INFECTION CONTROL and STERILIZATION UNIT

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Hospital acquired infections

- 3 – 10 / 100 hospitalized patients
  USA → > 2 million patients / year
- Cross-infections → 11 – 35%
- At least 20% → preventable
- Percentage of infections related to the sterilization units → ??

Zero risk should be the standard

MMWR, 1992
Harbarth S, J Hosp Infect, 2003
Outline

- Sterilization failures
  - Complex surgery equipment
  - Endoscopes
  - Reprocessing single use devices
  - Prions
Goal of infection control

- Reduce infection risk
  - Patients
  - Employees
  - Others

Sterilization Unit + Infection control team
Sterilization unit

- Cleaning
- Decontamination
- Inspection
- Assembly
- Packaging
- Sterilization
- Storage
- Delivery

Properly prepared, sterile medical devices

- Principles
- Methods
- Agents
- Limitations
- Regulations
Sterilization failure

- Polymicrobial ventriculitis
- Outbreak in CVS ICU
  - Mediastinitis
  - Endocarditis
  - Bacteraemia
  - Surgical site infection
  - *S. marcescens*
- 17 patients
- 5 deaths

- Plasmid profiles
- Inadequately sterilized theatre linen

- Large package size
- Irregular Bowie-Dick tests
- No biological indicator
- Improper humidity control
- Lack of proper infection control

*Esel D, J Hosp Infect, 2002*
Complex structured devices

- Narrow and long lumens
- Twisted structure with crevices
- Heat-sensitive material, lubricants
- Small pieces, difficult to detach

Disinfection / Sterilization
- Difficult
- Labor-intensive
- Requires attention to details
Complex structured devices

Phacoemulsification instruments

- 32 sets
- 16% moderately contaminated
- 22% severely contaminated

- lens capsule
- man-made fibres
- squamous cells
- bacteria and fungal elements
- red blood cells
- proteinaceous material.

Leslie T, Eye 2003
Endoscopes

**PATIENT**
Normal flora
  - E. coli
  - Klebsiella spp.
Colonizing organism
  - Serratia spp.
Infection
  - Salmonella spp.
  - M. tuberculosis
  - Hepatitis B or C virus
  - HIV

**ENVIRONMENT**
- Pseudomonas spp.
- Atypical mycobacteria

Failure of cleaning and disinfection ➔ Infection transmission

Ann Intern Med, 1993
Am J Infect Control, 2000
Endoscopes - Problems of disinfection

- Complex structure of endoscopes and accessories
- Compliance with established reprocessing guidelines

Endoscopy, 2000
Infect Control Hosp Epidemiol, 2003
Disinfection of endoscopes

- 26 hospitals in USA
- 78% → failure to sterilize biopsy forceps
- 71 GIS endoscopes
  - bacterial cultures of internal channels after disinfection
    - 24% grew $\geq 10^5$ colonies

Kaczmarek RG, Am J Med, 1992
Endoscopes - Failures of disinfection

- Inadequate manual CLEANING
  - Cleaning of all channels (flushing, brushing)
- Inadequate disinfection
  - Lack of full immersion in the disinfectant solution
  - Short duration of immersion
  - Unappropriate disinfectant
- Inadequate rinsing and drying
- Lack of sterilization of accessories
- Use of automated endoscope reprocessors
  - Contaminated reprocessor (water bottles and tubes)
  - Improper connection / usage
Endoscopy-related transmission

- Colonoscopy – HCV
  Biopsy suction channel was not cleaned
  Accessories were not autoclaved
  5 min. immersion in 2% gluteraldehyde
- Bronchoscopy – M. tuberculosis
  Poor manual cleaning
  Partial immersion in the disinfectant
  Failure to sterilize biopsy forceps

Langenberg W, J Infect Dis, 1990
Bronowicki JP, NEJM, 1997
Michele TM, JAMA, 1997
Agerton T, JAMA, 1997
Wenzel R, JAMA, 1997
Patient is not infected but the culture of the sample taken by the endoscope is positive

Pathogens
- P. aeruginosa, S. marcescens,
- M. tuberculosis and atypical mycobacteria

Possible results
- Transmission → Colonization or infection
- Unnecessary investigations
- Unnecessary treatment

Silva CV, Infect Control Hosp Epidemiol, 2003
Bennett SN, Am J Respir Crit Care Med, 1994
Microbial reservoirs

- Biofilm formation
  - Layer of bacteria (tightly attached to each other and the underlying surface) and extracellular material
  - Difficult to clean
  - Protection from disinfection and sterilization

☞ Importance of mechanical cleaning
A biopsy forceps after cleaning, demonstrating residual organic soil

*Am J Infect Control, 2000*

Biofilm: Microbial life on surfaces

[commtechlab.msu.edu](http://commtechlab.msu.edu)
Reuse of single use devices (SUD)

Cost saving
Waste minimization

Infection
Endotoxic reactions
Toxic residues
Loss of device integrity
 Increased employee risks

Controversial but common practice

Collignon PJ, MJA, 1996 and 2003
Muscarella LF, Gastroenterol Nurs, 2001
Studies related to reuse

In favor
- Catheters → Bloom, 1997; Kozarek, 1996; Browne, 1997; Druce 2003
- Sphincterotomes, papillotomes → Cohen, 1997; Wilcox 1998
- Coagulation probes → Roach, 1999
- Spinal needles → Penna, 2000

Against
- Endoscope stopcocks → Wilson, 2000
- Biopsy forceps, papillotomes, stone baskets → Heeg, 2001; Hambrick, 2001
- Laparoscopic devices → Roth, 2002
Reuse-related infections

- Frequency is unknown
- May be undetected
  - Long incubation period,
  - Asymptomatic nature of blood-borne viral infections
- Difficulty to trace infections back to reused device
Reuse of catheters

Balloon catheters contaminated with viruses (echo- and adenovirus)

Culture and PCR

Detectable virus after cleaning + sterilization (glutaraldehyde)

Luijt DS, Eur Heart J, 2001
Reuse - Questions

- Which device is suitable for reuse? (instructions of the manufacturer, decision of a central body, etc)
- Is it cost effective?
- What are the risks? (quality assurance and research)
- What are the standards and regulations?
- Is the patient informed?
- Is there a validated cleaning / sterilization process and a guideline?
- Is there a standardised assessment process?
- Is there a tracking system for the outcome?
Prion

- Abnormal isoform of a host encoded pr
- Accumulation within the CNS
- Spongioform changes in the brain
- Dementia and death

- Lack of nucleic acid
- Resistant to currently used sterilization methods
- Transmission - cornea, human GH, dura mater grafts, neurosurgical instruments - electrodes
vCJD protein

- Present in lymphoid tissue starting from early (asymptomatic) stages of disease
  - Tonsil
  - Spleen
  - Lymph nodes
  - Appendix

- Incubation period: years
vCJD pr - Risk of transmission

**UNKNOWN**

- Number of infected people (prevalence)
- Quantity of prions that can cause cross-infection
- Infectivity of the tissues involved in procedures
- Amount of reduction of infective tissue with the decontamination / sterilization procedures

Possibility of cross-infection with surgical instruments contaminated with lymphoid, neural, ocular tissues
Lowering the risk of transmission

- Using disposables (may be only in UK)
  - Which procedures?
  - Are the disposables as effective as reusable equipment?
- Special decontamination – sterilization methods
  - How to decide when to use them?
- Separated equipment for diagnosed patients
  - Endoscopes
Method of sterilization for prion

Combinations of

- Immersion in NaOH or sodium hypochlorite (at different temperatures and durations)
- Autoclaving at 121°C (30 min – 1 hour) or ≥ 132°C

www.who.int/emc-documents, 2003

Type of operation, tissue involved, risk level of the patient

↓

Collaboration between the surgery team, infection control group, sterilization unit
Summary

- Sterilization units’ success has a leading role in the prevention of health-care associated infections.

- Problems

  - Sterilization of the complex surgery equipment and endoscopes
  - Reprocessing single use devices
  - Inactivating prions
Success of the sterilization unit

- Skilled personnel
  - Asepsis, cleaning, disinfection, sterilization
- Adequate space and equipment
- Standardized written protocols
- Quality control - assurance
- Continuous education
- Communication and collaboration between departments
CAUTION
THIS MACHINE
HAS NO BRAIN
USE YOUR OWN