Infection Transmission in GI Endoscopy:

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Disclosures:

Sponsored to give invited presentations at various National and International conferences by:

The University of Manitoba has licensed Dr. Alfa’s patent for Artificial Test Soil to Healthmark.

Opinion Leader Panel participation or Consulting Services for: 3M, J&J, STERIS, Serim, Olympus, bioMerieux, Serim, Borden Ladner Gervais LLP, various Canadian Healthcare facilities.

Research projects for:
- 3M, STERIS, J&J, Novaflux, Virox, Serim, Olympus, Medic-Safe, Serim, Case Medical, Province of Manitoba, Public Health Agency of Canada
- No funds from these research projects come to Dr. Alfa – all funds handled by the St. Boniface Research Centre.

Objectives:

- Infection transmission by GI endoscopes
  - Recent data from Europe and USA

- Role of cleaning, HLD and storage:
  - Contamination of flexible GI endoscopes

- Prevention of Build-up Biofilm:
  - Flexible GI endoscopes

Pictures from Google Images
Patient Infections related to Medical Devices

**Endogenous**: Infections due to patient’s own organisms

**Exogenous**: Infection due to contaminated medical device

Recent data on infection outbreaks from GI scopes

- Guidelines indicate the risk of infection transmission due to GI scopes is very rare.

**HOWEVER**......
- *Outbreaks associated with GI scopes have high transmission rates*

Outbreak # 1: France 2010


The particular strain of *K. pneumoniae* was multi-resistant
**Key Conclusions**

- Endoscope cultures grew *K. pneumoniae*
- Not all transmissions resulted in infections (41% transmission rate)
- Cleaning and disinfection (Peracetic acid) done properly
- **Drying inadequate**
- *K. pneumoniae* survived multiple rounds of cleaning and HLD [Biofilm]

**Outbreak # 2: USA 2013**

**Alrabaa S. et al**  Early identification and control of carbapenemase-producing *K. pneumoniae* originating from contaminated endoscopic equipment. AJIC 2013;41:562-4

The *K. pneumoniae* was multi-resistant; CRKP strain
Patients with CRKP all had ERCP at same facility then transferred to 2 hospitals

<table>
<thead>
<tr>
<th>Patient [Hosp]</th>
<th>Age/SEX</th>
<th>Diagnosis</th>
<th>Infection</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 [A]</td>
<td>73 M</td>
<td>Pancreatic cancer</td>
<td>Blood</td>
<td>Colistin</td>
</tr>
<tr>
<td>2 [A]</td>
<td>62 F</td>
<td>Pancreatic cancer</td>
<td>Blood</td>
<td>Colistin</td>
</tr>
<tr>
<td>3 [A]</td>
<td>59 M</td>
<td>Gallbladder cancer</td>
<td>Urine</td>
<td>Tigecycline</td>
</tr>
<tr>
<td>4 [B]</td>
<td>78 F</td>
<td>Pancreatitis</td>
<td>Blood</td>
<td>Tig+Gent</td>
</tr>
<tr>
<td>5 [B]</td>
<td>81 M</td>
<td>Gallbladder cancer</td>
<td>Biliary fluid</td>
<td>Tig+Mero</td>
</tr>
<tr>
<td>6 [B]</td>
<td>82 M</td>
<td>Liver mass</td>
<td>Blood</td>
<td>Tig+Amik</td>
</tr>
<tr>
<td>7 [B]</td>
<td>83 M</td>
<td>Gallbladder cancer</td>
<td>Blood</td>
<td>Tig+Amik</td>
</tr>
</tbody>
</table>

Key Conclusions

- Cleaning of elevator was inadequate: debris remained under elevator piece
- *K. pneumoniae* survived multiple rounds of cleaning and HLD

Outbreak # 3: USA 2014

*MMWR: Notes from the Field: Transmission of New Delhi Metallo-betalactamase (NDM) strain of *E.coli* through endoscopy* 2014

The *E.coli strain was a multi-resistant NDM strain*
NDM *E. coli* strain: What does this mean to me???

**North-eastern Illinois Outbreak:**
- First 9 cases: linked to ERCP in Hospital A (odds ratio 78)
- *Colonization:* 50 of 90 other patients who had ERCPs at this site were screened and 46% were colonized with same NDM *E. coli* strain.
- *ERCP elevator channel* grew: NDM-*E. coli* & CRE-*K. pneumoniae*
- *No apparent breaks* in flexible endoscope reprocessing protocol??

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Un-sealed EGW: Fluid flow for cleaning of EGW channel

Sealed EGW: No cleaning of EGW channel
NDM- \textit{E.coli}: resistant to carbapenems

- Multi-antibiotic resistant
- Infections: blood, urine, biliary tract
- Treatment options limited (Alrabaa 2013):
  - Colistin
  - Tigecycline + aminoglycoside
- High transmission rates and high infection/mortality rates
- ?Biofilm development?

Instructions for Use (IFU):
Cleaning, HLD and Storage

Is the risk of infection outbreaks only associated with sites that have breaches in following IFUs?

Kovaleva J et al, Clinical Microbiology Reviews 2013;26:231-253

CSAO Endoscope Reprocessing
HUMAN FACTORS STUDY:
Manual Cleaning

Observed reprocessing of 69 scopes at 4 different facilities

<table>
<thead>
<tr>
<th>OBSERVED ACTIVITY [12 steps]</th>
<th>% COMPLETION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leak test performed in clear water</td>
<td>77%</td>
</tr>
<tr>
<td>Brush all endoscope channels &amp; components</td>
<td>43%</td>
</tr>
<tr>
<td>Purge endoscope with air (after cleaning prior to HLD)</td>
<td>84%</td>
</tr>
<tr>
<td>Flush endoscope with alcohol</td>
<td>86%</td>
</tr>
<tr>
<td>Use forced air to dry endoscope</td>
<td>45%</td>
</tr>
</tbody>
</table>


How does Biofilm develop in Endoscopes??

- **Build-up Biofilm:** Cyclical hydration and non-sterile dry storage
  - *Patient use:* exposed to organisms/fluid
  - *Cleaning of scope:* exposed to fluid
  - *HLD:* Kill organisms left after cleaning
  - *Final rinse:* remove HLD residuals
  - *Alcohol rinse/forced air drying*

  **How dry is dry enough for storage?**

Storage Cabinet with air flushing of endoscopes channels

- *Wassenburg Endoscope storage cabinets*
  - Channels connected to air-flow
  - Documentation of scope status

Pictures from website
How can users prevent build-up Biofilm?

- **Manual Cleaning**: ensure it is thoroughly done EVERY TIME (Rapid cleaning monitors)
- **HLD**: ensure MEC testing done
- **Final Rinse**: ensure 0.2um filters intact
- **Dry Storage**: ensure alcohol/forced air drying adequately done EVERY TIME
  OR: use channel-purge storage cabinets

**STAFF…..STAFF….STAFF….!!**

- **Initial training**:
  - clear written protocols
  - structured training process
  - verified initial competency
- **Ongoing Competency**:
  - year competency assessment
  - training on all new scopes acquired

**Take Home Messages**:  
- **Recent Infection outbreaks**:
  - High rate of transmission (~45%)
  - Antibiotic resistant organisms: NDM- _E.coli_
- **Cleaning, HLD and Storage**:
  - improper; cleaning, HLD or wet storage leads to → build-up biofilm
  - perform each step correctly EVERY TIME!
- **Ban build-up Biofilm**:
  - verify manual cleaning and MEC of HLD
  - STORE SCOPES DRY!
Flexible Endoscope Reprocessing

You are NOT ALONE........