Contemporary Review of Artificial Urinary Sphincters for Male Stress Urinary Incontinence

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ABSTRACT

Introduction: The most common cause of urinary incontinence in men after radical prostatectomy is intrinsic sphincter deficiency, which can affect long-term quality of life. The prevalence of stress urinary incontinence (SUI) after radical prostatectomy has been reported to be 2.5% to 90%. For patients with moderate to severe male SUI, the artificial urinary sphincter (AUS) is considered the gold standard in surgical treatment.

Aim: To review the available literature on the development, patient selection, surgical technique, complications, and management of AUS for male SUI.

Methods: A literature review was performed through PubMed from 1947 to 2015 regarding AUS for male SUI.

Main Outcome Measures: To assess various surgical techniques related to AUS insertion, outcomes, and complications and to offer recommendations regarding management of complications.

Results: The AUS can be placed through a perineal or trans-scrotal incision, particularly in the setting of dual insertion of an AUS and an inflatable penile prosthesis. The most commonly used cuff is 4.0 cm. The efficacy of InhibiZone is debatable. Pressure-regulating balloons can be filled with saline or contrast material and can be placed in an orthotopic or an ectopic location. In a systematic review of the literature, dry or improved continence rates are achieved in 79% of patients, with 90% reporting satisfaction and improved quality-of-life index scores after surgery. The most common AUS complications include a nonfunctioning device, sub-cuff atrophy, erosion, and infection. These complications are managed by strategies such as cuff downsizing, tandem cuff placement, and explantation. Dual AUS and inflatable penile prosthesis insertion is feasible for patients with SUI and erectile dysfunction.

Conclusion: The AUS is a durable and effective device for the management of SUI. Surgeons should be versed in the different device components, their potential complications, and their management

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Key Words: Artificial Urinary Sphincter; Urinary Incontinence; Inflatable Penile Prosthesis

INTRODUCTION

Stress urinary incontinence (SUI) in men is the involuntary leakage of urine secondary to insufficient bladder outlet resistance. It has become an increasingly common urologic problem, with a prevalence of 2.5% to 90% after prostatectomy and a cost burden of $19 to $32 billion in the United States.[1]

SUI can be caused by any or a combination of detrusor overactivity, urinary retention, or intrinsic sphincter deficiency. The most common cause of urinary incontinence in men after radical prostatectomy (RP) is from intrinsic sphincter deficiency, which can have a long-term impact on quality of life.[1–3] The prevalence of SUI after RP has been reported to be 2.5% to 40% and varies in the literature according to the exact definition and period studied.[2]

Urinary continence typically improves over the first 1 to 2 years after RP.[3] However, certain men who have undergone RP ultimately will require surgical intervention for incontinence.[2–4] Although it has been suggested that one must wait at least 1 to 2 years before intervening, many experts currently advocate doing so as soon as 6 months in the presence of stable non-improving symptoms. For those with moderate to severe male SUI, the artificial urinary sphincter (AUS) is considered the gold standard in surgical treatment.[5]

HISTORY AND DEVELOPMENT OF THE ARTIFICIAL URINARY SPHINCTER

In 1947, Foley[6] described the first artificial sphincter designed to improve urinary continence, which was an externally worn

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urethral cuff attached to a pump kept in the patient's pocket. In 1972, Scott et al,[7] at the Baylor College of Medicine, developed and successfully implanted the AS 721, the first iteration of the AUS that is commonly used today (Figure 1). The AS 721 consisted of a fluid reservoir, an inflatable occlusive cuff with a V4 unidirectional valve, a right-sided inflation bulb, and a left-sided deflation bulb. This model was bulky and carried with it a high rate of mechanical failure, with associated high urethral erosion rates caused by high cuff pressures. The subsequent AS 761 incorporated a pressure-regulating balloon (PRB) between the cuff and the valve to counter the high pressure applied to the urethra.[8,9]

In 1974, the AS 742, a complete redesign of the previous models, replaced the V4 valves and incorporated a balloon pressure reservoir for the cuff fluid and was the first prosthesis that offered automatic cuff closure. In addition, the AS 742 used a delay-fill resistor that slowed the return of fluid to the cuff, allowing the patient to void completely before closure of the urethral cuff. It also had fewer components with elimination of the inflation pump, thus allowing for easier implantation.[8,9]

The AS 791 and 792 were introduced in 1979 and were placed in the bulbous urethra and bladder neck regions, respectively. These models further streamlined the device by placing the resistor and valves in the same case. However, the device was always activated unless the patient was voiding and required an additional surgical procedure for activation. In consequence, the constant pressure on the urethra resulted in high urethral erosion rates.[8,9] These problems were remedied with the AMS 800 (American Medical Systems, Boston Scientific, Marlborough, MA, USA), the model currently in use.

Introduced in 1983, the AMS 800 took into account the shortcomings of the previous models by adding a deactivation button and moving the valves and resistor into the pump chamber, making it a single component. The new deactivation feature allowed the cuff to have an on-and-off function, which allowed for the cuff to be deflated during the postoperative period until healing was completed. After 6 to 8 weeks, the device would be activated, effectively decreasing the erosion rate and obviating a second activation operation. In 1987, the narrowback cuff was added to the AMS 800, which improved the focal pressure placed on the urethra, further decreasing the incidence of erosion.[8,9]

Approximately 12% of anti-incontinence procedures performed in the United States are AUS implantations.[10] AUS use has increased considerably since its inception in the early 1970s to approximately 3,900 cases per year by 2005, representing a 35% increase during the past 30 years.[1] To date, more than 150,000 patients have been treated with the AMS 800 after RP.[11]

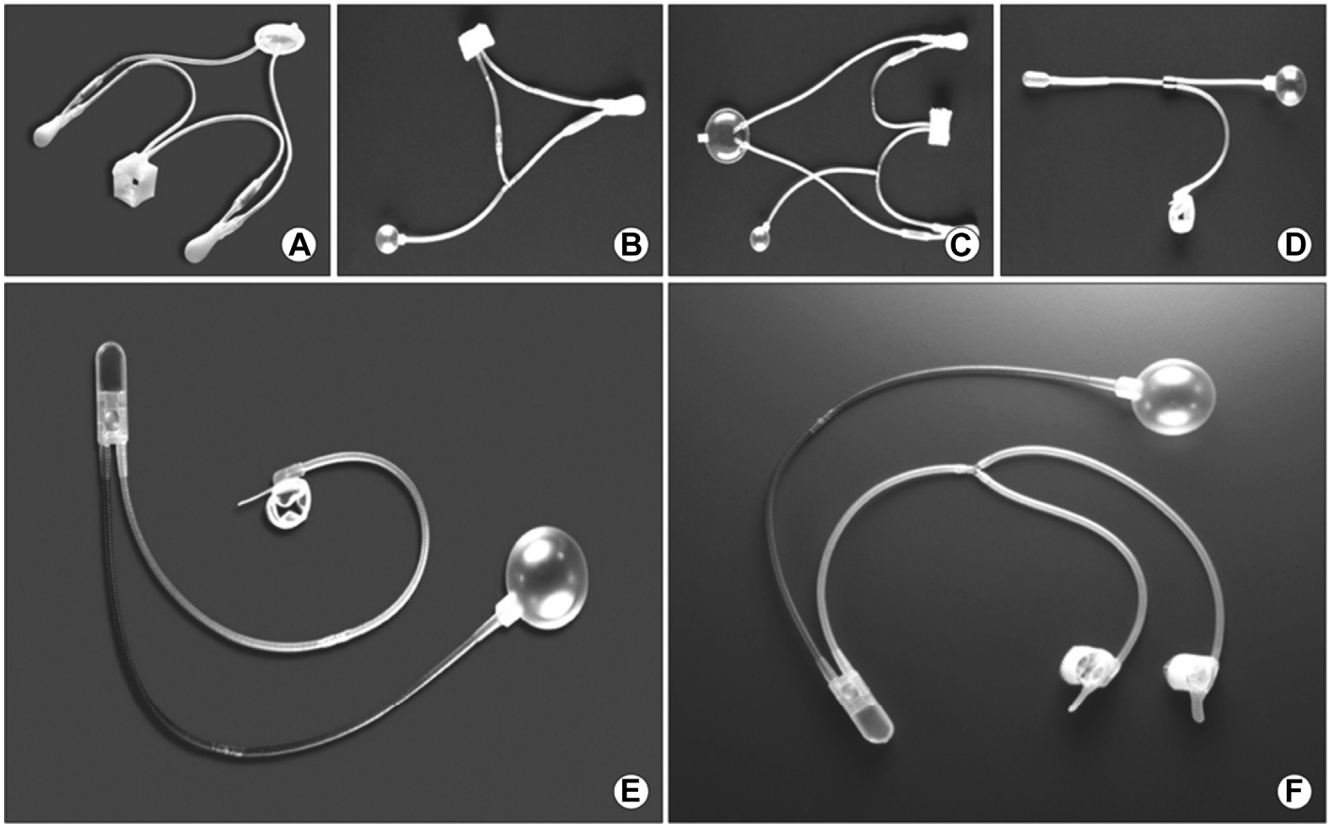

Figure 1. American Medical System artificial urinary sphincters. (A) AS 721 (1972–1979). (B) AS 742 (1974–1979). (C) AS 761 (1976–1977). (D) AS 791/792 (1977–1979). (E) AMS 800 single cuff (1983–present). (F) AMS 800 double cuff (1986–present).