

# Urethral Catheter: History, types and uses

Baikuntha Adhikari

National Academy of Medical Sciences, Bir Hospital





# History

- Greek
- *Kathiénai* - “Catheter”
- Meaning “to thrust into” or “to send down”



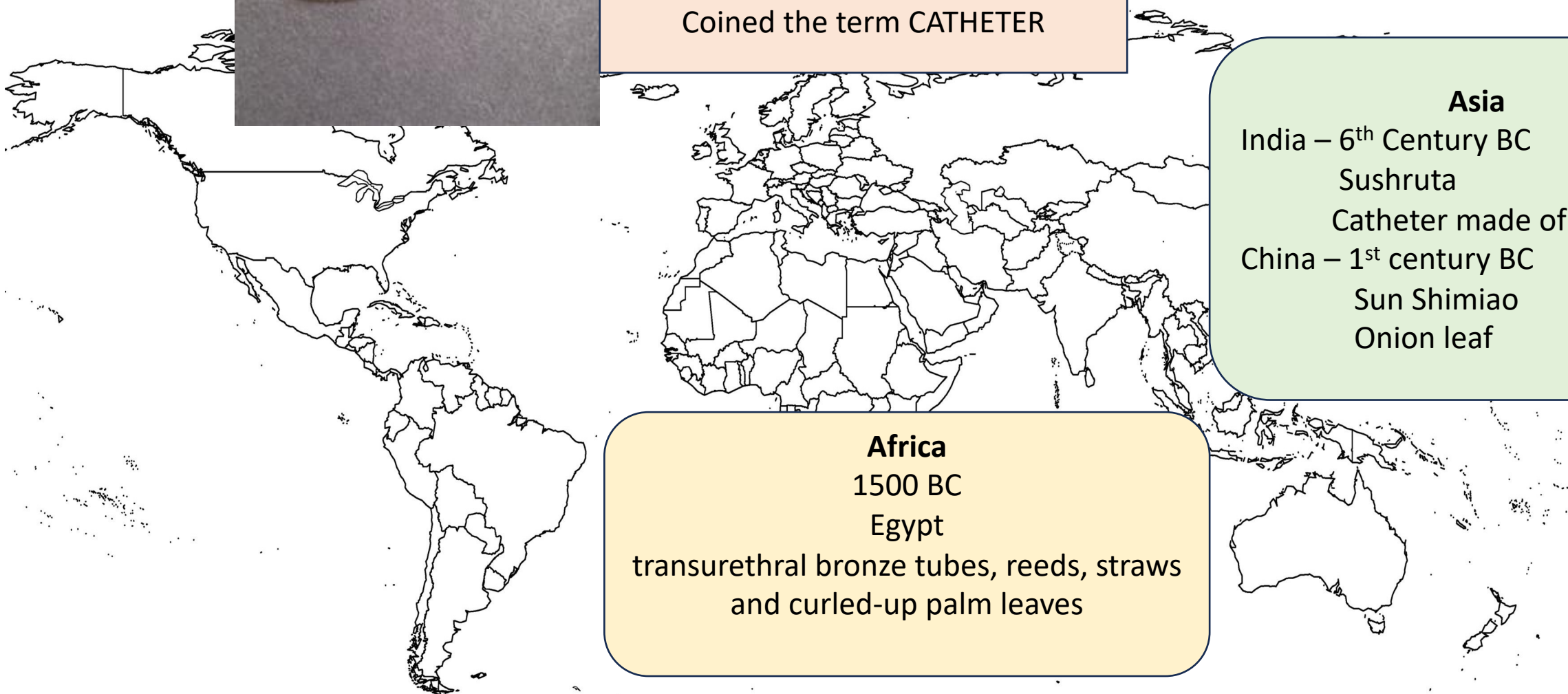
# Debate on first catheter use



**Europe**  
4<sup>th</sup> Century BC  
Erasistratus Greek physiologist and anatomist  
Coined the term CATHETER

**Asia**  
India – 6<sup>th</sup> Century BC  
Sushruta  
Catheter made of wood iron  
China – 1<sup>st</sup> century BC  
Sun Shimiao  
Onion leaf

**Africa**  
1500 BC  
Egypt  
transurethral bronze tubes, reeds, straws  
and curled-up palm leaves





- Organic/ Natural Catheter



Straw



Palm Leaf



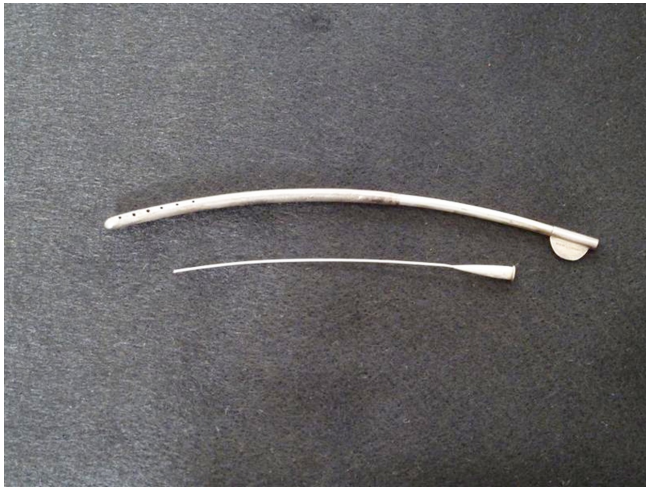
Onion hollow tops

# Catheters -11<sup>th</sup> century

- Malleable Catheters
  - Silver
- Avicenna - flexible catheters made from softened animal skins

# 16<sup>th</sup> Century

- Fabricius of Acquapendente (1537-1619)- earliest indwelling catheters which were made of cloth, impregnated with wax and moulded on a silver sound.



**1564**

**Figure 1** Catheters (from Ambroise Paré: *Dix Livres de la Chirurgie*, 1564)

# Catheters- 18<sup>th</sup> Century

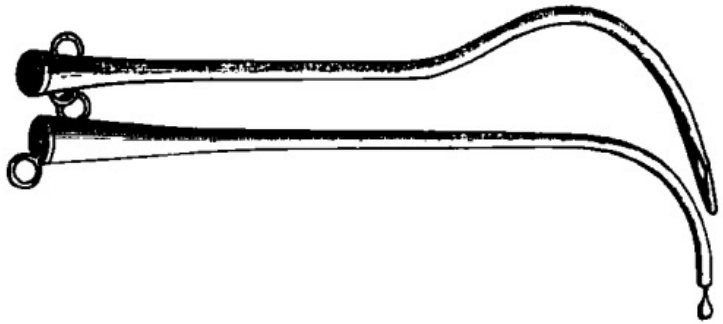


Fig. 3. Catheters. From Garengot, Croissante, *Traité des Instruments de Chirurgie*, La Haye, 1731.

1731



Fig. 4. Catheter. From Petit, *Traité des Maladies Chirurgicales*, 1790.

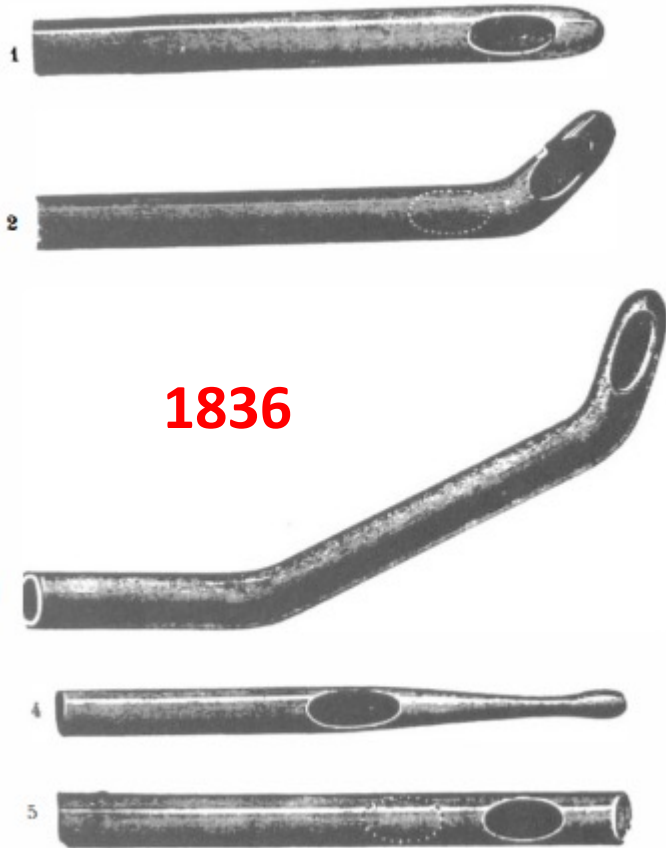
1790



1752



# 19<sup>th</sup> Century



**1836**

**Figure 3** Early coudé and bicoude catheters, depicted in an Eynard catalogue, were introduced by Mercier and Petit



**Figure 5** Nélaton's straight rubber catheter as it appeared in an early Eynard catalogue



**Fig. 7.** Reybard's self-retaining catheter. From Reybard, *Traité pratique des Rétrécissements de l'Uretre*, 1853.

**1853**



**Pezzer- 1890**



**Malecot- 1892**

# 20<sup>th</sup> Century

- 1930 – latex rubber catheter



1935

Frederick Eugene Basil Foley  
1891- 1966

*to D.A.C. from F.E.B. with affectionate regards and  
sincerely yours F.E.B.*

TRANSACTIONS OF THE CHICAGO UROLOGICAL  
SOCIETY

CYSTOSCOPIC PROSTATECTOMY

A NEW PROCEDURE AND INSTRUMENT; PRELIMINARY  
REPORT<sup>1</sup>

FREDERIC E. B. FOLEY  
*Saint Paul, Minnesota*

A SELF-RETAINING BAG CATHETER

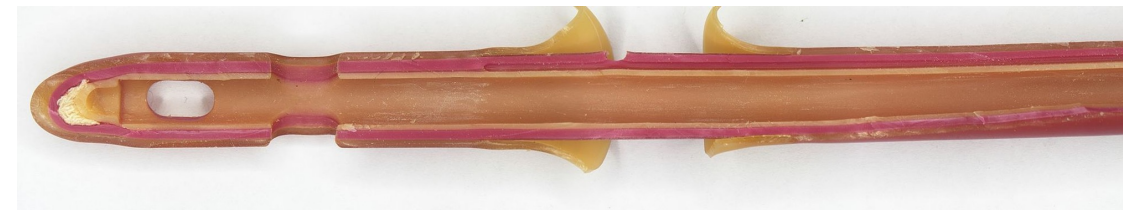
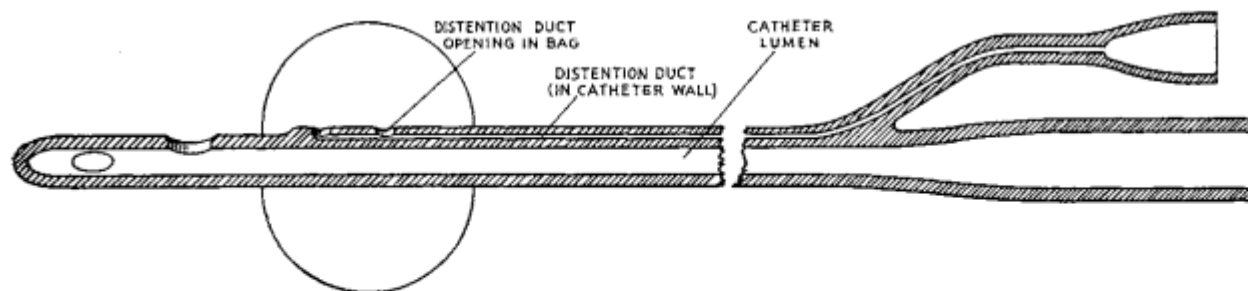
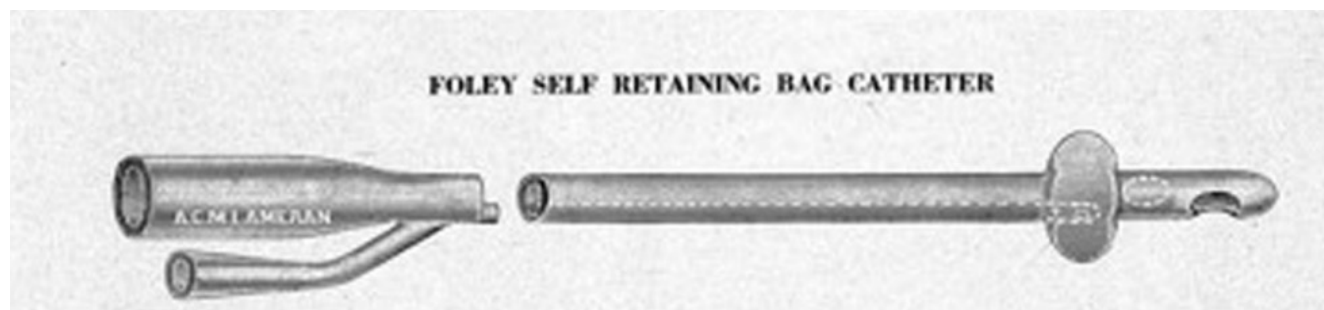
FOR USE AS AN INDWELLING CATHETER FOR CONSTANT DRAINAGE OF  
THE BLADDER

FREDERIC E. B. FOLEY, M.D.  
*Saint Paul*

A HEMOSTATIC BAG CATHETER

A ONE PIECE LATEX RUBBER STRUCTURE FOR CONTROL OF BLEEDING  
AND CONSTANT DRAINAGE FOLLOWING PROSTATIC RESECTION

FREDERIC E. B. FOLEY  
*Saint Paul*



# Important events

- Sir Ludwig Guttman introduced the concept of sterile intermittent catheterization in patients with spinal cord injury after World War II
- 1971- Dr. Jack Lapides of the University of Michigan at Ann Arbor introduced the clean intermittent catheterization technique

# Types of Urethral Catheter

- Material make
- Length
- Size
- Tip configuration
- Retainability
- Number of Channels
- Types of Coating



# Based on type of material used:



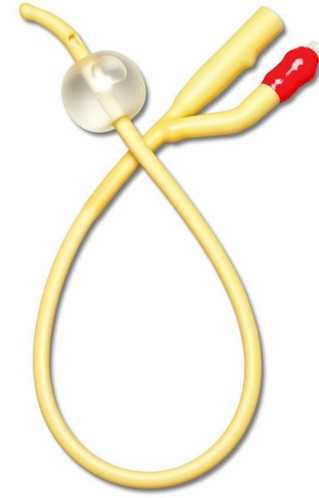
PVC



Metal



Rubber



Latex/ Siliconized latex



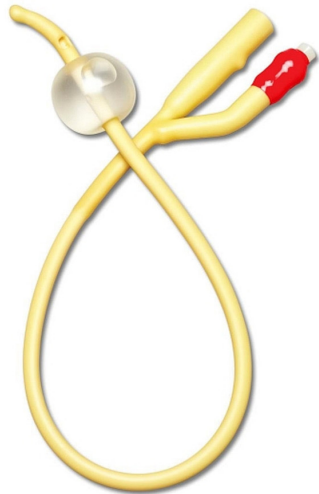
Silicon

- Catheter length

- Standard length (40–44 cm)
- Female length (23–26 cm)
- Paediatric length (30 cm)

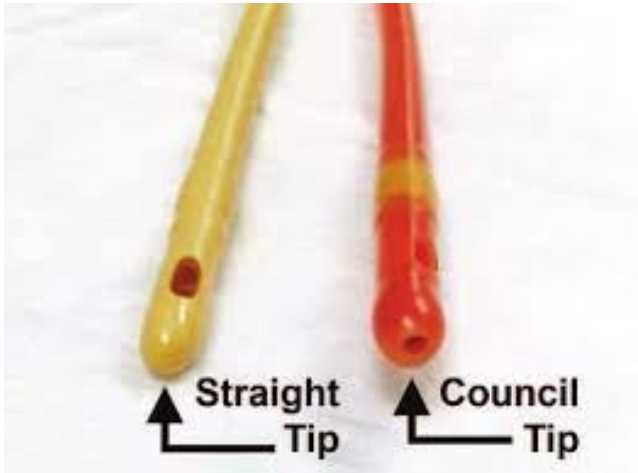
# Catheter size

- French unit
- External diameter of the catheter,
- 1 French unit = 0.33 mm

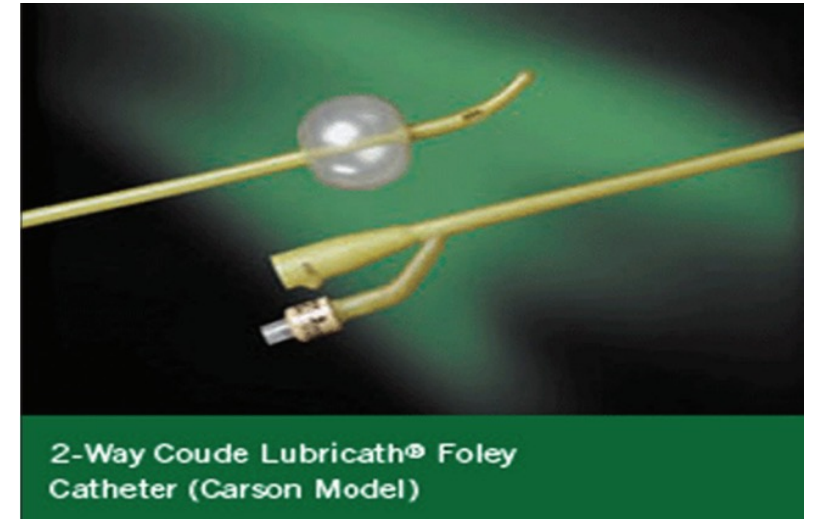


	Color	French units ↕	mm ↕
	Yellow-green	6	2.0
	Cornflower Blue	8	2.7
	Black	10	3.3
	White	12	4.0
	Green	14	4.7
	Orange	16	5.3
	Red	18	6.0
	Yellow	20	6.7
	Purple	22	7.3
	Blue	24	8.0
	Black	26	8.7

# Urethral catheter tip configuration

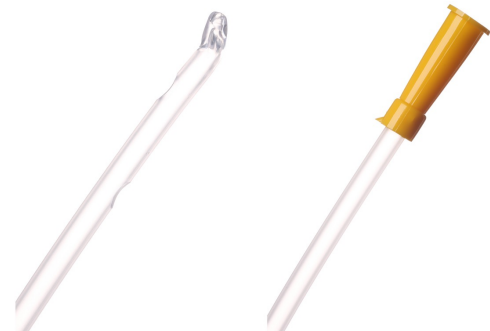


Tiemann Coude tip



Olive tip Coude

# Retainability



Tiemann Catheter





# Number of channels



- Urethral catheter coating modifications



### A Review of the Recent Advances in Antimicrobial Coatings for Urinary Catheters

Priyadarshini Singha<sup>a</sup>, Jason Locklin<sup>a,b,\*</sup>, and Hitesh Handa<sup>a,\*</sup>

<sup>a</sup>College of Engineering, University of Georgia, Athens, GA USA

<sup>b</sup>Department of Chemistry, University of Georgia, Athens, GA USA

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# A new urethral catheterisation device (UCD) to manage difficult urethral catheterisation

S. Bugeja<sup>1</sup> · K. Mistry<sup>1</sup> · I. H. W. Yim<sup>2</sup> · A. Tamimi<sup>2</sup> · N. Roberts<sup>2</sup> · A. R. Mundy<sup>1</sup>

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Fig. 1 Urethrotech Urethral Catheterisation Device (UCD®)

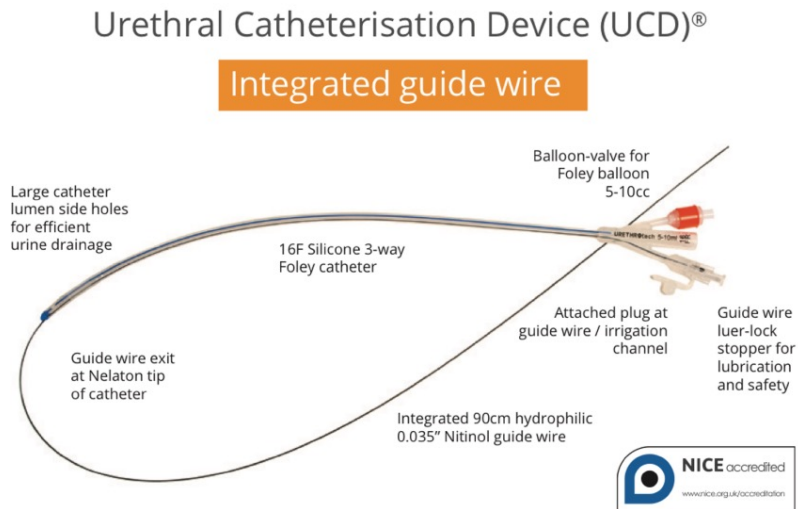
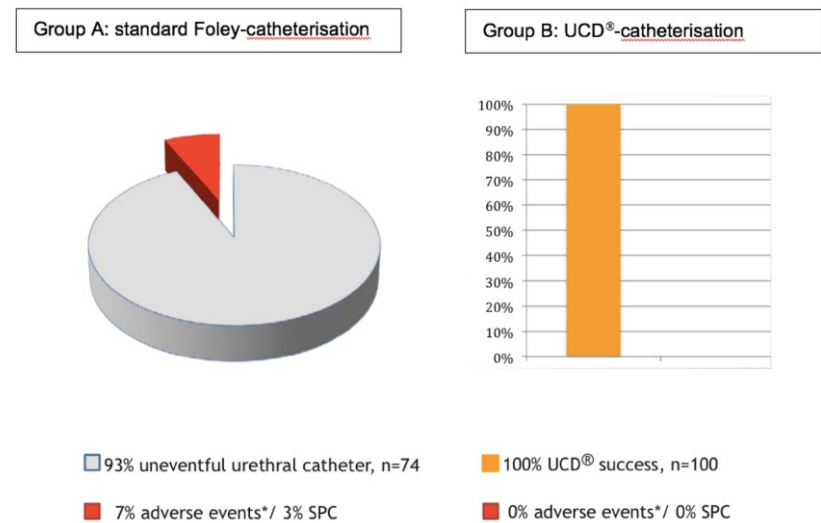


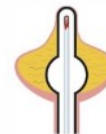
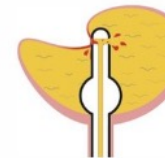
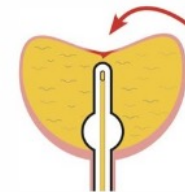
Fig. 3 Urethral catheterisation adverse events. Group A: standard Foley catheterisation; group B: UCD® catheterisation



# Flume catheter – new catheter after 80 years of Foleys



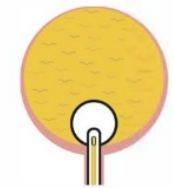
Foley



The FLUME catheter aims to address widely recognized design deficiencies of traditional Foley catheters



Flume



## Bladder Spasms

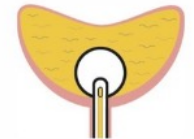
The bladder will contract, painfully at times, to try to expel foreign objects like a catheter.

With the FLUME balloon enveloping the tip, it reduces the length of material in the bladder by nearly half.

## Bladder Bruising & Abrasion

Repeated Foley tip contact can damage the bladder's protective lining, leading to bacterial colonization, encrustation and blockage.

With FLUME, the bladder wall comes into contact with the compliant balloon.



## Bladder Mucosal Tears

Bladder mucosa can be drawn into the Foley drainage holes, leading to mucosal damage, blockage and infection.

FLUME's drainage eyes are inset, protected by the balloon, designed to guard against mucosal aspiration.



## Residual Urine





With the Foley catheter, festering urine is trapped below the drainage hole by what is called the tent pole effect.

The FLUME drainage eyes are positioned at the base of the balloon, designed to facilitate full drainage.





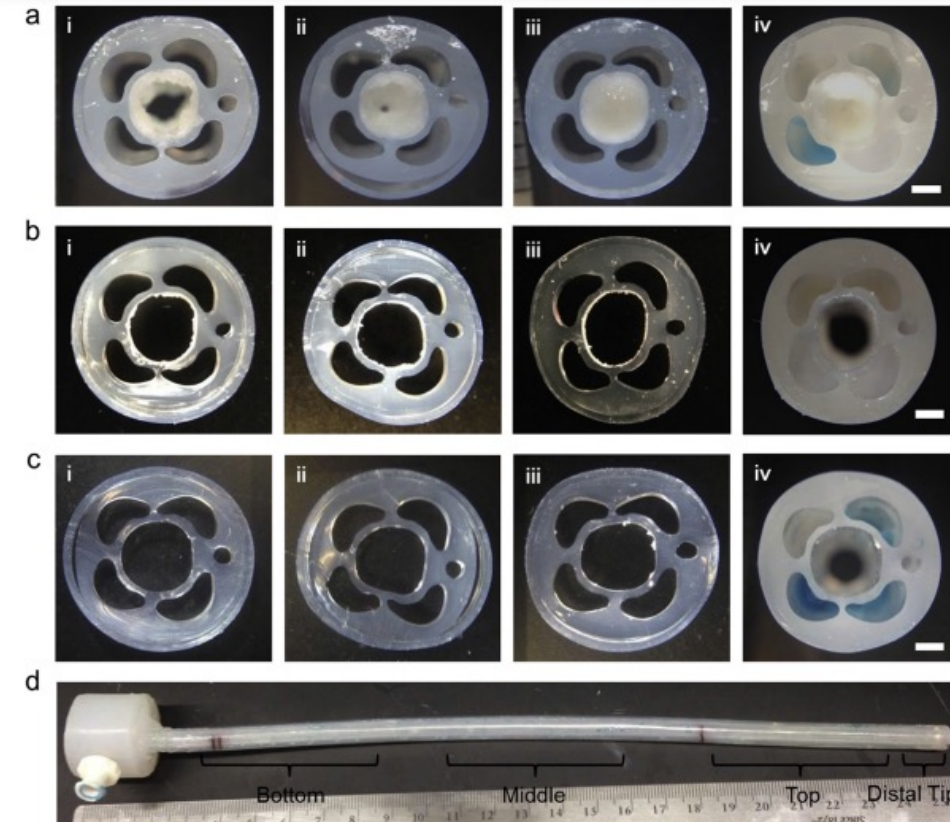
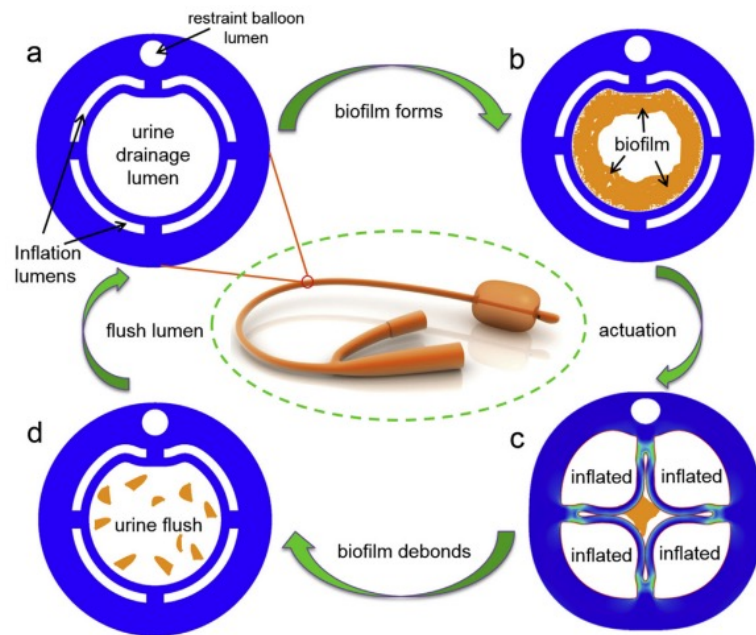
# Urinary catheter capable of repeated on-demand removal of infectious biofilms via active deformation

Vrad Levering<sup>a b 1</sup>, Changyong Cao<sup>a c 1</sup>, Phanindhar Shivapooja<sup>a b</sup>, Howard Levinson<sup>d</sup>,  
Xuanhe Zhao<sup>a c e</sup>  , Gabriel P. López<sup>a b c</sup>  

## Emerging medical and engineering strategies for the prevention of long-term indwelling catheter blockage

Scarlet Milo<sup>1</sup>, Jonathan Nzakizwanayo<sup>2</sup>, Hollie J Hathaway<sup>3</sup>,  
Brian V Jones<sup>4</sup> and A Toby A Jenkins<sup>1</sup>

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**Fig. 1.** Schematic of a urinary catheter capable of on-demand removal of infectious biofilms via active deformation. (a) Cross-section of the designed urinary catheter shaft with intra-wall inflation lumens. (b) Biofilm forms on the surface of urine drainage lumen after 1–2 days. (c) Actuation of inflation lumens by pumping air or water to generate large mismatched strains between biofilm and the surface of main lumen to debond the biofilm from the urine drainage lumen. (d) The detached biofilm is removed by the flow of urine once the inflation lumens are deflated. Therefore, the catheter can be maintained free of mature biofilms for long-term use and thereby may reduce the risk of catheter-associated urinary tract infections.



# Uses

- Centers for Disease Control and Prevention (CDC)
  - 15%–25% of hospitalized patients undergo catheterization
- The Future Market Insights report
  - Global UC market will grow at a compound annual growth rate of nearly 5% during 2020–2030.

# Uses of Urethral Catheter

- Monitor
- Diagnostic
- Therapeutic
  
- Transient use
- Short term use
- Long term use
  
- European regulation on medical devices
  - Urinary catheters are classified under Rule 5 as:
  - Class I, if they are intended for transient use (intended for continuous use for less than 60 min);
  - Class IIa, if they are intended for short-term use (intended for continuous use for between 60 min and 30 days) and;
  - Class IIb, if they are intended for long-term use (intended for continuous use for more than 30 days)

# Uses

- Monitor
  - Urine output monitoring –critically ill or post-operative patients, AKI, Sepsis
  - Trauma
- Diagnostic
  - Acquisition of urine sample - culture/ cytology
  - Radiographic contrast studies - Urethral / bladder injury
    - Cystogram or RGU
  - Urodynamic study

- Therapeutic

- Drainage - Perioperative use in selected surgeries/PCNL/URSL/ Retention of urine
- Irrigation following surgery- TURP/ TURBT/ Hematuria
- Instillation - Intravesical chemotherapy – UB carcinoma/ BPS
- Urethral stricture surgery
- Management of Extraperitoneal urinary bladder injury/ small vesicovaginal fistula
- Assistance in healing of the severe perineal and sacral wounds in incontinent patients
- Hospice/ comfort care/ palliative care

- **Contraindications**

- **Absolute**

- Confirmed urethral injury or history of bladder neck closure or repair

- **Relative**

- Recent urethral surgery or urethral stricture
    - Artificial urinary sphincter



Thank you