

A sequential comparison of postoperative voiding function between two different transobturator sling procedures

Don Kyoung Choi, MD; Ha Bum Jung, MD; Young Goo Lee, MD, PhD; Ki Kyung Kim, MD, PhD; Sung Tae Cho, MD, PhD

Department of Urology, College of Medicine, Hallym University, Seoul, Korea

Cite as: *Can Urol Assoc J* 2016;10(11-12):E372-6. <http://dx.doi.org/10.5489/cuaj.3703>
Published online November 10, 2016.

Abstract

Introduction: We evaluated sequential postoperative voiding function of two types of sling procedures (Monarc® and ALIGN®) in patients with stress urinary incontinence.

Methods: Ninety-one women diagnosed with urodynamic stress incontinence were randomly assigned to the study. All enrolled patients underwent Monarc or ALIGN procedure. They were postoperatively evaluated at one day, one week, one month, three months, 12 months, and 24 months. The voiding function was evaluated with uroflowmetry and post-void residual urine. Patients were asked if voiding had changed after surgery and had to complete the incontinence quality of life scale (I-QoL) questionnaire at 12 months.

Results: The Monarc (n=47) and ALIGN (n=44) groups had similar demographic characteristics. The maximal flow rate (Qmax) was significantly decreased on the first day after surgery and gradually increased during the following weeks. Comparing the two groups at one week, the ALIGN group had a significantly decreased Qmax than the Monarc group (17.6 ± 5.2 vs. 20.7 ± 5.0 ; $p=0.004$). However, at one, three, 12, and 24 months, there were no significant differences between the two groups.

Conclusions: This study demonstrated that an absorbable tensioning suture in the Monarc mesh could increase Qmax compared to ALIGN at one week after surgery. An absorbable tensioning suture may reduce the risk of an early postoperative voiding dysfunction compared to other meshes that do not have this.

Introduction

Midurethral sling (MUS) has been used for female stress urinary incontinence (SUI) treatment. To date, a great number of products have been developed, using various techniques and materials to perform sling surgery. Although several sling systems are commercially available, all are thought to work in a similar manner.¹ The Monarc® (American Medical Systems, Minnetonka, MN, U.S.) Subfascial Hammock System and the ALIGN® (Bard, Covington, G, U.S.) Trans-

Obturator Urethral Support System are of the outside-to-in transobturator approach type and consist of polypropylene monofilament mesh.² The main difference with these products is that an absorbable tensioning suture is threaded into the length of the Monarc sling, but not the ALIGN sling. It allows for the tensioning adjustment of the mesh after placement.^{2,3} Monarc has this feature. However, ALIGN has no absorbable tensioning suture. In addition, ALIGN has a halo needle with a larger radius arc than Monarc, which makes a large radius curve when the needle tip perforates the obturator membrane. The difference of trajectory between the two devices may produce different outcomes.

To our knowledge, little data exist on the comparison of patient outcomes between the Monarc and ALIGN products. Thus, the present study was designed to compare the sequential postoperative voiding function between the two types of sling devices. Secondary outcome studies were the success rates, changes of quality of life, subjective voiding difficulties, and complications of these two types of suburethral slings.

Methods

Subjects

Ninety-one women prospectively diagnosed with SUI were randomly assigned to the study. Randomization was done using a computer that generates a list of random numbers. Institutional review board (IRB) approval was obtained, and written informed consent was also obtained from all participants prior to randomization after surgical procedures were fully explained. All enrolled patients underwent Monarc or ALIGN procedure by the same operator under general anesthesia.

All patients complained of symptoms of pure SUI with proven urodynamic stress incontinence.⁴ Exclusion criteria included patients who had: 1) a preoperative predominant complaint of urgency incontinence; 2) detrusor overactivity on cystometrogram; 3) post-voiding residual (PVR) greater than 100 ml; 4) genital prolapse greater than stage I (pel-

vic organ prolapse quantification [POP-Q]); and 5) previous anti-incontinence surgery. Patients with concomitant operations were also excluded.

Preoperative workup included medical history, physical examination, POP-Q, Q-tip testing, urinalysis, one-hour pad test, and urodynamic evaluation (Duet[®] Logic G/2 device (Medtronic, Skovlunde, Denmark), including free maximal flow rates (Q_{max}), filling cystometry, Valsalva leak point pressure (VLPP), detrusor pressure at maximal flow (pdetQ_{max}), and maximal urethral closing pressure (MUCP). Data were interpreted in accordance with the International Urogynecological Association (IUGA) and International Continence Society (ICS) guidelines.^{4,5} The quality of life was measured by the urinary incontinence-specific quality of life (I-QoL) questionnaire, with 22 items in I-QoL summed and then transformed to a 0–100 scale for greater interpretability, with higher scores representing greater QoL.^{6,7}

Device description

The Monarc system is designed to be positioned through the medial aspect of the obturator membrane and underneath the ischiopubic ramus bone bilaterally to ensure that it provides midurethral support. It consists of a large pore-size polypropylene monofilament mesh and two stainless steel and curved needle passers. The tip portion of each needle passer is configured to allow for secure connector placement. Each needle passer has a plastic handle attached. The 1.1 × 50 cm polypropylene mesh contains an absorbable tensioning suture and is covered with two protective polyethylene sheaths. The helical design enables the surgeon to rotate the needles under the posterior surface of the ischiopubic ramus and bypass the retropubic space. Each needle is specifically designed for placement along one side of the pelvis. After placement of the needles, connectors on both ends of the mesh are used to attach to the needle tip for retrieval through the obturator membrane.²

The ALIGN system is also a suburethral sling device that uses the outside-in technique intended for the treatment of female SUI. The system is comprised of halo introducers and a polypropylene mesh sling implant encased in a protective sheath with green guide tubes at each end of the sheath. Connectors are attached to the distal ends of the guide tubes and are designed to attach to the tip portion of the introducer needles.

Surgical procedures and followup

Women with SUI were randomly assigned to either the Monarc or the ALIGN group. All enrolled patients underwent outside-in transobturator tape procedures by the same operator under general anesthesia. Surgical procedure was carried out as previously described.^{3,8} A urinary catheter was

inserted after operation and removed, which is often done after 24 hours. After urinary catheter removal, patients were evaluated for flow rate (Portaflow Advanced, Mediwatch, Williston, VT, U.S.) and PVR volumes using ultrasound scanning (Biocon-500, M-cube Technology). Patients remained hospitalized until a PVR <100 ml was obtained. When difficulty with bladder emptying persisted, they were taught to self-catheterize before being discharged.

The patients were postoperatively evaluated at one day, one week, one month, three months, and 12 months. The patients had postoperative followups for up to 24 months. The voiding function was evaluated through uroflowmetry and PVR measurement. Patients were asked if voiding had changed after surgery at every visit and completed the I-QoL questionnaire, a self-reported quality-of-life measure that is specific to urinary incontinence, at 12 months. Surgical outcomes or sling efficacies were evaluated through a cough stress test with a full bladder. Cure of SUI was defined as an absence of any episodes of involuntary urine leakage during physical activities and a stress cough test. Improvement was defined as a significant reduction of urine leakage, where the patient did not require further treatment. Failure was defined as unchanged or exacerbated urine leakage.⁹

Postoperative complications were collected and compared. We classified these complications by using the modified Clavien-Dindo grading of surgical complications.^{10,11} Subjective voiding difficulty was defined as postoperative de novo voiding symptoms (weak stream, hesitancy, or residual urine sensation). In addition, postoperative storage symptoms were analyzed as de novo urgency.

Statistical analysis

Statistical analyses were performed with SPSS (Window Version 18.0; SPSS, Chicago, IL, U.S.). Continuous variables were compared using the Student's t-test and the Mann-Whitney U test. Dichotomous variables were compared using Pearson's Chi-square and Fisher's exact tests between the two groups. The Wilcoxon signed-rank test was used for preoperative and postoperative comparison. A p value of <0.05 was considered statistically significant.

Results

The Monarc group (n=47) and the ALIGN group (n=44) had similar demographic characteristics and preoperative urodynamic parameters, including Q-tip angle degree, free Q_{max}, VLPP, pdetQ_{max}, and MUCP (Table 1). The Q_{max} in both groups were significantly decreased on the first day after surgery (-7.7 ml/sec; p < 0.001 vs. -8.0 ml/sec; p < 0.001, respectively) and gradually increased during the following weeks. However, there were no significant differences in the postoperative Q_{max} and PVR on the first day after sur-

Table 1. Characteristics of patients who underwent either Monarc or ALIGN tape procedure

Variables	Monarc (n=47)	ALIGN (n=44)	p value
Age (years)	54.3 ± 11.0	50.7 ± 9.5	0.096
Parity (times)	2.4 ± 1.1	2.3 ± 1.2	0.493
Body mass index (kg/m ²)	23.7 ± 1.6	24.1 ± 1.3	0.181
Menopause, n (%)	39 (83.0%)	33 (75%)	0.349
Period of symptoms (years)	4.3 ± 2.0	4.3 ± 1.8	0.843
One-hour pad test (gram)	23.9 ± 16.1	22.3 ± 10.9	0.557
No. prolapse grade (%)			
0	15 (31.9)	11 (25.0)	
1	32 (68.1)	33 (75.0)	
Q-tip test (degree)	31.4 ± 8.0	28.8 ± 9.2	0.148
Preoperative UDS parameters			
Free Qmax (ml/s)	25.3 ± 7.2	25.2 ± 6.8	0.938
Voided volume (ml)	280.2 ± 60.2	265.1 ± 78.4	0.305
PVR (ml)	14.2 ± 16.7	11.1 ± 14.0	0.342
MCC (ml)	365.2 ± 92.6	367.6 ± 78.0	0.896
PdetQmax (cmH ₂ O)	28.1 ± 8.5	27.1 ± 8.5	0.579
VLPP (cmH ₂ O)	70.6 ± 13.7	68.1 ± 14.0	0.404
MUCP (cmH ₂ O)	52.6 ± 8.6	55.1 ± 15.1	0.349

Results are presented as mean (± standard deviation) or n (%). MCC: maximal cystometric capacity; MUCP: maximal urethral closing pressure; PdetQmax: detrusor pressure at maximal flow; PVR: post-void residuals; Qmax: maximal flow rate; UDS: urodynamic study; VLPP: Valsalva leak point pressure.

gery between the two groups. Comparing the two groups at one week, the ALIGN group had a significantly decreased Qmax than the Monarc group (17.6 ± 5.2 vs. 20.7 ± 5.0; p=0.004). However, there was no significant difference of PVR between the two groups. In addition, at one, three, 12, and 24 months, there were no significant differences of Qmax and PVR between the two groups. At 24-month followup, 21 (44.7%) and 19 (43.2%) patients were available for the evaluation respectively. The results are summarized in Table 2.

Table 2. Sequential comparisons of postoperative uroflowmetry parameters and voiding symptoms between the two groups

	1 day	1 week	1 month	3 months	12 months	24 months*
Monarc (n=47)						
Qmax (ml/sec)	17.6 ± 4.0	20.7 ± 5.0	20.6 ± 5.4	22.5 ± 5.8	23.5 ± 4.5	24.7 ± 5.3
Voided volume (ml)	240.4 ± 79.5	234.0 ± 81.9	236.3 ± 85.7	225.2 ± 76.1	244 ± 0 ± 78.3	261.9 ± 60.2
PVR (ml)	26.9 ± 25.8	20.5 ± 10.8	24.6 ± 14.3	8.0 ± 7.3	8.7 ± 9.2	4.5 ± 6.3
ALIGN (n=44)						
Qmax (ml/sec)	17.2 ± 5.0	17.6 ± 5.2	19.2 ± 6.6	23.0 ± 5.3	22.3 ± 3.0	24.3 ± 4.4
Voided volume (ml)	254.4 ± 82.4	255.5 ± 78.0	268.4 ± 83.8	246.9 ± 71.7	267.7 ± 90.7	287.3 ± 86.6
PVR (ml)	23.0 ± 22.4	21.3 ± 13.7	20.5 ± 19.4	9.7 ± 10.1	8.3 ± 8.7	6.9 ± 8.2
p value (Monarc vs. ALIGN)						
Qmax (ml/sec)	0.697	0.004	0.297	0.651	0.142	0.706
Voided volume (ml)	0.411	0.204	0.074	0.165	0.186	0.110
PVR (ml)	0.443	0.735	0.252	0.363	0.829	0.123

Results are presented as mean (± standard deviation). *21 (44.7%) of Monarc and 19 (43.2%) of ALIGN patients were available for 24-month followup. Qmax: maximal flow rate; PVR: post-void residuals.

No significant differences were found in subjective voiding difficulty (31.9% vs. 43.2%; p=0.267) and cure rate (80.9% vs. 88.6%; p=0.304) between the groups at 12 months after surgery (Table 3). Pre- and postoperative I-QoL questionnaires scores showed significant improvement; however, there was no significant difference between the groups (-45.6 ± 9.1, -44.0 ± 7.6; p=0.364, respectively).

The postoperative complications were classified according to the modified Clavien-Dindo classification system in Table 4. Four (8.5%) out of the 47 patients (Monarc) and 5 (11.4%) out of 44 patients (ALIGN) complained of mild pelvic pain (Grade I). Eleven patients (23.4 %) in Monarc and nine patients (20.5 %) in ALIGN had de novo urgency (Grade II). Only one patient from the ALIGN group developed vaginal tape erosion (Grade IIIb). However, the differences demonstrated were not significant.

Discussion

According to the latest update of the International Consultation on Incontinence Recommendations and guidelines of the European Association of Urology, MUS represents the gold standard for the treatment of female SUI.^{12,13} The transobturator MUS technique is simple and has the potential to reduce the incidence of significant complications associated with a retropubic approach. This technique has been further refined by the availability of the Monarc system. Its difference with previous products is that an absorbable tensioning suture is threaded into the length of the mesh. More recently, the ALIGN system has been shown to be effective and safe for SUI treatment. However, ALIGN has no absorbable tensioning suture and halo needle with a larger radius arc. Although both procedures use type I, knitted macroporous, monofilament polypropylene mesh, there is a large difference between them in terms of absorbable tensioning suture and radius arc.¹⁴ In addition, to our

Table 3. Success rates, I-QoL scores, and subjective voiding difficulty rates at the one-year followup

	Monarc (n=47)	ALIGN (n=44)	p value
Anatomical success rates (%)			
Cured	38 (80.9)	39 (88.6)	0.304
Improvement	6 (12.8)	3 (6.8)	
Failed	3 (6.3)	2 (4.6)	
I-QoL score			
Preoperative	37.6 ± 6.1	38.2 ± 6.1	0.674
Postoperative	83.3 ± 6.0	82.2 ± 4.5	0.332
Subjective voiding difficulty (%)			
Yes	15 (31.9)	19 (43.2)	0.267
No	32 (68.1)	25 (56.8)	

Results are presented as mean (± standard deviation) or n (%). I-QoL: incontinence quality of life questionnaire.

knowledge, there have been no previous studies comparing the outcomes of the two procedures.

This study evaluated sequential postoperative voiding function of two types of sling procedures. In addition, we compared the success rates, I-QoL scores, and subjective voiding difficulties at the one-year followup. The Qmax was significantly decreased on the first day after surgery and gradually increased during the following weeks. However, there were no significant differences between the groups.

Previous studies have reported that Qmax decreased significantly from 26 to 18 ml/sec at 6–12 weeks in the Monarc procedure.⁸ In another study, the Qmax maintained about 19 ml/sec at 6–14 months (median, nine months) after Monarc surgery.¹⁵ However, little data exist in comparing Qmax at the first day after surgery. Comparing two groups at one week, the ALIGN group had a significantly decreased Qmax than the Monarc group. Based on these findings, we could hypothesize that an absorbable tensioning suture in the Monarc may help increase Qmax at one week after surgery. However, there were no significant differences at one, three, 12, and 24 months. When the uroflowmetry of ALIGN was evaluated at 12 months, it was reported that there was no significant decrease in Qmax.¹⁶

The subjective voiding difficulty and cure rate do not differ between the two groups. Monarc system reported an objective cure rate at 12 months after surgery ranging from 80.8–95.3%.^{17,18} In general, success rates of MUS range from 84–99%.¹⁹ In addition, postoperative voiding dysfunction occurs after 5–15 % of sling surgeries.^{20,21} Results of the present study correspond well with those of the previous study. Postoperative I-QoL questionnaire scores showed significant improvement. However, no significant difference exists between the groups. These changes of I-QoL after surgery are also consistent with previous studies.²² They reported that I-QoL score improved significantly, ranging from 25.3–56.1, six months postoperation.²³

Table 4. Complications of Monarc and ALIGN surgery according to the Clavien–Dindo classification

	Monarc (n=47) n (%)	ALIGN (n=44) n (%)	p value
Grade I	4 (8.5%)	5 (11.4%)	0.679
Mild pelvic pain	4	5	
Dyspareunia/sexual discomfort	0	0	
Grade II	11 (23.4%)	9 (20.5%)	0.734
De novo urgency	11	9	
Severe groin and/or leg pain	0	0	
Vaginal erosion, local estrogen application	0	0	
Grade IIIa	0 (0.0%)	0 (0.0%)	
Urinary retention, prolonged urethral catheterization	0	0	
Grade IIIb	0 (0.0%)	1 (2.3%)	0.299
Vaginal erosion, mesh removing	0	1	

There were no serious complications, such as wound infection, urethra or bladder perforation; 8.5% (4/47) of the Monarc group and 11.4% (5/44) of ALIGN group had pelvic pain. ALIGN has a halo needle with a larger radius arc than Monarc and it is a little too big for Asian women. Morphologic differences in the bony pelvis among different races were reported,^{23,24} in particular, Caucasian women have a wider pelvic inlet, wider outlet, and shallower anteroposterior outlet than other races.²³ Hence, we hypothesized that racial differences in the pelvic bone with Asian women could perhaps influence differences in pelvic pain. We only performed sling surgery on Asian women. However, there were no significant differences between the groups. According to previous morphological findings using ultrasound, there were no significant differences between Monarc and the tension-free vaginal tape-obturator (TVT-O) procedure at three-month followup. The parameters reflecting the tape location, tape tension, and urethral mobility were similar between the two groups.²¹ However, to our knowledge, no information is available on postoperative morphological differences of mesh between Monarc and ALIGN procedure.

The limitations of this study stem from the use of free Qmax. Qmax data were collected when the patients' voided volumes were more than 150 ml, and were subsequently interpreted in accordance with the ICS guidelines. However, this study did not compare the adjusted values of Qmax on nomograms. Despite this limitation, an absorbable tensioning suture may influence the early postoperative flow rate. Studies with longer followup and larger cohorts are necessary to evaluate voiding dysfunction and flow rates of the two different meshes.

Conclusion

This study demonstrated that an absorbable tensioning suture in the Monarc mesh could increase Qmax compared to ALIGN at one week after the MUS procedure. An absorbable tensioning suture may reduce the risk of early postoperative voiding dysfunction compared to other meshes that do not have this.

Competing interests: The authors report no competing personal or financial interests.

This paper has been peer-reviewed.

References

- Novi JM, Mulvihill BH. Surgical intervention for stress urinary incontinence: Comparison of midurethral sling procedures. *J Am Osteopath Assoc* 2008;108:634-8.
- Davila GW, Johnson JD, Serels S. Multicentre experience with the Monarc transobturator sling system to treat stress urinary incontinence. *Int Urogynecol J Pelvic Floor Dysfunct* 2006;17:460-5. <http://dx.doi.org/10.1007/s00192-005-0039-9>
- Mellier G, Mistrangelo E, Gery L, et al. Tension-free obturator tape (Monarc Subfascial Hammock) in patients with or without associated procedures. *Int Urogynecol J Pelvic Floor Dysfunct* 2007;18:165-72. <http://dx.doi.org/10.1007/s00192-006-0126-6>
- Haylen BT, de Ridder D, Freeman RM, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Int Urogynecol J* 2010;21:5-26. <http://dx.doi.org/10.1007/s00192-009-0976-9>
- Abrams P, Cardozo L, Fall M, et al. The standardization of terminology of lower urinary tract function: report from the Standardization Sub-committee of the International Continence Society. *Neurourol Urodyn* 2002;21:167-78. <http://dx.doi.org/10.1002/nau.10052>
- Bushnell DM, Martin ML, Summers KH, et al. Quality of life of women with urinary incontinence: Cross-cultural performance of 15 language versions of the I-QOL. *Qual Life Res* 2005;14:1901-13. <http://dx.doi.org/10.1007/s11136-005-5266-5>
- Chen X, Tong X, Jiang M, et al. A modified inexpensive transobturator vaginal tape inside-out procedure vs. tension-free vaginal tape for the treatment of SUI: A prospective comparative study. *Arch Gynecol Obstet* 2011;284:1461-6. <http://dx.doi.org/10.1007/s00404-011-1871-4>
- Barry C, Naidu A, Lim Y, et al. Does the MONARC transobturator suburethral sling cause postoperative voiding dysfunction? A prospective study. *Int Urogynecol J Pelvic Floor Dysfunct* 2006;17:30-4. <http://dx.doi.org/10.1007/s00192-005-1358-6>
- Cho ST, Song HC, Song HJ, et al. Predictors of postoperative voiding dysfunction following transobturator sling procedures in patients with stress urinary incontinence. *Int Neurourol J* 2010;14:26-33. <http://dx.doi.org/10.5213/inj.2010.14.1.26>
- Joukhadar R, Meyberg-Solomayer G, Hamza A, et al. A novel operative procedure for pelvic organ prolapse utilizing a MRI-visible mesh implant: Safety and outcome of modified laparoscopic bilateral sacropexy. *Biomed Res Int* 2015;2015:860784. <http://dx.doi.org/10.1155/2015/860784>
- Yonguc T, Bozkurt IH, Arslan B, et al. Outcomes of two different incision techniques for surgical treatment of stress urinary incontinence with concomitant anterior vaginal wall prolapse. *World J Urol* 2015;33:1045-9. <http://dx.doi.org/10.1007/s00345-014-1388-0>
- Serati M, Sorice P, Bogani G, et al. TVT for the treatment of urodynamic stress incontinence: Efficacy and adverse effects at 13-year followup. *Neurourol Urodyn*. Epub 2015 Oct 19.
- Lucas MG, Bosch RJ, Burkhard FC, et al. EAU guidelines on surgical treatment of urinary incontinence. *Eur Urol* 2012;62:1118-29. <http://dx.doi.org/10.1016/j.eururo.2012.09.023>
- Moldovan CP, Marinone ME, Staack A. Transvaginal retropubic sling systems: Efficacy and patient acceptability. *Int J Womens Health* 2015;7:227-37.
- Wang AC, Lin YH, Tseng LH, et al. Prospective randomized comparison of transobturator suburethral sling (Monarc) vs. suprapubic arc (Sparc) sling procedures for female urodynamic stress incontinence. *Int Urogynecol J Pelvic Floor Dysfunct* 2006;17:439-43. <http://dx.doi.org/10.1007/s00192-005-0035-0>
- Ugurlucan FG, Erkan HA, Onal M, Yalcin O. Randomized trial of graft materials in transobturator tape operation: Biological vs. synthetic. *Int Urogynecol J* 2013;24:1315-23. <http://dx.doi.org/10.1007/s00192-012-2008-4>
- Leanza V, Intagliata E, Leanza A, et al. Comparison between three mini-sling surgical procedures and the traditional transobturator vaginal tape technique for female stress urinary incontinence. *G Chir* 2014;35:80-4.
- De Ridder D, Berkens J, Deprest J, et al. Single incision mini-sling vs. a transobturator sling: A comparative study on MiniArc and Monarc slings. *Int Urogynecol J* 2010;21:773-8. <http://dx.doi.org/10.1007/s00192-010-1127-z>
- Wood LN, Anger JT. Urinary incontinence in women. *BMJ* 2014;349:g4531. <http://dx.doi.org/10.1136/bmj.g4531>
- Kawasaki A, Edenfield AL, Visco AG, et al. Comparing the risk of urethrolisis for the treatment of voiding dysfunction between two retropubic mesh slings: A case-control study. *Int Urogynecol J* 2013;24:589-94. <http://dx.doi.org/10.1007/s00192-012-1920-y>
- Huang WC, Yang SH, Yang JM, et al. Functional and morphological differences following Monarc and TVT-O procedures. *Ultrasound Obstet Gynecol* 2012;40:699-705. <http://dx.doi.org/10.1002/uog.10153>
- Ryu JG, Yu SH, Jeong SH, et al. Transobturator tape for female stress urinary incontinence: Preoperative Valsalva leak point pressure is not related to cure rate or quality of life improvement. *Korean J Urol* 2014;55:265-9. <http://dx.doi.org/10.4111/kju.2014.55.4.265>
- Handa VL, Lockhart ME, Fielding JR, et al. Racial differences in pelvic anatomy by magnetic resonance imaging. *Obstet Gynecol* 2008;111:914-20. <http://dx.doi.org/10.1097/AOG.0b013e318169ce03>
- Patriquin ML, Loth SR, Steyn M. Sexually dimorphic pelvic morphology in South African whites and blacks. *Homo* 2003;53:255-62. <http://dx.doi.org/10.1078/0018-442X-00049>

Correspondence: Dr. Sung Tae Cho, Department of Urology, Hallym University Kangnam Sacred Heart Hospital, College of Medicine, Hallym University, Seoul, Korea; cst326@paran.com