. *Urology* 75(6):1494–1498
11. Linder BJ, Piotrowski JT, Ziegelmann MJ, Rivera ME, Rangel LJ, Elliott DS (2015) Perioperative complications following artificial urinary sphincter placement. *J Urol* 194(3):716–720
12. Steinberg SM, Popa MR, Michalek JA, Bethel MJ, Ellison EC (2008) Comparison of risk adjustment methodologies in surgical quality improvement. *Surgery* 144(4):662–667; discussion -7
13. Davenport DL, Henderson WG, Khuri SF, Mentzer RM, Jr. (2005) Preoperative risk factors and surgical complexity are more predictive of costs than postoperative complications: a case study using the National Surgical Quality Improvement Program (NSQIP) database. *Ann Surg*. 242(4):463–468; discussion 8–71
14. Khuri SF (2005) The NSQIP: a new frontier in surgery. *Ann Surg* 228:491
15. Charlson M, Szatrowski TP, Peterson J, Gold J (1994) Validation of a combined comorbidity index. *J Clin Epidemiol* 47(11):1245–1251
16. Chughtai B, Sedrakyan A, Isaacs AJ, Mao J, Lee R, Te A et al (2014) National study of utilization of male incontinence procedures. *Neurourol Urodyn* 35(1):74–80
17. Light JK, Reynolds JC (1992) Impact of the new cuff design on reliability of the AS800 artificial urinary sphincter. *J Urol* 147:609–611
18. Kim SP, Sarmast Z, Daignault S, Faerber GJ, McGuire EJ, Latini JM (2008) Long-term durability and functional outcomes among patients with artificial urinary sphincters: a 10-year retrospective review from the University of Michigan. *J Urol* 179:1912–1916
19. Linder BJ, de Cogain M, Elliott DS (2014) Long-term device outcomes of artificial urinary sphincter reimplantation following prior explantation for erosion or infection. *J Urol* 191:734–738
20. Lai HH, Hsu EI, Teh BS, Butler EB, Butler TB (2007) 13 years of experience with artificial urinary sphincter implantation at Baylor College of Medicine. *J Urol* 177:1021–1025
21. Migliari R, Pistolesi D, De Angelis M (2003) Polypropylene sling of the bulbar urethra for post-radical prostatectomy incontinence. *Eur Urol* 43:152–157
22. Romano SV, Metrebian SE, Vaz F, Muller V, D'Ancona CA, de Souza EA et al (2009) Long-term results of a phase III multicentre trial of the adjustable male sling for treating urinary incontinence after prostatectomy: minimum 3 years. *Actas Urol Esp* 33:309–314
23. Romano SV, Huebner W, Rocha FT, Vaz FP, Muller V et al (2014) A transobturator adjustable system for male incontinence: 30-month follow-up of a multicenter study. *Int Braz J Urol* 40(6):781–789
24. Mascle L, Descazeaud A, Robert G, Bernhard JC, Bensadoun H, Ferrier JM et al (2015) Multicenter study of Advance[®] suburethral sling for treatment of postoperative urinary incontinence of male. *Prog Urol* 25(5):249–255
25. Rehder P, Haab F, Cornu JN, Gozzi C, Bauer RM (2012) Treatment of postprostatectomy male urinary incontinence with the transobturator retroluminal repositioning sling suspension: 3-year follow-up. *Eur Urol* 62(1):140–145
26. Lim B, Kim A, Song M, Chun J-Y, Park J, Choo M-S (2014) Comparing Argus sling and artificial urinary sphincter in patients with moderate post-prostatectomy incontinence. *J Exerc Rehab* 10(5):337–342