

Small Diameter Penile Implants: A Survey on Current Utilization and Review of Literature



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ABSTRACT

Background: Inflatable penile prostheses (IPPs) with smaller diameter cylinders have been in use for over 30 years, yet the literature is sparse on their utilization patterns amongst prosthetic surgeons.

Aim: To understand current usage of small diameter penile implants (SDPI) among prosthetic surgeons.

Methods: IRB approval was obtained to conduct a survey of prosthetic surgeons. A 23-question online survey was distributed via email to physician members of the Sexual Medicine Society of North America (SMSNA) and Society of Urologic Prosthesis Surgeons (SUPS). The survey included questions regarding surgeon experience and volume, frequency of SDPI utilization, indications for SDPI, surgical strategy in the setting of SDPI (approach, use of concordant modeling/grafting), reservoir and pump management, and perceived infection risk and patient satisfaction.

Main Outcome Measure: SDPI were utilized by the vast majority of respondents in certain clinical situations such as corporal fibrosis or anatomically small corpora, and surgeons have had a favorable experience with these as a final destination implant or as a place-holder until reimplantation with a normal diameter device.

Results: Fifty individuals responded to the survey, 48 of whom routinely utilized SDPI. The most common indication for SDPI placement was corporal fibrosis from prior infection, followed by anatomically small corpora and priapism. The most common maximal dilation diameter was 10 mm (47%), an additional 23% of respondents utilized SDPI with 11 mm dilation. 75.4% of respondents sometimes or always intended to upsize to standard diameter cylinders in the future. 68.8% of surgeons routinely counseled patients on the possibility of reduced girth and rigidity with SDPI. Patient satisfaction was perceived to be comparable to standard diameter cylinders in 56.3% of respondents, while the remaining 43.6% believed it to be lower than traditional cylinders. Utilization of SDPI can be an important tool for prosthetic surgeons faced with difficult cases due to corporal fibrosis or small corpora. This survey provides new insight into patterns of SDPI utilization by surgeons. A limitation of the study is that patient satisfaction is indirectly addressed through surgeons' perception and experience, further research will be necessary to include patient questionnaires regarding device satisfaction.

Conclusion: SDPI are necessary in certain scenarios that preclude the use of normal diameter cylinders. These implants may offer satisfactory erections, but can also be upsized to standard diameter cylinders in the future.

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INTRODUCTION

Since their inception, inflatable penile prostheses (IPPs) have undergone several modifications that have improved patient-specific treatment approaches. One such modification is the development of IPPs with smaller diameter cylinders; these are currently available in the form of the American Medical System (AMS) 700 CXR (Boston Scientific, Marlborough MA) and the

Coloplast Titan Narrow-base (NB) (Coloplast Corp, Minneapolis MN). Advantages of the AMS CXR and Titan NB are that they require only 9 and 10 mm dilation, respectively, and their additional noninflatable 3 cm segments facilitate insertion in difficult cases. While the first small diameter cylinder 3-piece IPP was developed in 1990 by AMS with the CXM,¹ the literature remains sparse on the ideal setting for their use and outcomes associated with small diameter cylinders. Small diameter penile implants (SDPI) are a viable option across a multitude of clinical scenarios, and often provide usable erections in patients with complex urologic problems. However, it is not clear how often and in what situations these implants are utilized by prosthetic surgeons, and surgeons may benefit from understanding how their colleagues use these devices in their practice. We hypothesize that SDPI are utilized by most prosthetic surgeons but that their utilization is heterogeneous including different indications, dilation diameters, surgical approaches, and staging versus use as a final solution. In addition, we hypothesize that prosthetic surgeons generally view these devices as effective and perceive their patients to be satisfied with these small diameter cylinders.

MATERIALS AND METHODS

After IRB approval was obtained, a 23-question online survey was distributed via email to physician members of the Sexual Medicine Society of North America (SMSNA) and Society of Urologic Prosthesis Surgeons (SUPS). Survey questions were chosen to describe the population of respondents in terms of implant surgery volume, as well as to address various components of SDPI utilization that can be variable such as indication, dilation diameter, approach, etc. Survey data was collected and managed using REDCap (Vanderbilt University, Nashville TN) electronic data capture tools hosted at Duke University.^{2,3} Questions pertained to yearly total IPP volume and yearly SDPI volume. In addition, surgeons were asked about their preferred surgical approach, use of adjuvant maneuvers and/or graft usage, and maximal dilation diameter to use an SDPI. Brand preference, appropriate sizing options, pump and reservoir management, and perceived infection rate and patient satisfaction were also included in the survey. See Appendix I in supplementary material for the exact survey.

RESULTS

50 individuals responded to the survey, 48 of whom routinely utilized SDPI (Table 1). While 64% of respondents placed more than 50 IPPs annually, only 46% placed more than 5 SDPI per year. The most common indication for SDPI placement was corporal fibrosis from prior infection, followed by anatomically small corpora and priapism.

75% of respondents preferred SDPI over malleable IPP, and among SDPI the preferred model was the Coloplast Titan Narrow-base (64%). The most common maximal dilation diameter

was 10 mm (47%), with an additional 23% of respondents utilizing SDPI with 11 mm dilation. A total of 48% of respondents have used grafts in conjunction with SDPI implantation, and 73% felt comfortable using other adjuvant maneuvers such as modeling at the time of SDPI placement.

With regards to sizing, 74% and 72% of respondents believed that Titan NB and 700 CXR offered appropriate length options, respectively. A total of 60.4% of respondents stated that they sometimes implanted SDPI with intent to upsize in the future, 15% always intended to upsize in the future, and 25% never planned to upsize.

Regarding pump size options, the majority of respondents (56.3%) were satisfied with the current pump size, whereas 22.9% preferred a smaller pump and 20.8% were unsure. Only 1 respondent (2.1%) altered reservoir placement with SDPI placement. Smaller reservoirs were used by 54.2% of surgeons in the setting of SDPI placement. The majority of surgeons did not alter rear-tip extenders (75%), though 18.8% used shorter rear-tip extenders.

A total of 68.8% of surgeons always counseled patients on the possibility of reduced girth and rigidity in the setting of SDPI placement, with an addition 12.5% stating they sometimes did depending on the patient. The majority of respondents stated that perceived patient satisfaction was comparable to traditional cylinders (56.3%), with 43.7% believing patient satisfaction was lower with SDPI placement. 6.3% of surgeons were more concerned about infection with SDPI placement. In addition, 70.8% of respondents did not believe that SDPI placement was associated with a higher unplanned revision rate.

DISCUSSION

This survey lends insight into how SDPI are currently employed by prosthetic urologists. The data suggest that while SDPI remain a small proportion of total IPPs placed, many surgeons employ them in some circumstances. Consistent with multiple prior reports, SDPI were commonly implanted in the setting of severe corporal fibrosis due to prior infection or priapism.⁴⁻⁶ However, in addition to these known indications, anatomically small corpora were also noted to be a common indication according to our survey. There is no absolute cutoff for maximal dilation diameter that SDPI placement is ideal, though the literature suggests 10 mm¹ as well as 11 mm.⁵ The survey results were consistent with these published figures, as 10 and 11 mm were the 2 most common maximal dilation diameters.

The most common approach for SDPI placement was penoscrotal with 71% of respondents preferring this method. This is consistent with a previous report suggesting that the penoscrotal approach is used in 80% of all penile implant cases.⁷ Many favor the penoscrotal approach because of the ability to extend corporotomies and enhance exposure,¹ and this is particularly useful

Table 1. Survey Results. (Please note, not all questions were answered by all respondents, owing to different total responses for certain questions. In addition, some questions allowed multiple answers and these will also have a different total number of responses.)

n		n (%) 50
IPPs/yr	<20	8 (16)
	20-50	10 (20)
	>50	32 (64)
Time in practice	<10 y	17 (34)
	10-20 y	10 (20)
	>20 y	23 (46)
Use NB SDPI/y	<5	48 (96)
	>5	26 (54.2)
Reason	Corporal fibrosis from prior infection	22 (45.8)
	Priapism	39 (81.3)
	Anatomically small corpora	24 (50)
	Peyronie's disease	29 (60.4)
	Other	8 (16.7)
Preference	Coloplast	2 (4.2)
	Boston Scientific	29 (64.4)
Preferred approach	Penoscrotal	16 (35.6)
	Infrapubic	34 (70.8)
	Mixed	6 (12.5)
	Subcoronal	7 (14.6)
	Other	0 (0)
SDPI vs Malleable	SDPI	1 (2.1)
	Malleable	36 (75)
Intent to upsize in future?	Yes	12 (25)
	No	29 (60.4)
	Sometimes	7 (14.6)
Maximal dilation diameter	9 mm	23 (47.9)
	10 mm	32 (74.4)
	11 mm	11 (23.4)
	12 mm	3 (6.4)
Graft in conjunction with SDPI	Don't routinely dilate	6 (12.8)
Appropriate size	Coloplast Titan Narrow-base	23 (47.9)
	American Medical Systems 700 CXR	32 (74.4)
Prefer smaller pump	Yes	33 (71.7)
	No	11 (22.9)
	Maybe	27 (56.3)
Less durable		10 (20.8)
Alter reservoir placement		4 (8.3)
Reservoir Filling	Smaller reservoir (65-75 cc)	1 (2.1)

(continued)

Table 1. Continued

n		n (%) 50
Underfill standard reservoir		17 (35.4)
	No modification to reservoir fill or size	17 (35.4)
Alter rear-tip extenders	Longer	3 (6.3)
	Shorter	9 (18.8)
Adjuvant maneuvers	No change	36 (75)
	Yes	35 (72.9)
	No	4 (8.3)
Higher unplanned revision rate	Sometimes	9 (18.8)
	Yes	6 (12.5)
	No	34 (70.8)
	Unsure	8 (16.7)
More concerned about infection		3 (6.3)
Patient satisfaction	Comparable to traditional	27 (56.3)
	Lower than traditional	21 (43.7)
Counseling on reduced girth	Yes	33 (68.8)
	No	9 (18.8)
	Sometimes	6 (12.5)

when anticipating a challenging case due to corporal fibrosis or otherwise narrow corpora.

Based on the survey, SDPI were favored over malleable IPPs. Furthermore, the Coloplast Titan Narrow-base was preferred over the AMS 700 CXR. This may be based on the perception that Coloplast provides more rigidity than AMS, and while this is true for standard diameter cylinders,⁸ data suggest that the 2 small diameter cylinder models behave comparably to each other with regards to rigidity and buckling. For example, when Barboglio et al.⁸ assessed cylinder rigidity by applying force to the midshaft of maximally inflated cylinders, the AMS 700 CXR required the highest force to compress the cylinder by 50%, followed closely by the Titan Narrow and the Titan. In this test, the 2 SDPI along with the Titan performed in nearly identical fashion while the AMS 700 CX and AMS 700 LGX displayed substantially less rigidity. Furthermore, when buckling was assessed by applying force to the tip of the cylinder, the same pattern was seen with the 2 SDPI models performing similarly to the Titan, while the AMS 700 CX and LGX displayed buckling at much lower forces. This data suggests that the AMS CXR displays similar rigidity and buckling behavior to that of its Coloplast counterpart the Titan Narrow. The only notable difference seen between the Titan Narrow and the AMS 700 CXR in this study was that the Titan Narrow

achieved maximal inflation diameter at a lower volume (14 vs 16 mL), suggesting the Titan Narrow gains more girth and rigidity per mL than its AMS counterpart. Furthermore, while narrower when deflated, both the Coloplast Titan Narrow and AMS 700 CXR achieved maximal girth of 16.3 mm, which was higher than the AMS 700 LGX (15.6 mm) and comparable to the AMS 700 CX (16.5 mm).⁸ Only the Coloplast Touch had a significantly larger maximal cylinder girth of 17.6 mm. This data implies that while these smaller diameter cylinders can be easier to place in the setting of corporal fibrosis or otherwise small corpora, once in place they may achieve similar girth and rigidity to the standard cylinders.

One strategy outlined in the literature is the use of SDPI with intent to upsize in the future. Wilson et al.⁵ published data on a series of 37 patients that received SDPI due to fibrosis from prior infection or priapism. These patients were instructed to inflate their device daily for up to 3 hours, and successful upsize to standard diameter cylinders was performed in 35 of these patients, with the other 2 excluded due to development of postoperative infection. This study highlighted the feasibility of upsizing to standard diameter cylinders in patients that required SDPI due to fibrosis/infection, and our survey suggests that this strategy continues to be widely used. According to our survey, 75% of respondents indicated they either always intended (14.6%) or sometimes intended (60.4%) to upsize to standard diameter cylinders after SDPI placement. Given that maximal inflation girth of the SDPI is comparable to that of standard cylinders,⁸ it should not come as a surprise that upsizing is eventually possible for the vast majority of patients. However, the comparable physical characteristics between SDPI and standard cylinders should prompt the question of whether or not future upsize is necessary, and additional research regarding device satisfaction and utility in appropriately matched patients with each type of device may help answer this question.

Similar to the overall literature on small diameter cylinders, there is a dearth of data on outcomes following SDPI implantation. Henry *et al.* reported a higher infection rate with the use of the Mentor Alpha Narrow Base relative to standard diameter cylinder IPPs,⁹ however they argued that this is confounded by patient and surgery complexity and is therefore an expected finding. Only 6% of respondents in our survey had higher concern for infection following SDPI placement based on their clinical experience, however further research is required to investigate infection risk in SDPI implant surgeries in a contemporary series. Henry et al. also performed phone call interviews to determine functionality of the penile implants, and patients that received SDPI utilized their implants with similar frequency to those that received standard diameter IPPs.⁹ While reassuring that SDPI were functional, it is still unclear how patient satisfaction with these devices compares to traditional diameter cylinders. Our survey indirectly attempted to gauge patient satisfaction through questioning surgeons on perceived patient

satisfaction, and 56% of respondents reported similar satisfaction with SDPI compared to traditional diameter implants. A significant limitation of our study is that patients were not surveyed directly, so any data regarding patient satisfaction is indirect and likely to be biased by surgeon experience with small diameter implants. Furthermore, there may have been a response bias towards surgeons that do routinely use SDPI in their practice. Additional investigation that questions patients directly on this outcome is warranted.

CONCLUSION

Our survey of current SMSNA and SUPS members provides a real-world view of current utilization of SDPI. The survey results demonstrate that SDPI are used by many surgeons in select clinical conditions that preclude the use of normal diameter cylinders. Furthermore, these devices may offer satisfactory erections and/or efficacy as perceived by providers; however, many surgeons utilize them with the intention of subsequently upsizing to standard diameter cylinders in the future. While this survey provides basic data on current usage patterns of SDPI, future studies involving validated patient surveys may provide better insight into the utility and patient satisfaction with these devices. In addition, future investigation into preoperatively determining candidates for SDPI may offer the opportunity for improved surgical planning and preoperative patient counseling.

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STATEMENT OF AUTHORSHIP

Conceptualization: ACL, JPS Methodology: SPC, CJK, BDN, AA Software: SPC, BDN, CJK Data curation: SPC, CJK Writing original draft: ACL, SPC, AA, CJK, BDN Writing - review and editing: SPC, ACL, CJK, AA, BDN, JPS Supervision and administration: ACL.

REFERENCES

1. Levine LA, Becher EF, Bella AJ, et al. Penile Prosthesis surgery: Current recommendations from the international consultation on sexual medicine. *J Sex Med* 2016;13:489–518.
2. Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377–381.

3. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: Building an international community of software platform partners. *J Biomed Inform* 2019;95:103208.
4. Clavijo RI, Sávio LF, Prakash NS, et al. Three-piece penile prosthesis implantation in refractory ischemic priapism-tips and tricks. *Urology* 2017;106:233–235.
5. Wilson SK, Delk JR, Mulcahy JJ, et al. Upsizing of inflatable penile implant cylinders in patients with corporal fibrosis. *J Sex Med* 2006;3:736–742.
6. Scherzer ND, Dick B, Gabrielson AT, et al. Penile prosthesis complications: Planning, prevention, and decision making. *Sex Med Rev* 2019;7:349–359.
7. Trost LW, Boonjindasup AG, Hellstrom WJ. Comparison of infrapubic versus transcrotal approaches for inflatable penile prosthesis placement: A multi-institution report. *Int J Impot Res* 2015;27:86–89.
8. Barboglio Romo P, Chikkatur HP, Beldona S, et al. Comparative evaluation of physical characteristics of different inflatable penile prostheses. *Scand J Urol* 2017;51:420–425.
9. Henry GD, Brinkman MJ, Mead SF, et al. A survey of patients with inflatable penile prostheses: Assessment of timing and frequency of intercourse and analysis of implant durability. *J Sex Med* 2012;9:1715–1721.