High submuscular versus space of Retzius placement of inflatable penile prosthesis reservoirs: results of a surgeon survey

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Introduction: *High submuscular (HSM) inflatable penile prosthesis (IPP) reservoir insertion is a new technique that involves placing the reservoir high beneath the muscles of the abdominal wall. We queried a variety of surgeons to assess their impressions of how HSM reservoir placement compares with traditional space of Retzius (SOR) placement.*

Materials and methods: *A nationwide group of urologists trained in HSM reservoir placement was surveyed to assess preferences and concerns compared to SOR placement. Using a Likert scale survey, we compared HSM to traditional SOR placement with regard to ease of implementation, surgical preference, and patient safety. Results were analyzed according to numbers of implants performed by the surgeons.*

Results: *A total of 25 urologists from eight states participated in this survey (12 residents and 13 attending surgeons). Overall, surgeons report that HSM placement is safer ($p < 0.001$). The participants believed it conveyed lower risk to visceral ($p < 0.001$) and vascular ($p < 0.001$) structures. Moreover it was easier to learn ($p = 0.008$) and to teach ($p = 0.002$). The majority (17/25, 68%) prefer HSM reservoir placement, while 4/25 (16%) are neutral, and 4/25 (16%) prefer SOR. Among high volume implanters (> 20 implants/year), 7/9 (78%) prefer the HSM technique and report that it is safer ($p = 0.001$) with lower risk of visceral ($p = 0.010$) and vascular ($p < 0.001$) injuries.*

Conclusions: *Urologists trained in HSM reservoir placement report that this technique is readily implemented, strongly preferred, and safer for patients.*

Key Words: inflatable penile prosthesis, reservoir, submuscular, ectopic, surgeon survey

Introduction

Traditional placement of inflatable penile prosthesis (IPP) reservoirs in the space of Retzius (SOR) may be difficult or dangerous in patients who have undergone prior pelvic surgery, such as robot-assisted laparoscopic prostatectomy (RALP). Most high volume implanters agree that prior RALP may complicate the SOR dissection at the time of reservoir placement.[1] Because access to the SOR requires a blind puncture through the transversalis fascia, this maneuver can lead to morbid complications including reservoir erosion into neighboring structures or compressive damage to vascular, enteric, or genitourinary structures.[2-5] Placement of the reservoir outside of the traditional SOR, or "ectopically," has long been advocated in these potentially difficult situations.[6,7]

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High submuscular (HSM) placement of IPP reservoirs via a penoscrotal incision is a recent innovation which has proven reliable and reproducible in a wide variety of patients, regardless of prior surgical history.[8] HSM insertion involves placing the reservoir high beneath the abdominal wall posterior to the rectus abdominis musculature, avoiding the pelvis altogether. Rates of patient and surgeon palpability are low, and the overwhelming majority (96%) of patients are not bothered by the HSM reservoir placement.[8] We questioned urologists recently trained in HSM reservoir placement regarding their impressions of its efficacy, safety, and reproducibility.

HSM technique

The technique of HSM reservoir placement involves utilizing the transverse scrotal incision to bluntly identify the external inguinal ring on the side where the reservoir will be placed. Blunt finger dissection then develops the space just inside the ring, opening the potential space between the rectus abdominis musculature and the transversalis fascia. A pediatric Deaver retractor is then placed into the ring beneath the rectus muscle, and a Foerster lung grasping clamp (Scanlan International, St. Paul, MN, USA) or ordinary long ring (a.k.a. sponge) forceps is then introduced into the ring beneath the retractor blade. The Deaver blade acts as a fulcrum to elevate the rectus abdominis muscle away from the transversalis fascia as the paddles are spread firmly in an anterior-posterior plane. As the separation "gives," the clamp is then advanced cephalad in the direction of the ipsilateral nipple, creating a long submuscular tunnel by using a "four spread technique" in alternating coronal and sagittal planes four times. The same clamp is then used to grasp, insert, and place the reservoir in the space created.[9]

Materials and methods

We surveyed 25 urologists and residents recently trained in HSM reservoir placement. The responders practiced in eight different states. The respondent group consisted of 12 (48%) residents, 3 (12%) fellows, and 10 (40%) practicing urologists. A total of 9 (36%) were frequent implanters (> 20 implants/year) and 16 (64%) were occasional (< 20 implants/year) implanters. The group of frequent implanters consisted primarily of fellows and experienced surgeons (> 10 years). Occasional implanters consisted primarily of residents and those in practice less than 10 years.

The various aspects of the surgeons' experience with the SOR and HSM techniques constituted the primary outcome measures of this study. These included ease of teaching and learning the techniques, perceived risk for various types of iatrogenic injury, and preference for one technique or the other. These and other outcome measures are delineated in the survey.

Survey

A 10-question survey instrument was administered via email, completed independently and without coaching, Table 1. The survey was completed at least 1 month after initial demonstration of the HSM insertion technique. All surgeons returned their surveys (100% participation) with no financial incentive to reply. All data were de-identified and analyzed in aggregate to preserve respondent anonymity. Data were analyzed according to prosthetic surgical volume, and we defined frequent, or high volume, implanters as those performing 20 or more procedures annually.

All respondents were asked to rate their impressions using a 5-point Likert scale regarding the safety, teachability, risk of organ injury, and risk of reservoir herniation regarding both the HSM and SOR placement of the IPP reservoir. The 5-point scale included frequencies of: "Strongly Disagree," "Disagree," "Neutral," "Agree," and "Strongly Agree." Surgeon experience with both types of reservoir placement as well as years of surgical experience as a urologist was also assessed. Respondents were also queried on their preferred approach for IPP reservoir placement.

Statistical methods

Survey responses were analyzed through a comparison of preferences based on method of IPP reservoir placement. Demographic and subgroup analyses were compared using Chi-square tests. Student t-tests were used to identify any differences in reservoir preferences by category. All analyses were performed using SPSS statistical software (ver. 19) with a p value of < 0.05 considered statistically significant.

Results

Surgeons reported that the HSM technique poses less risk to the visceral and vascular structures and is overall safer than patients undergoing SOR dissection, Figure 1. They also noted that the HSM placement is easier to learn and teach. The majority (17/25, 68%) prefer HSM placement, while 6/25 (24%) are neutral, and 2/25 (8%) prefer the SOR technique. Although responses from both high volume and low volume implanters were similar in showing preference of HSM over SOR reservoir placement, low volume implanters favored the HSM technique slightly more often than high volume implanters.

TABLE 1. **The survey questions that were sent to surgeons following instruction in the HSM technique of IPP reservoir placement. (HSM = high submuscular; IPP = inflatable penile prosthesis)**

Space of Retzius IPP Reservoir					Submuscular IPP Reservoir				
How many cases have you performed in the last year?					**How many cases have you performed in the last year?**				
<5	5-10	10-20	20-50	>50	<5	5-10	10-20	20-50	>50
Have you had any major complications? (vascular, bladder, bowel)?					**Have you had any major complications? (vascular, bladder, bowel)?**				
Yes		No			Yes		No		
Safe?					**Safe?**				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Easy to learn?					**Easy to learn?**				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Easy to teach?					**Easy to teach?**				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Preferred technique?					**Preferred technique?**				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
High risk for visceral injury?					**High risk for visceral injury?**				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
High risk for vascular injury?					**High risk for vascular injury?**				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
High risk for reservoir herniation?					**High risk for reservoir herniation?**				
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Perform this technique in my practice?					**Perform this technique in my practice?**				
0%	0-25%	26-50%	51-75%	76-100%	0%	0-25%	26-50%	51-75%	76-100%

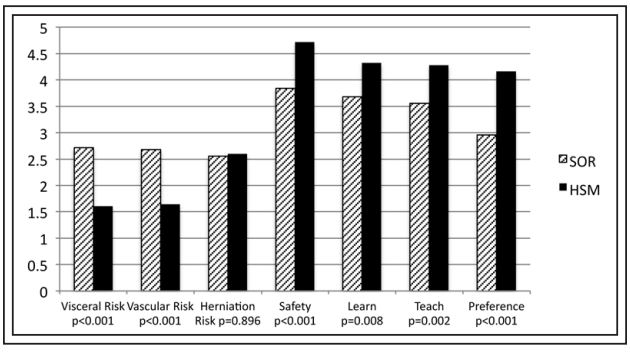

Figure 1. Comparison of SOR versus HSM reservoir placement among urologists overall. (SOR = space of Retzius; HSM = high submuscular).

Discussion

Potential complications with SOR placement

Penetration into the SOR has been the standard method of reservoir placement for decades, but dissection within the pelvis may be complicated by previous surgeries within this anatomic space. During a RALP, the lower peritoneum is incised, entering the SOR, making this space contiguous with the peritoneum and its contents, allowing adhesion and scar formation that could result in intraperitoneal reservoir placement.[10] On account of this potential for non-anatomic migration of vital organs, blind puncture could result in direct damage or compressive pathology to enteric

or vascular structures. With the widespread use of robot assistance to perform pelvic surgery nowadays, urologists are now more likely to encounter patients in need of prosthetic surgery who may have "hostile" post-surgical pelvic anatomy. Careful dissection of the submuscular plane just superficial to the transversalis fascia avoids potential pitfalls in post-operative patients.

Recent innovations in reservoir design include "flat" reservoirs, reducing palpability when placed in a submuscular location. Both the AMS Conceal (American Medical Systems, Minnetonka, MN, USA) and the Coloplast Cloverleaf (CL) (Coloplast, Minneapolis, MN, USA) reservoirs are constructed with low profiles and allow for under-filling, resulting in easier insertion via a transverse scrotal incision with less palpability under the abdominal wall musculature.

For these reasons, HSM placement has been preferred at our institution for over 2 years. Overall patient satisfaction with the penile implant, including the occasional palpability, seems to be consistent with SOR placement.[8] We have seen no visceral or vascular injuries, with only one revision due to reservoir herniation, which was early in our experience. Reservoir herniation is an unusual complication (0.7%). When herniation does occur we believe there may be several factors: vigorous coughing or vomiting in the early postoperative period, aggressive retraction that stretches the inguinal ring, or not providing enough redundancy of reservoir tubing, thereby "tethering" the reservoir to the device when the patient manipulates the pump.[11]

Technique teaching and learning

When implementing any variation to an accepted surgical procedure, one must question whether the new method is safe, efficacious, and reliable. Our assessment of surgeons who have learned the HSM technique indicates that it appears to meet these criteria, as most have incorporated it into their practices. The responses also suggest that HSM placement is readily teachable and easily learned and implemented into one's practice. Importantly, survey results are consistent across both high and low volume implanters, attesting to the ease with which less-experienced surgeons can learn and employ the technique.

One recent survey of experienced implanters indicated that nearly all reported that alternative reservoir placement techniques such as HSM placement should be taught in physician prosthetic training courses.[1] Our findings attest to the teachability of the HSM method, with surgeons apparently becoming comfortable with the technique following brief educational sessions (usually 2-3 observational cases). The results of our survey attest to the efficacy of this model in teaching HSM reservoir placement.

Limitations

There are several limitations to our study. First, the administered was non-validated and presented mainly to surgeons taught by two senior surgeons, leading to a possible selection bias on account of instructor passion and/or instruction skill. This initial experience with HSM placement points favorably that it may grow to occupy a central role in prosthetic urology. Nevertheless, as the procedure is attempted by occasional implanting urologists, results may vary. Second, as the technique is new, patient follow up is limited. Though the complication rate to date is quite low, it is possible delayed patient complaints or complications may impact future surgeon enthusiasm. Third, all of the surveyed surgeons have limited (or no) experience in removal of reservoirs placed using the ectopic technique. We believe it should be easy and safe by merely following the reservoir tubing exposed by Deaver retractors and sequentially exposing the component by the electrosurgical pencil on "cut". Regardless of our opinion, if experience shows a large number of patients will require a secondary abdominal incision, surgeon enthusiasm may diminish.

One factor precluding general physician acceptance of the HSM placement of penile prosthesis reservoir is that the Federal Drug Administration considers placement of the reservoir in any location but the traditional SOR an "off label" use. The two IPP manufacturers both market "flat reservoirs" developed with physician input for use in ectopic locations. American Medical Systems Conceal has a pancake configuration when fully inflated. Coloplast Cloverleaf reservoir has a bellows configuration that is quite flat when partially filled. The manufacturers are not permitted to provide education concerning the new flat reservoirs to the physician implanter and this limitation may temper physician enthusiasm for extensive usage of alternative reservoir locations.

Notwithstanding these limitations, we feel that the positive survey responses from both low and high volume implanters reflect a strongly favorable initial impression of the HSM technique among penile prosthesis implanters. Early experience with regard to its safety, efficacy, and transferability has been positive, as indicated by the majority of surgeons who have started using the HSM method regularly in their practices.

Conclusions

With the number of patients undergoing ablative pelvic surgery that results in altered and sometimes obliterated surgical planes within the retroperitoneal space, ectopic IPP reservoir placement in an HSM location offers a safe alternative. Urologists trained in HSM placement of the IPP reservoir report that this technique is easy to learn, easy to implement and may be safer for patients. More experience by different implanters and longer follow up of implanted patients is necessary for a definitive opinion as to whether HSM will change the paradigm of reservoir placement. □

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