Comparative Analysis Between The Use of External Ureteral Stents And Internal Ureteral Stents In Orthotopic Urinary Diversion

THESIS

SUBMITTED FOR FULFILLMENT OF THE MASTER DEGREE IN UROLOGY

BY

Ahmed Abd Allah Abd El-Hamid

(M.B.,B.Ch.)

SUPERVISED BY

Prof. Dr. Amr Abd El-Hakim

Professor of Urology

Faculty of medicine

Cairo University

Ass.Prof. Dr. Hosny Khairy

Assistant Professor of Urology

Faculty of medicine

Cairo University

Ass.Prof. Dr. Ahmed Al-Shenofy

Assistant Professor of Urology

Faculty of medicine

Cairo University

Faculty of medicine

Cairo University

2010

بسم الله الرحمن الرحيم

وقل رب زدني علما

صدق الله العظيم

(سورة طه آية رقم ١١٤)

ABSTRACT

Since the first description of a cystoscopically placed ureteral stent, improvements in stent design and composition have expanded their indications and have allowed their widespread use in urology.

Ureteral catheters have been used with success in stenting of the ureteral-intestinal anastomosis, allowing for ureteral implantation in almost all segments of the gastrointestinal tract during urinary diversion. In this setting, urinary stents are used for anastomotic support until the suture lines have healed, and safeguard against urinary leakage thus decreasing significantly the stricture rate of the ureterointestinal anastomosis. At the same time they allow for safe upper urinary tract drainage securing the urinary output throughout the postoperative period.

Although ureteral stents have significantly reduced perioperative complications of urinary diversions, their use however is not without problems. Stent migration can occur causing inaccurate urine output assessment, ureteral obstruction or urinary leakage. Infections and patient discomfort can also occur.

Key Words:

History of Ureteric Stent, Ureteric Stent Designs, Complications of Ureteral Stenting, Update on Ureteral Stents.

ACKNOWLEDGMENT

First, I would like to thank **God,** the merciful and compassionate for making this work possible and for giving me the strength to bring it to light.

I am honored to have **Prof. Dr. Amr Abd El-Hakim** Professor of Urology, Cairo University, as a supervisor for this work. I am greatly indebted to him for his valuable supervision, precious advice and continuous encouragement.

I greatly appreciate the advice I received from **Ass.Prof. Dr. Hosny Khairy** Ass.Prof. of Urology Cairo University, I will always appreciate his help and endless guidance throughout this study that made it possible.

I convey my thanks to **Ass.Prof. Dr. Ahmed Shunofy** Ass.Prof. of Urology Cairo University for his tremendous efforts in bringing this work to light.

I would also like to send special thanks to **Dr.Mahmoud Abd El-Hakim** Assistant lecturer of Urology, Cairo University for his great assistance in this work.

I thank **all my professors and members of the staff of the Urology Department** at Kasr Al-Aini Cairo University for their encouragement and help especially my dear brother **Dr.Mohammad Abd EL-Wahab,** assistant lecturer of urology, Faculty of Medicine, Cairo University, for his great help, assistance and encouragement.

Finally I would like to thank **my family** for their patience, time, support, and effort throughout my life, no words can express my feeling of gratefulness.

Ahmed Abd Allah

CONTENTS

LIST OF TABLES

LIST OF FIGURES

Page

LIST OF FIGURES

Page

<u>HISTORY OF STENTS</u>

The concept of stenting the urinary system began as an adjunct to open surgery to facilitate upper tract drainage or to align the ureter. Gustav Simon performed the first reported case during the 19thcentury by placing a tube in the ureter during open cystostomy, and Joaquin Albarrano created the first catheter intended for use in the ureter in the early 1900s. **(Herman *et* al, 1973).**

Although vulcanization of rubber was first reported in 1839, early catheters were constructed from fabric coated with varnish**. (Mack, 1998).** The development of plastics, such as polyethylene and polyvinyl, allowed for stents to become more rigid and easier to place; however, problems such as bladder irritation, infection, encrustation, and migration still occurred. **(Herdman, 1949). In 1952, Tulloch** described using polyethylene tubes to help repair ureters and fistulas in patients.

In 1967, the era of the modern long-term indwelling ureteral stent began when Zimskind and colleagues reported the use of open-ended silicone tubing inserted endoscopically to bypass malignant ureteral obstruction or ureterovaginal fistulas. **(Zimskin *et* al, 1967).**

Straight silicone stents provided good internal drainage and developed less encrustation than other compounds, but had no distal or proximal features to prevent migration. Minor improvements followed, with closing the proximal end of the stent to facilitate passage and using a“pusher” to hold the stent in place during wire removal**. (Marmar , 1970 ; Orikasa *et al*, 1973).**

Gibbons and colleagues made several modifications to prevent stent migration, including a distal flange to prevent proximal migration and sharply pointed barbs to prevent down ward migration and expulsion. In 1974, the Gibbons stent became the first commercially available “modern” internal ureteral stent. **(Gibbons *et al*, 1974).**

Following the Gibbons stent, single-pigtail stents were designed that could be straightened and placed over a wire cystoscopically to prevent distal, but not proximal, migration. In 1978, the migration issue was resolved with the use of double-J stents, which contained proximal and distal J-shaped hooks.**(Hepperlen *et al*, 1978).**

The word “stent” is commonly used in genitourinary reconstructive surgery. Two related uses of the stent are given in most medical dictionaries. First, a stent is a device used to maintain a bodily orifice, cavity, or contour, and second, it is a catheter, rod, or tube within a tubular structure to maintain luminal patency or protect an anastomosis or graft. **(Bloom *et al*, 1999)**.

The word “stent” is aneponym related to three English dentists named Stent who contributed to improving a substance used for dental impressions. **(Bloom *et al,* 1999).** The transition of the dental impression compound into a urologic tool is attributed to Esser of Holland during World WarI, as the name became associated with a support for oral skin grafts and later adopted in plastic surgery.**(Esser, 1917).**

Urologic stenting first appeared in print beginning in the 1970s. Goodwin wrote a brief commentary in 1972 titled, “Splint, Stent, Stint,” concluding: “Urologists are always talking about putting a tube in a ureter or urethra. When they do this, it is not a splint. It may be a stent. It probably is never a stint. Perhaps the process is most properly described as leaving a tube or stent in an organ.” The word “stent” became forged into the urologic literature when Montie *et al.* explicitly defined the term: “When referring to an intraluminal device to maintain patency until healing has taken place, the stent is most appropriate.”

STENT DESIGNS

Double-J Stent

A double-J has has an open hook configuration at either end of the ureteral stent, and a double pigtail stent has a full retentive coil at either end. The double-J stent is the original, silicone, closed tipped stent to which ACMI/Surgitek holds the patent. **(Finney *et al*, 1978).** All stent manufacturers produce a basic double-pigtail stent, which have a variety of names, designs, and compositions. Standard double-pigtail stents must be sized correctly because those that are too long can cause bladder irritation, and those that are too short can migrate up the ureter. A 24-cm ureteral stent is well suited for most adults, but should be individualized according to the ureteral length of the patient. Multiple-coil stents were designed to meet the "one size fits all" concept. Multiple-coil stents leave redundant length in the bladder coiled, so the trigone is not irritated. Some stents are manufactured with a nylon suture attached to the distal end, which can be left at the urethral meatus, allowing for removal after short term drainage without the need for repeat cystoscopy.**(John and Mantu, 2004).**

Open-ended ureteral stents

Open-ended ureteral stents have no coils and thus are not suitable for long-term urinary drainage. However, they can be secured externally to provide temporary drainage. Open-ended stents are useful in helping to direct and advance a guidewire into a ureteral orifice. They can assist in collecting upper urinary tract urine samples and permitting retrograde pyelography. Furthermore, open-ended ureteral stents are commonly placed intraoperatively to identify ureters to avoid inadvertent injury during abdominal or pelvic surgery. Transilluminating ureteral stents have been used to prevent ureteral injuries during gynecologic procedures.**(Phipps and Tyrrell, 1992)**.

Grooved stents

Grooved stents have grooves spiraling down the exterior of the stent to improve extraluminal flow aimed at postlithotripsy or holmium laser cases. The Towers peripheral stent is a grooved stent manufactured by Cook Urological. The outer diameter ranges from 6 to 8 F and the length from 22 to 32 cm. The LithoStent by ACMI features three grooves spiraling down the exterior of stent-like gutters designed to prevent ureteral strictures and urinomas. **(John and Mantu, 2004).**

Spiral stents

Spiral stents are polyurethane stents supported by a built-in metal spiral wire intended to keep the stent patent and improve drainage. In a study of 14 patients with spiral stents placed for chronic ureteral obstruction, only one stent change occurred after a mean indwelling time of 6.5 weeks.

(Tschada *et al*, 1994). When spiral-ridged stents were compared with smooth walled double-J stents in an in vitro mechanical ureteral model, extraluminal flow was greatest with the 7F spiral-ridged stents.
(Stoller *et al*, 2000).

Mesh stent

A mesh stent is a lightweight, self-expanding stent designed to preserve drainage while minimizing irritative symptoms. In a porcine model, although not statistically significant, the mesh stent resulted in less inflammation along the urinary tract at 1 week than a standard 7F double-pigtail polyurethane stent. **(Olweny *et al*, 2000)**. Furthermore, the flow rate through the mesh stent tended to be greater than the flow through the standard stent at both 1 and 6 weeks. When the flow characteristics were compared with other stents in a separate porcine animal study, the mesh stent had the greatest flow. **(Brewer *et al*, 1999)**

Tail stents

Tail stents have a standard pigtail and a 6F or 7F shaft at the proximal end, but the distal end tapers into an elongated 3F closed-tip tail to decrease stent-related bladder irritability. Drainage is achieved around the distal portion of tail stents, and, consequently, they are contraindicated when trauma to the distal ureter is suspected. Tail stents resist reflux because the distal third of the tail is occluded and approximately 3 to 5 cm of the tail's occluded portion lies within the intramural tunnel and the distal ureter. Boston Scientific/Microvasive makes a tail stent called the Percuflex Tail Plus. Tail stents have been shown to produce significantly fewer irritative voiding symptoms and result in significantly less postoperative flank pain after percutaneous nephrolithotomy.

(Dunn *et al*, 2000 ; Liatsikos *et al*, 2002).

Dual-durometer stents

Dual-durometer stents incorporate a smooth transition from a firm biomaterial at the renal end to a soft biomaterial at the bladder end. Two such devices are the Sof-Curl (ACMI) and Polaris (Boston Scientific/Microvasive) stents, which have long tapered tips at the renal end and are coated with a hydrophilic-bonded hydrogel that decreases their coefficients of friction**.(Kay, 2002).** In a study comparing six ureteral stents, the Polaris stent was shown to have superior lubricity, which eases stent passage, and lower flexural strength, which minimizes bladder discomfort. **(Mardis, 2001)**.