معاونت درمان
دانشگاه علوم پزشکی تبریز

Nosocomial outbreaks

دکترضیاءالدین ساعی
بوردتخصصی بیماریهای عفونی
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خرداد۱۳۹۵

Content

- Nosocomial infections
- Health care setting
- Antimicrobial resistance
- Nosocomial outbreaks
  - History
  - Characteristics
  - Outbreak database
  - Detection, Investigation
- Summary

Nosocomial infection

…hospital-acquired infection, health-care associated infection…

- Infection acquired in the hospital due to exposure to the pathogen in the hospital
- Development of infection after 48 hours of hospital admission (CDC)

Burden of nosocomial infections

- Increased morbidity, mortality
  - 10% of in-patients acquire an infection in the hospital
- Increased costs
  - Prolonged hospital stay, additional medical procedures and treatment
- 30% preventable

Health care setting

- Devices: endoscope, catheter, ventilator..
- Medical procedures: surgery..
- Medical personnel: doctors, nurses..
- Patient: immunocompromised, susceptible
- Dangerous residents: MRSA, VRSA, VRE, ESBL*, *C. difficile* ribotype 027

*methicillin-/vancomycin-resistant *S.aureus*; vancomycin-resistant *Enterococcus*; extended spectrum beta-lactamases

Patients at risk

- Immunocompromised patient
  - Malignancy, immunosuppressive treatment, HIV infection
- Other factors
  - Severe underlying disease, age, obesity
- Intensive care units
  - Medical, surgical, neonatal, burn units

Antimicrobial resistance

1945 – Penicillin
1948 – Penicillin-resistant *S.aureus*
1959 – Methicillin
1961 – Methicillin-resistant *S.aureus*
1998 – Vancomycin-resistant *S.aureus*

- Use, overuse and wrong use of antibiotics
- Knowledge → Attitude → Behaviour

What can be worse than a nosocomial infection?

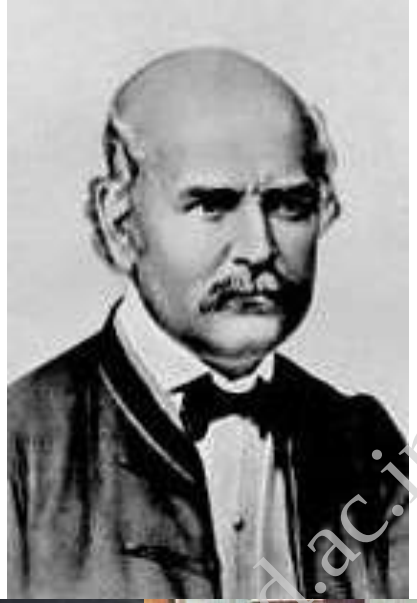
A Nosocomial Outbreak!!!

An unusual increase in the number of nosocomial infections (time, place, person)

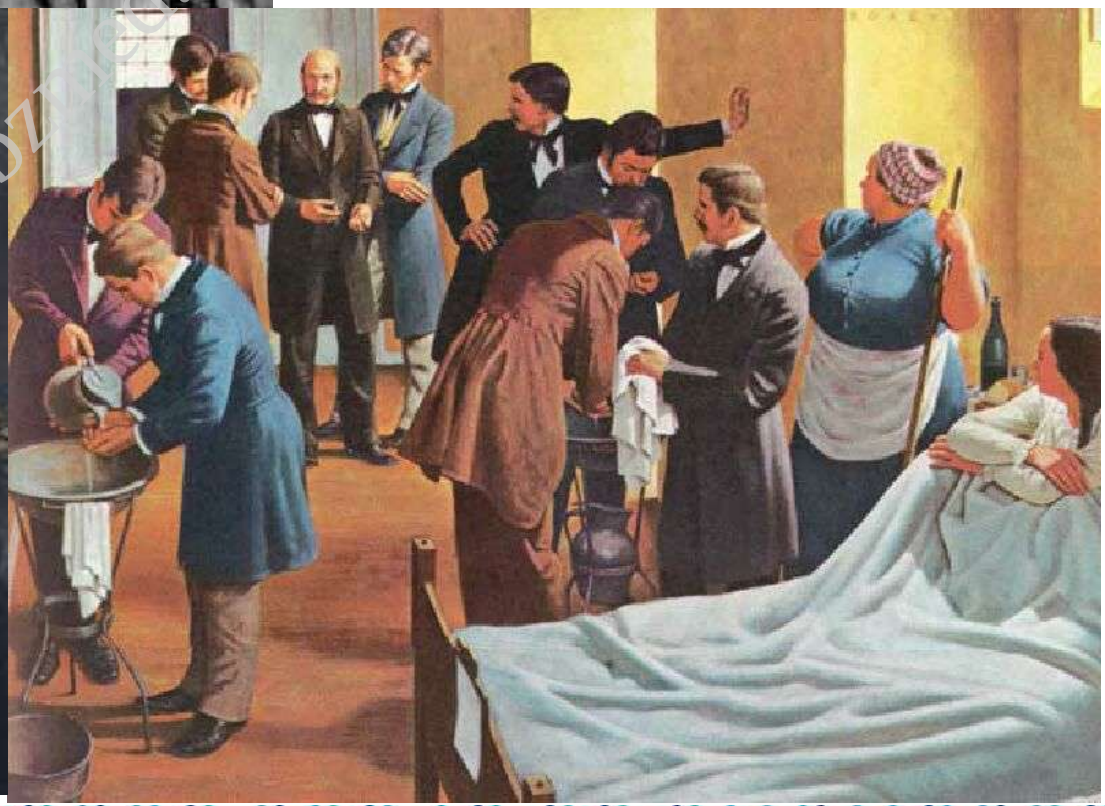
History of nosocomial outbreaks

- First well-documented outbreak
  - Puerperal (child-bed) fever in a hospital in Vienna, 1847
  - Ignác Semmelweis, Hungarian physician gathered and analysed mortality data
  - Autopsy room → Maternity wards
  - Handwashing intervention (chlorine solution)

- Modern epidemiology
  - *S. aureus* hospital outbreaks worldwide, 1950s
  - CDC projects from 1970s
  - Intensive research from 1990s



1847



2006

Nosocomial outbreaks - examples

- Unusual transmission
  - *ESBL Klebsiella pneunomiae*
  - Maternity wards, contaminated ultrasonography gel (France, 1993)
- Rare pathogen
  - *Malassezia pachydermatis*
  - Neonatal ICU, associated with colonization of health care workers' pet dogs (US, 1995)
- Emergence of more virulent strain
  - *C. difficile* ribotype 027
  - Increased severity of diarrhoea, recent outbreaks in US, Canada, Netherlands, England

Nosocomial outbreak database

- Database providing information to facilitate interventions
- A learning tool
  - What kind of data to collect? Control selection?
- Search by pathogen, ward type etc.
- Osaka University, Japan
- http://health-db.net/infection/top1.htm

Infection Outbreak Database

display by
- card(each paper)
- table

Search keyword

- [x] Pathogens: Vancomycin-R Enteroco. VRE
- [ ] Infection Sites: bacteremia
- [ ] Type of Investigation: case report
- [ ] Mode of Transmission: airborne
- [ ] Ward/Service: Bone Marrow Transplant

Search reset

No. of Hits =1/12

BACK NEXT

Details of this paper(with Results and Discution) | Print All the search results

Author:	Quale J, Landman D, Atwood E, Kreiswirth B, Willey BM, Ditore V, Zaman M, Patel K, Saurina G, Huang W, Oydna E, Burney S.
Title:	Experience with a hospital-wide outbreak of vancomycin-resistant enterococci
Journal:	Am-J-Infect-Control. 1996 Oct; 24(5): 372-9
year:	1996
Pathogen:	VRE, enterococci, vancomycin-resistant
Duration:	5 years
Dates:	1991-1994
Country:	U.S.A., New York City
No.of Beds:	
Hospital:	Veterans Affairs Medical Center at Brookly, tertiary-care, university-affiliated
Type of Investigation:	microbiological: retrospective review of microbiological record
Mode of Transmission:	contaminated environment?
Infection Sites:	respiratory culture (27), urine (63), wound (31), blood (26)

Characteristics of nosocomial outbreaks

- Location
- Type of infection
- Pathogens
- Source
- Mode of transmission
- Preventive/control measures

Gastmeier et al. How Outbreaks Can Contribute to Prevention of Nosocomial Infections: Analysis of 1022 Outbreaks. Infection Control and Hospital Epidemiology; 2005 26(4);357-361

Location

- Hospital – 83%
  - 50% in intensive care units
- Outpatient care – 12%
- Nursing home – 5%

Special problems:

- Hospital staff with part-time job in nursing homes (transmissing pathogens in both ways)
- Nursing home: no infection control personnel, underreporting of outbreaks, gastroenteritis, scabies

Type of infections

- Bloodstream – 37%
- Gastrointestinal* – 29%
- Pneumonia – 23%
- Urinary tract – 14%
- Surgical site – 12%
- Other lower respiratory – 10%
- Central nervous system – 8%
- Skin and soft tissue – 7%

*Probable underreporting

Most frequently reported pathogens*

Nosocomial infections

- *Staphylococcus aureus*
- Enterococci
- *E. coli*
- *Pseudomonas aeruginosa*
- Streptococci
- *Enterobacter* spp.

Nosocomial outbreaks

- *Staphylococcus aureus*
- *Pseudomonas aeruginosa*
- *Klebsiella pneumoniae*
- *Serratia marcescens*
- *Hepatitis B, C virus*
- *Legionella pneumophila*

*Probable underreporting: *Salmonella* spp., *Campylobacter* spp., norovirus, rotavirus, respiratory viral infections

Source of outbreak

- Patient – 26%
- Medical equipment / device – 12%
- Environment – 12%
- Medical personnel – 11%
- Contaminated drug – 4%
- Contaminated food – 3%
- Care equipment – 3%

- Unclear source – 37%

Mode of transmission

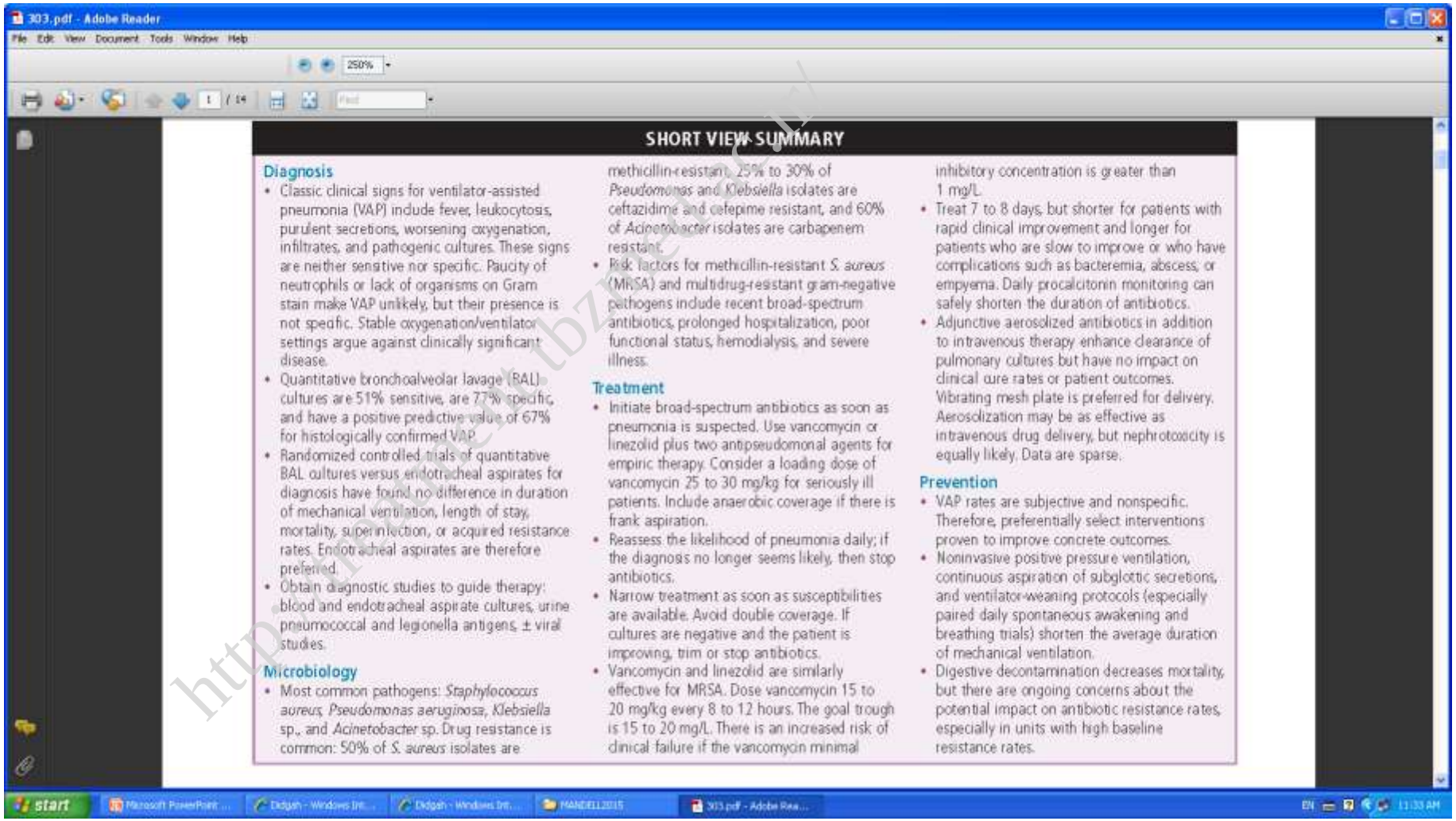
- Contact – 45%
- Invasive technique – 16%
- Inhalation – 15%
  (droplet, airborne)
- Ingestion – 4%

- Unclear mode of transmission – 28%

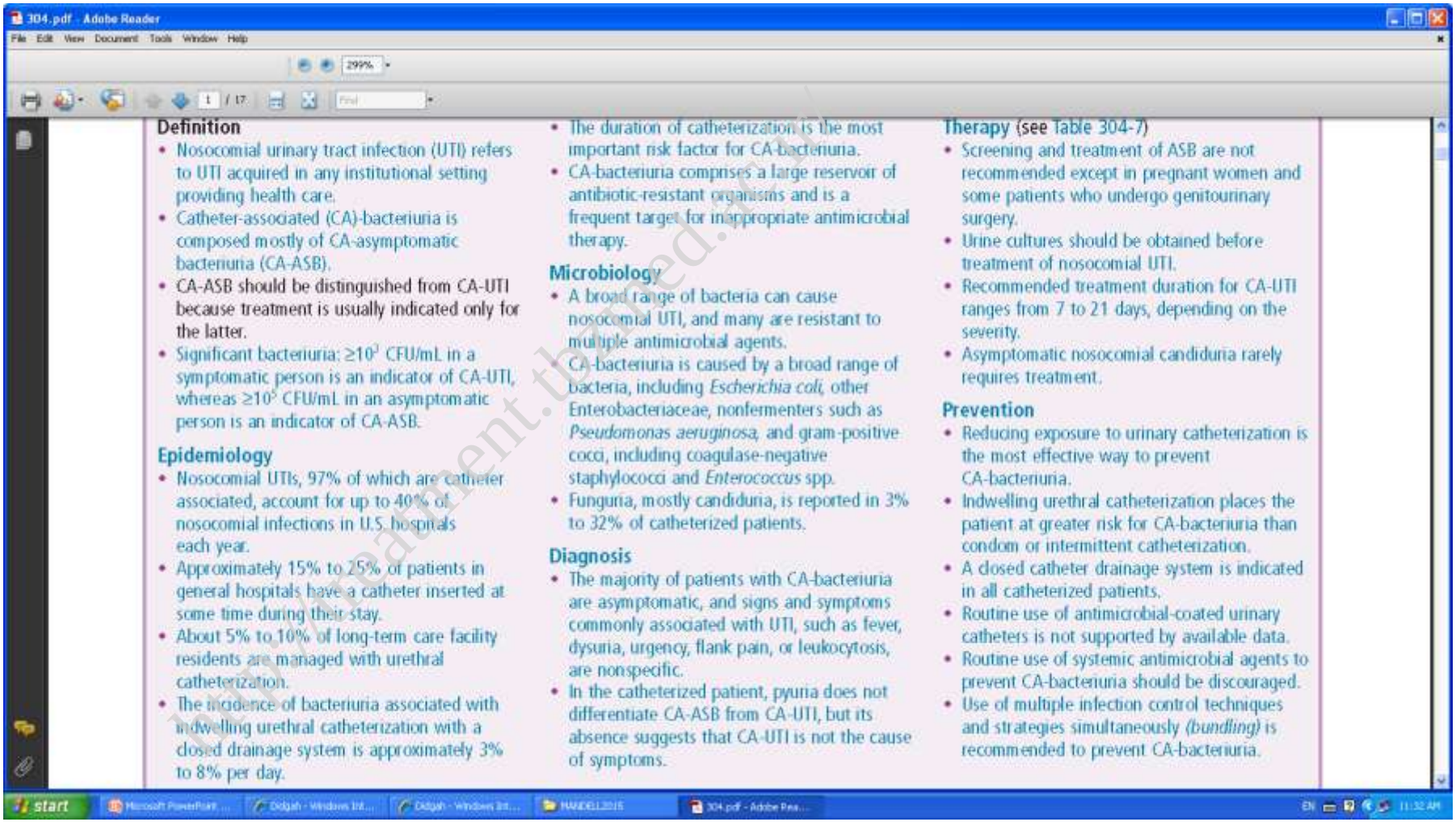
Managing hospital outbreaks

- Patient, health personnel screening, surveillance
- Isolation, cohorting
- Handwashing, hand disinfection
- Sterilisation, disinfection
- (Change) antibiotic therapy
- Modification of care / equipment
- Protective clothing
- Restriction of work load
- Vaccination

Nosocomial Pneumonia



Nosocomial UTI



Detection of nosocomial outbreaks

- Alert from an effective surveillance system
- Alert from – the physician
  - the nurse
  - the hospital microbiologist
  - the hospital epidemiologist

Nosocomial transmission?

- Similar cases at one department / among similar patients
- Cases associated with invasive device
- Health personnel and patients with same infection
- Nosocomial pathogen

Problems with detecting outbreaks

- No detection
  - 2-3 patients with pneumonia in intensive care unit
- Detection → No investigation
  - Nursing homes
- Detection → Investigation → No reporting
  - If sanctions against reporting doctors, nurses
- False detection: pseudo-epidemics (artefacts)
  - E.g. consequent laboratory contamination
  - May lead to unnecessary antibiotic treatment

Summary

- Detection
  - Effective surveillance system, vigilant hospital personnel
- Investigation
  - Skilled hospital infection control practicioner, epidemiologist, microbiologist
- Prevention / Control
  - Appropriate infection control practices
  - Strategies to prevent and control antimicrobial-resistent pathogens (antibiotic-plan)

The ultimate goal: patient safety