Catheter-associated UTI
many guidelines, no solutions?

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Introduction

- 15-25% of patients in general hospitals ⇒ have urethral catheter inserted
- NAUTI ⇒ 65-75% associated with catheterization
- Mortality ⇒ 3x higher when catheters are inserted ⇒ LoE IIb.


Global Prevalence Study of Infections in Urology (GPIU)

- 2003 – 2017
- 56 countries
GPIU Patients (2003-2017)

- 27,542 patients screened
- 2,768 patients with UTI (13%)
- 2,056 patients with microbiological proven UTI (10%)
- Mean age $59.9 \pm 18.2$

Tandogdu Z et al. WJU 2015
Characteristics of patients with NAUTI
(Results of the GPIU studies 2005-2010)

- Urinary indwelling catheter 74%
- Average catheter duration 6-11 days
- Urinary tract obstruction 49%
- Previous UTI 44%
- Hospitalisation in prev. 6 months 45%
- Urinary stones 20%


Hospital acquired urinary tract infections in urology departments: pathogens, susceptibility and use of antibiotics. Data from the PEP and PEAP-studies. Johansen TE, Cek M, Naber KG, Stratchounski L, Svendsen MV, Tenke P; PEP and PEAP-study investigators; Board of the European Society of Infections in Urology.
European and Asian guidelines on management and prevention of catheter-associated urinary tract infections

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d Department of Medicine, National University Singapore, 5 Lower Kent Ridge Road, Singapore 119074, Singapore
e Technical University of Munich, Munich, Germany, mailing address: Bickleder 44c, D-94315 Straubing, Germany
Diagnosis, Prevention, and Treatment of Catheter-Associated Urinary Tract Infection in Adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America

Thomas M. Hooton, Suzanne F. Bradley, Diana D. Cardenas, Richard Colgan, Suzanne E. Geerlings, James C. Rice, Sanjay Saint, Anthony J. Schaeffer, Paul A. Tambayh, Peter Tenke, and Lindsay E. Nicolle


Carolyn V. Gould, MD, MSCR; Craig A. Umscheid, MD, MSCE; Rajender K. Agarwal, MD, MPH; Gretchen Kuntz, MSW, MSLIS; David A. Pegues, MD; and the Healthcare Infection Control Practices Advisory Committee (HICPAC)
Guidelines
Recommendations of EAU, IDSA, CDC CAUTI guideline (2010)

- Meta-analyses of randomized controlled trials in medline ⇒ Cochrane reviews
- PubMed search using subject headings „urinary” with the keyword „catheter”, „nosocomial”, ”neurogenic bladder”, „intermittent”, „suprapubic” and „methenamine”
- Experts ⇒ to identify any additional trials not accessed through review
- The majority of CAUTI prevention studies ⇒ CA-ASB, CA-B ⇒ rather than CAUTI ⇒ outcome
Levels of recommendations of IDSA and CDC guidelines

**IDSA guideline**

<table>
<thead>
<tr>
<th>Category/grade</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength of recommendation</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Good evidence to support a recommendation for or against use.</td>
</tr>
<tr>
<td>B</td>
<td>Moderate evidence to support a recommendation for or against use.</td>
</tr>
<tr>
<td>C</td>
<td>Poor evidence to support a recommendation for or against use.</td>
</tr>
<tr>
<td>Quality of evidence</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Evidence from &gt;1 properly randomized, controlled trial.</td>
</tr>
<tr>
<td>II</td>
<td>Evidence from &gt;1 well-designed clinical trial, without randomization; from cohort or case-controlled analytic studies (preferably from &gt;1 center); from multiple time-series; or from dramatic results from uncontrolled experiments.</td>
</tr>
<tr>
<td>III</td>
<td>Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.</td>
</tr>
</tbody>
</table>

**CDC guideline**

**Table 1. Modified HICPAC Categorization Scheme* for Recommendations**

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category IA</td>
<td>A strong recommendation supported by high to moderate quality† evidence suggesting net clinical benefits or harms</td>
</tr>
<tr>
<td>Category IB</td>
<td>A strong recommendation supported by low quality evidence suggesting net clinical benefits or harms or an accepted practice (e.g., aseptic technique) supported by low to very low quality evidence</td>
</tr>
<tr>
<td>Category IC</td>
<td>A strong recommendation required by state or federal regulation.</td>
</tr>
<tr>
<td>Category II</td>
<td>A weak recommendation supported by any quality evidence suggesting a trade off between clinical benefits and harms</td>
</tr>
<tr>
<td>No recommendation/ unresolved issue</td>
<td>Unresolved issue for which there is low to very low quality evidence with uncertain trade offs between benefits and harms</td>
</tr>
</tbody>
</table>

*NOTE: Adapted from the Canadian Task Force on the Periodic Health Examination [10]. Adapted and reproduced with the permission of the Minister of Public Works and Government Services Canada, 2009. Any combination of strength of recommendation and quality of evidence is possible. See Practice Guidelines and Methodology for further discussion.
The incidence of bacteriuria:
- 3-8% ↑/day\(^1,2\)
- 100% of patients develop bacteriuria by the end of the month

The most important risk factor \(\Rightarrow\) the duration of catheterization (diabetes, se.creatinin ↑, female, absence of antibiotic use, indications other than surgery, errors in catheter care, microbial colonization of the drainage bag) \(^3,4,5\)

\(\Rightarrow\) LoE IIa-III

Catheterization – incidence of CA-B

- Short-term CAB ⇒ asymptomatic, single organism\(^1,^2\) ⇒ LoE III

- Long-Term CAB ⇒ symptomatic, polymicrobial\(^1,^3\) ⇒ LoE II.b-III


Pathogenesis of CA-B and CAUTI

- Bacteria ⇒ at the time of catheter insertion 20% of patients will be colonized immediately\(^1,2\) - LoE IIa
- Bacteria ⇒ through the lumen of the catheters ⇒ by reflux of urine from contaminated bags (intraluminal)
- Bacteria ⇒ ascend from the urethra along the extraluminal catheter-urethral surface
- Biofilm ⇒ favourable environment for bacterial invasion or proliferation via the extraluminal route

Prevention of catheter-associated UTI

- Prevention of catheterization
- Prevention of bacteriuria
- Prevention of bacteriuria complications
Prevention of catheterization - alternatives

- **Condom catheters**:
  - Data are insufficient ⇒ risk of CAUTI ↓
  - Cognitively not impaired men with low residual urine\(^1,2\) ⇒ bacteriuria ↓ ⇒ LoE Ib

- **Intermittent catheterization**
  - Should be used ⇒ short-term\(^3\) (Ia) and long-term\(^1\) (IV) catheterization
  - RT ⇒ clean rather than sterile technique is advisable ⇒ no difference in the risk of CAB or CAUTI\(^4\) ⇒ LoE Ib

- **CDC**: In the **acute** care hospital setting, use aseptic technique and sterile equipment

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Alternatives

Intermittent catheterization

- **IDSA**: Hydrophilic catheters are **not recommended** for routine use to reduce the risk of CA-bacteriuria or CA-UTI

- **CDC**: Hydrophilic catheters **might be preferable** to standard catheters for patients requiring intermittent catheterization
Suprapubic catheterization ⇒ IDSA, EAU LoE III

☑ Should be considered ⇒ short-term¹ (CI) and long-term (AIII) catheterization

☑ Data are insufficient ⇒ risk of CAUTI ↓

☑ Cochrane review² ⇒ CA-B ↓, discomfort ↓, recatheterization ↓


3. Jain Pet al. Overuse of the indwelling uri
Prevention of catheterization - alternatives

Suprapubic catheterization

**CDC:**

- **Further research is needed** on the risks and benefits of suprapubic catheters as an alternative to indwelling urethral catheters in selected patients requiring short- or long-term catheterization, particularly with respect to complications related to catheter insertion or the catheter site
Prevention of bacteriuria

- Indwelling catheters should be placed only when they are indicated\(^1,2\)
  - 30% of initial urinary catheterizations are unjustified ⇒ LoE IIaB
- Institutions ⇒ list of appropriate indications of catheterization, reminder system
  - 1/3-1/2 days of continued catheterization are unjustified\(^3\)

Prevention of bacteriuria

- Remove the catheter as soon as possible
- Catheter insertion ⇒ antiseptic and sterile equipment
- CDC: Ensure that only properly trained persons (e.g., hospital personnel, family members, or patients themselves) who know the correct technique of aseptic catheter insertion and maintenance are given this responsibility

- Catheter system closed\(^1,2\) ⇒ LoE IIa (CAB 50% at 14 days closed v. 95% at 96 h open system)

Types of urethral catheters

- There is still no consensus as to which catheter is the best in which circumstances ⇒
  - clinical indication, cost, availability and personal preference
The method of catheter insertion

- **Optimum type and size**: the smallest diameter ⇒ adequate drainage
  - 12-16Ch ⇒ to drain clear dilute urine
  - 16-18Ch ⇒ to drain urine containing debris
  - >18Ch ⇒ for drainage of haematuria and clots

- **Balloon size**: should only be inflated with sterile water
Modification of catheter material
(Prevention of bacteriuria)

- Goals:
  - Prevent bacterial adherence
  - Inhibit bacterial growth
  - Delay the onset bacteriuria
  - Delay or prevent encrustation or blockage
Modification of catheter material
(Prevention of bacteriuria)

- Strategies
  - Incorporation of biocides or antibiotics into the catheter material
  - Development of materials with surface properties, which prevent the adherence of bacterial cells
Evidence level of antimicrobial coated urinary catheters

No effect in long-term patients

Some advantages for short-term patients ⇒ intensive care (LoE IIa-III)
CA-ASB – Effectiveness Ag coating < 1 week

<table>
<thead>
<tr>
<th>Study or sub-category</th>
<th>Antiseptic n/N</th>
<th>Standard n/N</th>
<th>RR (fixed) 95% CI</th>
<th>Weight %</th>
<th>RR (fixed) 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Silver oxide versus standard</td>
<td></td>
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<tr>
<td>Johnson 1990</td>
<td>19/207</td>
<td>28/275</td>
<td>7.78 0.90 [0.52, 1.57]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Takeuchi 1993</td>
<td>26/26</td>
<td>11/11</td>
<td>Not estimable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riley 1995</td>
<td>85/745</td>
<td>73/564</td>
<td>26.87 0.88 [0.66, 1.18]</td>
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</tr>
<tr>
<td>Subtotal (95% CI) 978</td>
<td>978</td>
<td>850</td>
<td>34.65 0.89 [0.68, 1.15]</td>
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</tr>
<tr>
<td>Total events: 130 (Antiseptic), 112 (Standard)</td>
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<tr>
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<tr>
<td>Test for overall effect: Z = 0.92 (P = 0.36)</td>
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<tr>
<td>02 Silver alloy versus standard</td>
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<tr>
<td>Lundeberg 1986</td>
<td>6/51</td>
<td>17/51</td>
<td>5.50 0.35 [0.15, 0.82]</td>
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<td></td>
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<tr>
<td>Liedberg 1990a</td>
<td>3/30</td>
<td>25/60</td>
<td>5.39 0.24 [0.08, 0.73]</td>
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<td></td>
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<tr>
<td>Liedberg 1990b</td>
<td>6/60</td>
<td>22/60</td>
<td>7.11 0.27 [0.12, 0.62]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liedberg 1993</td>
<td>8/75</td>
<td>23/96</td>
<td>6.52 0.45 [0.21, 0.94]</td>
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<td></td>
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<tr>
<td>Maki 1996b</td>
<td>64/407</td>
<td>94/443</td>
<td>29.11 0.74 [0.56, 0.99]</td>
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<tr>
<td>Verleyen 1999b</td>
<td>8/79</td>
<td>31/101</td>
<td>8.80 0.33 [0.16, 0.68]</td>
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<td></td>
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<tr>
<td>Thibon 2000</td>
<td>7/90</td>
<td>10/109</td>
<td>2.92 0.85 [0.34, 2.14]</td>
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<td></td>
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<tr>
<td>Subtotal (95% CI) 792</td>
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<td>920</td>
<td>65.35 0.54 [0.43, 0.67]</td>
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<tr>
<td>Total events: 102 (Antiseptic), 222 (Standard)</td>
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<td>Test for overall effect: Z = 5.64 (P &lt; 0.00001)</td>
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<tr>
<td>Total (95% CI) 1770</td>
<td>1770</td>
<td>1770</td>
<td>100.00 0.66 [0.56, 0.78]</td>
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</tr>
<tr>
<td>Total events: 232 (Antiseptic), 334 (Standard)</td>
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<tr>
<td>Test for heterogeneity: Chi² = 20.18, df = 8 (P = 0.010), I² = 60.4%</td>
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<tr>
<td>Test for overall effect: Z = 4.98 (P &lt; 0.00001)</td>
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</table>
## CA-ASB – Effectiveness Ag coating

**> 1 week**

| Review: Types of urethral catheters for management of short-term voiding problems in hospitalised adults (Minor update) |
| Comparison: 01 ANTI-SEPTIC CATHETER VERSUS STANDARD CATHETER |
| Outcome: 02 Number with asymptomatic bacteriuria (>1 week) |

<table>
<thead>
<tr>
<th>Study or sub-category</th>
<th>Treatment</th>
<th>Control</th>
<th>RR (fixed)</th>
<th>Weight</th>
<th>RR (fixed)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td>95% CI</td>
<td>%</td>
<td>95% CI</td>
</tr>
<tr>
<td>01 Silver alloy versus standard</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Liedberg 1993</td>
<td>26/75</td>
<td>56/96</td>
<td>40.71</td>
<td>0.59</td>
<td>[0.42, 0.85]</td>
</tr>
<tr>
<td>Verleyen 1999a</td>
<td>6/12</td>
<td>8/15</td>
<td>5.89</td>
<td>0.94</td>
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<td>Verleyen 1999b</td>
<td>28/79</td>
<td>60/101</td>
<td>43.65</td>
<td>0.60</td>
<td>[0.43, 0.84]</td>
</tr>
<tr>
<td>Thibon 2000</td>
<td>9/90</td>
<td>13/109</td>
<td>9.75</td>
<td>0.84</td>
<td>[0.38, 1.87]</td>
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<tr>
<td>Subtotal (95% CI)</td>
<td>256</td>
<td>321</td>
<td>100.00</td>
<td>0.64</td>
<td>[0.51, 0.80]</td>
</tr>
<tr>
<td>Total events: 69 (Treatment), 137 (Control)</td>
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<tr>
<td>Test for heterogeneity: Chi² = 1.80, df = 3 (P = 0.62), I² = 0%</td>
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<tr>
<td>Test for overall effect: Z = 3.90 (P &lt; 0.0001)</td>
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</tbody>
</table>

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Favours silver alloy  | Favours standard

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0.1  | 0.2  | 0.5  | 1    | 2    | 5    | 10   |
CAUTI – Effectiveness Ag coating
>

<table>
<thead>
<tr>
<th>Study or sub-category</th>
<th>Treatment</th>
<th>Control</th>
<th>RR (fixed)</th>
<th>Weight</th>
<th>RR (fixed)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>n</td>
<td>nN</td>
<td>n</td>
<td>nN</td>
<td>95% CI</td>
</tr>
<tr>
<td>01 Silver alloy versus standard</td>
<td>26/75</td>
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<td>5.89</td>
<td>0.94 [0.45, 1.96]</td>
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<td>9/90</td>
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<td>0.84 [0.38, 1.87]</td>
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<tr>
<td>Thibon 2000</td>
<td>256</td>
<td>321</td>
<td>100.00</td>
<td>0.64 [0.51, 0.80]</td>
<td></td>
</tr>
</tbody>
</table>

Total events: 69 (Treatment), 137 (Control)
Test for heterogeneity: $\chi^2 = 1.80$, df = 3 (P = 0.62), $I^2 = 0$
Test for overall effect: $Z = 3.90$ (P $<$ 0.0001)

Total (95% CI) | 256 | 321 | 100.00 | 0.64 [0.51, 0.80] |

Test for heterogeneity: $\chi^2 = 1.80$, df = 3 (P = 0.62), $I^2 = 0$
Test for overall effect: $Z = 3.90$ (P $<$ 0.0001)
### CAUTI – Effectiveness antibiotic coating < 1 week

**Review:** Types of urethral catheters for management of short-term voiding problems in hospitalised adults (Minor update)

**Comparison:** 02 ANTIBIOTIC-IMPREGNATED CATHETER VERSUS STANDARD CATHETER

**Outcome:** 01 Number with asymptomatic bacteriuria (< 1 week)

<table>
<thead>
<tr>
<th>Study or sub-category</th>
<th>Antibiotic</th>
<th>Standard</th>
<th>RR (fixed)</th>
<th>Weight</th>
<th>RR (fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n/N</td>
<td>n/N</td>
<td></td>
<td>%</td>
<td></td>
</tr>
<tr>
<td><strong>01 Antibiotic-impregnated (minocycline and rifampicin) versus standard</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Darouiche 1999</td>
<td>8/56</td>
<td>27/68</td>
<td>29.30</td>
<td>0.36</td>
<td>29.30</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>56</td>
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<td></td>
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<tr>
<td>Total events: 0 (Antibiotic), 27 (Standard)</td>
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<tr>
<td>Test for heterogeneity: not applicable.</td>
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<td>Test for overall effect: Z = 2.84 (P = 0.004)</td>
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<tr>
<td><strong>02 Antibiotic-impregnated (nitrofurazone) versus standard</strong></td>
<td></td>
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<tr>
<td>Maki 1997</td>
<td>9/170</td>
<td>14/174</td>
<td>16.69</td>
<td>0.59</td>
<td>23.73</td>
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<tr>
<td>Lee 2004</td>
<td>14/92</td>
<td>19/95</td>
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<td>Stensballe 2007</td>
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<td>25/102</td>
<td>30.33</td>
<td>0.35</td>
<td>30.33</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>365</td>
<td>361</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total events: 31 (Antibiotic), 56 (Standard)</td>
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</tr>
<tr>
<td>Test for heterogeneity: Chi² = 1.93, df = 2 (P = 0.38), P = 0%</td>
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<tr>
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<tr>
<td>Total (95% CI)</td>
<td>422</td>
<td>425</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total events: 39 (Antibiotic), 85 (Standard)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for heterogeneity: Chi² = 2.78, df = 3 (P = 0.43), P = 0%</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 4.13 (P &lt; 0.0001)</td>
<td></td>
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</tr>
</tbody>
</table>
Antimicrobial coated urinary catheters

CDC

- If the CAUTI rate is not decreasing after implementing a comprehensive strategy to reduce rates of CAUTI, consider using antimicrobial/antiseptic-impregnated catheters

- Further research is needed on the effect of such catheters in reducing the risk of symptomatic UTI, their inclusion among the primary interventions, and the patient populations. No recommendation can be made.
The time taken for 18 different types of catheters to block in the bladder model infected with *Proteus mirabilis*.

*N.S.Morris B.J.of Urology 1997.80,58-63*
HEPARIN-COATING IN VITRO

- Heparin coating inhibits bacterial adherence
  > 90% by its strong electronegativity
  (Ruggieri, J. Urol. 138, 1987)

- ⇒ reduction of incrustations
  (struvite -NH₄MgPO₄,
  brushit - CaHPO₄,
  hydroxylapatite -
  Ca₅PO₄OH, calcium-
  phosphate)
Heparin-coated urinary stents in vivo

Polyurethane and heparin-coated urinary stents in vivo

Phosphoryl-choline coating ureteral stents in vivo

Summary of encrustation scores on stents recovered from patients

<table>
<thead>
<tr>
<th>Stent type</th>
<th>Mean encrustation scores on stent sections</th>
<th>Mean total encrustation scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bladder</td>
<td>Ureteral</td>
</tr>
<tr>
<td>Uncoated</td>
<td>2.17</td>
<td>1.96</td>
</tr>
<tr>
<td>Biocompatibles PC-coated</td>
<td>1.79</td>
<td>1.66</td>
</tr>
</tbody>
</table>

Microbial colonisation of coated and uncoated stents

<table>
<thead>
<tr>
<th>Type of stents</th>
<th>Total number examined</th>
<th>Number (%) with visible biofilm</th>
<th>Number (%) from which microbes were isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncoated stents</td>
<td>28</td>
<td>17 (61)</td>
<td>15 (54)</td>
</tr>
<tr>
<td>Biocompatibles PC-coated stents</td>
<td>44</td>
<td>16 (36)</td>
<td>16 (36)</td>
</tr>
</tbody>
</table>

New Approach in the prevention CAUTI
Surface Acoustic Waves (SAW)

- Experimental work with ultrasound - “bursts” (Mott, 1998) seemed to have some effect on biofilms
- Animal studies with rabbits showed that low energy acoustic nanowaves could block biofilm formation on medical devices (Hazan, 2006)

Effective Prevention of Microbial Biofilm Formation on Medical Devices by Low-Energy Surface Acoustic Waves

Zadik Hazan,1 Joni Zumerah,1 Harold Jacob,1 Haman Baskin,1 Gera Kratvsh,1 Moshe Vishniz,1 Naima Dro,2,3 Tilda Barliya,2 Melila Mandel,2 and Gad Lavitz4

Nanovision Corporation, Nother,2 and Institute of Hematology and Blood Center, Shela Medical Center, Tel Hashomer,2 Israel

Received 4 April 2006; Revised 9 May 2006; Accepted 18 August 2006

Low-energy surface acoustic waves generated from electrically activated piezoelectric elements are shown to effectively prevent microbial biofilm formation on indwelling medical devices. The development of biofilms by four different bacteria and Candida species is prevented when such elastic waves with amplitudes in the nanometer range are applied. Acoustic-wave-activated Foley catheters have all their surfaces vibrating with longitudinal and transversal dispersion vectors homogeneously surrounding the catheter surfaces. The acoustic waves at the surface are repulsive to bacteria and interfere with the docking and attachment of planktonic microorganisms to solid surfaces that constitute the initial phases of microbial biofilm development. Filamentation-adhesion of opportunistic Escherichia coli to guinea pig erythrocytes was prevented at power densities below thresholds that activated bacterial force sensor mechanisms. Elevated power densities dramatically enhanced red blood cell aggregation. We inserted Foley urinary catheters attached with elastic-wave-generating actuators into the urinary tracts of male rabbits. The treatment with the elastic acoustic waves maintained urine sterility for up to 9 days compared to 2 days in control catheterized animals. Scanning electron microscopy and biofilm analysis revealed diminished biofilm development on these catheters. The ability to prevent biofilm formation on indwelling devices and catheters can benefit the implanted medical device industry.
UroShield™ Surface Acoustic Solution

- Prevention of bacterial attachment
- Always active on surface (silver/coatings are neutralized)
- Micro-ventilation of zone of contact between catheter and body entry
- Acoustic envelope improves contact conditions of catheter and body - Endothelial Restoration
- Converts balloon into resonator
- Increases antibiotic efficacy
Effect of UroShield Treatment on Pain and Discomfort In Patients Requiring Urinary Catheter

2014 EAU
Tenke
SEM of indwelling catheters with UroShield of 3 months indwelling time
SEM of indwelling catheter control

P. Tenke 2010
Surface Micropattern (Sharklet)

- **Mechanical** modification, not chemical
- Galapagos shark skin pattern: protects it from attachment of living organisms such as algae and barnacles
- Used in Ship and submarine technology
- In Catheters: may prevent biofilm formation, migration of the bacteria
OBJECTIVES

- Sharklet vs standard silicone catheter
  - Biofilm
  - Bacteriuria
  - CAUTI
Asymptomatic bacteriuria and CAUTI, symptoms

Significant asymptomatic bacteriuria:
• Four patients in each group

CAUTI: No symptomatic CAUTI

Quality of Life:
• 5 patients complained of a change in pain severity from none or mild pain to severe pain in the standard silicone Foleys group
• This difference was statistically significant with $P = 0.018$ when compared to Sharklet group
Biofilm formation was significantly reduced on the outer surface of the tip (P=0.003)
Prevention of complications of bacteriuria - Antibiotic prophylaxis

● **Short-term**
  - Antibiotic prophylaxis should NOT be routinely used⁰ (Ia)
  - BUT Cochrane authors concluded: ⇒ limited evidence
  - In women with abdominal surgery and urethral catheter for 24 h² ⇒ CAUTI ↓
  - The first 3 postoperative days or until catheter removal ⇒ CA-B↓ in surgical patients with urethral catheter at least 24h postop.

● **Long-term**
  - According to the Cochrane database the data are sparse³ (Ia)
  - ⇒ No recommendation can be made
  - Creates more resistant flora

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Prevention of complications of bacteriuria-Antibiotic prophylaxis

- The possible role of prophylaxis in short-term catheterized patients ⇒ high risk for serious complications if UTI occurs
  - granulocytopenia
  - urologic or gynecologic surgery
  - foreign bodies
- But no studies have been performed ⇒ high risk group
Prevention of complications of bacteriuria - Additional methods of prevention

- Methenamine salts
  - Shouldn’t be used routinely to prevent CA-B and CAUTI (C)
  - In patients following gynecologic surgery ⇒ catheterized <1 week (Ib)
- Cranberry: data are insufficient
  ⇒ No recommendation can be made (D)
- Irrigation with antiseptics (povidone-iodine or chlorhexidine) or antibiotics
  - Not effective ⇒ not recommended (A)
  - Considering: in selected surgery patients undergoing short-term catheterization to prevent CA-B (C)
Prevention of complications of bacteriuria - Catheter change

- Routine catheter change ⇒ not recommended to prevent CAB or CAUTI in patients with functional urethral or suprapubic catheter
- Early catheter blockage ⇒ catheter change every 7-10 days
- CDC: Changing at routine, fixed intervals is not recommended. Rather, it is suggested to change catheters and drainage bags based on clinical indications such as infection, obstruction, or when the closed system is compromised
- No studies ⇒ value of prophylactic antibiotic to prevent CAUTI at catheter removal or change

Screening and treatment ⇒ not recommended

- Short- and long-term catheterized patients: - low rate in complications
  - Treatment does not appear beneficial ⇒ CAUTI↓
Systemic antimicrobial treatment is only recommended:

1. Patients undergoing urological surgery or implantation of prostheses (A)
2. Treatment is part of a plan to control nosocomial infection due to a virulent organism (B)
3. Patients who have a high risk of serious infectious complications, e.g. patients who are immunosuppressed (C)
4. In case of pregnancy (B)
5. Infections caused by strains causing a high incidence of bacteraemia, e.g. *Serratia marcescens* (B)
Conclusion

- Effective ways ⇒ CAB or CAUTI ↓
- Reduce urinary catheters ⇒ clear indication
- Remove the catheter

Strategies
- Use of condom catheters or intermittent catheterization
- Use of a closed drainage system with proper catheter maintenance
- Use of antimicrobial coated catheters ⇒ short-term
- Use of catheter with antiadhesive surfaces ⇒ heparine, sharklet....
Thank you for your attention.
Treatment of symptomatic UTI

- Urine and blood culture
- Parenteral antibiotics
- Changes or removal of the catheter $\Rightarrow > 1$ week
- 7 days treatment is recommended$^1 \Rightarrow$ prompt resolution of symptoms (IIIC)
- 10-14 days treatment is usually required$^2 \Rightarrow$ delayed response - LoE Ib
- 5 days of levofloxacin $\Rightarrow$ who are not severely ill$^3$ (IbB)
- Minor symptoms, negative blood culture $\Rightarrow$ short courses of oral antibiotics (3-5 days)