**CONCEPT: IMPROVED SUPRAPUBIC CATHETER**

An estimated 21.5% of the 2008 worldwide population (4.3 billion) was affected by lower urinary tract symptoms suggestive of bladder outlet obstruction (Wei et al., 2005a). The most common cause of this is Benign Prostatic Hyperplasia (BPH): also called an enlarged prostate, a condition that affects almost 3 of 4 men during the seventh decade of life (Wei et al., 2005b). Current disease trends worldwide suggest that the incidence and prevalence of these conditions will increase in the near future, among other reasons due to aging of the world population (Patel and Parsons, 2014). The number of affected individuals is the developing world was predicted to increase the most rising by 30% in Africa alone by 2018 (Irwin et al., 2011), a region where challenges of late diagnosis, limited access to testing and prompt treatment continue to prevail.

Despite the several alternatives for managing bladder outlet obstruction (i.e medical and surgical), catheterization remains the best option for some patients (Getliffe, 2002). This could be the case in men presenting with acute urinary retention in BPH (Muruganandham et al., 2007), patients unfit for surgery due to their frailty, in advanced prostate cancer and in neurogenic bladder dysfunction associated with conditions such as stroke and spinal cord injury(Wilde et al., 2010).

The choice of catheterization (intermittent or indwelling) depends on the individual’s requirement and skill or the availability of carers who can carry out the procedure for them. Long-term indwelling catheterization can be transurethral (into the bladder through the urethra) or suprapubic (into the bladder via the anterior abdominal wall) (Boreta et al., 2017). A suprapubic catheter has for long been the preferred method for urine diversion especially when long-term catheterization (more than 1 month) is required(Horgan et al., 1992),(O'kelly et al., 1995). Patients find it more comfortable, easier to manage, catheter changes less painful and allows the resumption of sexual activity in some patients unlike the urethral catheter(English, 2017). As a conservative approach to early localized prostate cancer, it has been shown to be more cost-effective as compared to radical prostatectomy: the surgical removal of the prostate(Koerber et al., 2014).

The current design of suprapubic urine diversion is of a long catheter tubing inserted through an opening on the abdominal wall to the bladder to diverting urine outside the body into a urine bag. This set up however exposes users to a high infection risk since it involves open insertion of a catheter to the bladder as opposed to the recommended sterile closed draining system that allows unobstructed flow (English, 2017).

The long exposed tubing encourages bacterial colonization which in return may result in cellulitis at suprapubic catheter site, recurrent and chronic catheter associated urinary tract infections(CAUTIs), catheter blockage, bladder stones and septicemia which may be fatal if inadequately treated (Feneley et al., 2015). The use of antibiotics to control catheter-induced infections further contributes significantly to the development of resistant strains(Organization, 2014).

In addition, external display and usage of tubing negatively affects the patient’s self-body image, intimacy and sexuality. It further creates a sense of discomfort, embarrassment and reduced daily activities(Wambui and Xejang, 2018).

We are proposing a safer, easier to insert and change suprapubic urine diversion system/device, that is devoid of the existing long external catheter tubing. One that will in addition allow near to complete emptying of the bladder as opposed to the existing method.

**Innovation/Technology**

The team proposes to design an affordable user-friendly urine excretion device for patients with Benign Prostatic Hyperplasia (BPH)) condition. The device is intended to bridge the gaps for the current suprapubic catheter tubing for patients with Benign Prostatic Hyperplasia (BPH) condition and have opted for surgical urine diversion through catheterization.

The device shall be connected to the catheter end on the immediate outside for excretion, with a unique re-coilable property to enable adjustments during and after use so that the user remains comfortable and reduce stigma when not in use.

It will use the principle of negative pressure by creating a vacuum to enable flow and complete drainage of urine from the bladder to the outside. The vacuum shall be created when the user opens the one-way valve to allow a uni-directional flow of the excretion to the outside.

The design is intended to reduce the contact time when not in use to reduce the risk of infection that could be spread to the catheter-incision/wound from the environmental interactions.

**Sketch design**

**REFERENCES:**

BORETA, L., RALEIGH, D. R. & ROACH, M. 2017. Palliation of urinary obstruction from advanced prostate cancer with SBRT. *Journal of Clinical Oncology,* 35**,** 246-246.

ENGLISH, S. F. 2017. Update on voiding dysfunction managed with suprapubic catheterization. *Translational Andrology and Urology***,** S180-S185.

FENELEY, R. C., HOPLEY, I. B. & WELLS, P. N. 2015. Urinary catheters: history, current status, adverse events and research agenda. *Journal of medical engineering & technology,* 39**,** 459-470.

GETLIFFE, K. 2002. Suprapubic catheterisation: Suprapubic catheterisation is becoming increasingly popular as it offers a number of potential advantages for some patients. However, the research evidence to support practice is still limited (Getliffe and Dolman 2002). *Primary Health Care,* 12**,** 35-36.

HORGAN, A., PRASAD, B., WALDRON, D. & O'SULLIVAN, D. 1992. Acute urinary retention. Comparison of suprapubic and urethral catheterisation. *British journal of urology,* 70**,** 149-151.

IRWIN, D. E., KOPP, Z. S., AGATEP, B., MILSOM, I. & ABRAMS, P. 2011. Worldwide prevalence estimates of lower urinary tract symptoms, overactive bladder, urinary incontinence and bladder outlet obstruction. *BJU Int,* 108**,** 1132-8.

KOERBER, F., WAIDELICH, R., STOLLENWERK, B. & ROGOWSKI, W. 2014. The cost-utility of open prostatectomy compared with active surveillance in early localised prostate cancer. *BMC Health Services Research,* 14**,** 163.

MURUGANANDHAM, K., DUBEY, D. & KAPOOR, R. 2007. Acute urinary retention in benign prostatic hyperplasia: risk factors and current management. *Indian journal of urology: IJU: journal of the Urological Society of India,* 23**,** 347.

O'KELLY, T., MATHEW, A., ROSS, S. & MUNRO, A. 1995. Optimum method for urinary drainage in major abdominal surgery: a prospective randomized trial of suprapubic versus urethral catheterization. *British journal of surgery,* 82**,** 1367-1368.

ORGANIZATION, W. H. 2014. *Antimicrobial resistance: global report on surveillance*, World Health Organization.

PATEL, N. D. & PARSONS, J. K. 2014. Epidemiology and etiology of benign prostatic hyperplasia and bladder outlet obstruction. *Indian journal of urology : IJU : journal of the Urological Society of India,* 30**,** 170-176.

WAMBUI, M. W. & XEJANG, L. 2018. Experiences of Living with Indwelling Urinary Catheters: A Literature Review.

WEI, J. T., CALHOUN, E. & JACOBSEN, S. J. 2005a. Urologic diseases in America project: benign prostatic hyperplasia. *J Urol,* 173**,** 1256-61.

WEI, J. T., CALHOUN, E. & JACOBSEN, S. J. 2005b. Urologic diseases in America project: benign prostatic hyperplasia. *The Journal of urology,* 173**,** 1256-1261.

WILDE, M. H., BRASCH, J., GETLIFFE, K., BROWN, K. A., MCMAHON, J. M., SMITH, J. A., ANSON, E., TANG, W. & TU, X. 2010. Study on the use of long-term urinary catheters in community-dwelling individuals. *Journal of Wound Ostomy & Continence Nursing,* 37**,** 301-310.

**APPENDIX**

