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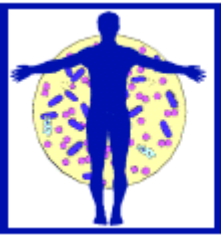

Société belge d'infectiologie et de microbiologie clinique

Belgische vereniging voor infectiologie en klinische microbiologie

Catheter-related infections: practical aspects in 2003

A joint meeting of the *Société Belge d'Infectiologie et de Microbiologie Clinique / Belgische Vereniging voor Infectiologie en Klinische Microbiologie* (21st meeting) and the *Groupement pour le Dépistage, l'Etude et la Prévention des Infections Hospitalières / Group ter Opsporing, Studie en Preventie van Infecties in de Ziekenhuizen*

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Clinical manifestations and impact of catheter-related infections

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Clinical manifestations of CRI

Definitions

- catheter colonization
- phlebitis (peripheral vein)
- exit site infection
- tunnel infection / port pocket infection
- catheter-related bloodstream infection
    - uncomplicated
    - complicated

Clin Infect Dis 2001; 32: 1249-1272.
MMWR 2002; 51 (RR-10): 1-29.

Clinical manifestations of CRI

Complicated CR-BSI

- severe sepsis / septic shock
- infective endocarditis
- septic thrombophlebitis
- metastatic seeding (muscle abscess; osteomyelitis; etc)

Clin Infect Dis 2001; 32: 1249-1272.
MMWR 2002; 51 (RR-10): 1-29.

Clinical manifestations of CRI

also specify

- type of catheter
- insertion site
- microbiological etiology

Clin Infect Dis 2001; 32: 1249-1272.
MMWR 2002; 51 (RR-10): 1-29.

Clinical manifestations of CRI

- Difficult to differentiate CR-BSI from primary bacteremia in surveillance programmes.
  - NNIS: 87 % of primary BSI are CR

    Crit Care Med 1999; 27: 887-892.
  - France: 26 % CR and 29 % primary non-CR BSI
    45 % secondary BSI

    AJRCCM 2001; 163: 1584-1590.
  - Geneva: 49 % primary BSI of which 35 % CR (17.4 %)

    Arch Surg 2002; 137: 1353-1359.

Clinical manifestations of CRI

- Unexplained sepsis with suspected CRI leading to catheter removal in ICU patients
  - only minority (8-15 %) are confirmed CRI
  - unnecessary catheter replacement increases risk of iatrogenic complications and costs

BJA. Rijnders et al. (submitted)

Impact of CRI: high risk patient

- high risk for CRI / CR-BSI (incidence)
  - type of catheter
  - insertion site
  - duration
  - intensity of usage
  - patient characteristics
- high risk for complications when CRI occurs (morbidity / mortality)
  - not clearly defined
  - clinical assumptions
  - microbiological assumptions

Incidence of CR-BSI (NNIS)

Type of ICU		mean/1000 CVC-days	
CCU		4.5	4.8
MICU		5.9	6.1
M/S ICU		5.3	5.6
Pediatric		-	7.9
NICU	< 1 kg	11.3	-
	1-1.5 kg	6.9	-

MMWR 2002; 51 (RR-10): 1-29.

MMWR 2000; 49 (8): 149-153.

Impact of CR-BSI

- increase in morbidity: proven
- increase in duration of hospitalisation: proven
- increase in costs: proven
- attributable mortality: still debated

Clin Infect Dis 2001; 32: 1249-1272.
MMWR 2002; 51 (RR-10): 1-29.

Impact of CR-BSI

- meta-analysis of 2573 CR-BSI
  - case fatality rate 14 %
  - 19 % of deaths directly attributed to CRI
  - attributable mortality of S. aureus CR-BSI (8.2 %) exceeded rates for other pathogens
  - attributable mortality of CNS CR-BSI (0.7 %) lower than that for other pathogens

Clin Infect Dis 2001; 32: 1249-1272.
MMWR 2002; 51 (RR-10): 1-29.

Impact of nosocomial BSI in SICU

- matched case-control study (n=86)
  - primary diagnosis for admission
  - age and sex
  - LOS prior to infection
  - number of discharge diagnoses
- crude mortality 50 % versus 15 % ($p < 0.01$): attributable mortality 35 % (CI: 25 % to 45 %)
- median LOS in ICU (survivors):
  - 15 days versus 7 days ($p < 0.01$)
- median LOS in hospital (survivors):
  - 54 days versus 30 days ($p < 0.01$)
- extra costs per survivor: 40 000 $

D. Pittet et al. JAMA 1994; 271: 1598-1601.

Impact of primary nosocomial BSI in MICU

- matched case-control study (n=34)

  predicted mortality on admission

  based upon APACHE II score (54 % - 53 %)

- crude mortality 82.4 % versus 52.9 % ($p < 0.02$)
  attributable mortality 28 %

R. Smith et al. Chest 1991; 100: 164-167.

Impact of primary nosocomial BSI in MICU

- retrospective matched cohort study (n=68)
  - predicted mortality on day –1 (APACHE III)
  - age and sex
  - LOS prior to day of matching
  - diagnostic group at admission
- crude ICU mortality: 35.3 % versus 30.9 %
  (RR 1.33 (CI: 0.56 – 3.16); p 0.51)
- mean LOS in ICU (survivors): 17.4 versus 7 days
  (p 0.007)
  mean LOS in hospital (survivors): 35.4 versus 30.3 days
  (p 0.02)
- extra costs per survivor: 34 500 $

B. Digiovine et al. Am J Respir Crit Care Med 1999; 160: 976-981.

Impact of CR-BSI in M/S ICU

- retrospective cohort study (n=49)
  - estimated mortality (24 %) at admission (APACHE II)
  - diagnostic category
  - age
  - LOS ≥ day of CR-BSI
- crude mortality in ICU: 18.4 % versus 28.6 % ($p > 0.20$)
- crude mortality in hospital: 22.4 % versus 34.7 ($p > 0.20$)
- excess LOS in hospital (survivors); 19.6 days (CI -1.1- 40.4)

J. Rello et al. Am J Respir Crit Care Med 2000; 162: 1027-1030.

Impact of primary and CR-BSI in ICU

- prospective cohort study (n=2201) to identify risk factors for bacteremia and death
- matched case-control study (n=96)
  - admission category
  - location prior to ICU
  - age
  - severity of underlying disease
  - severity of illness (SAPS II)
  - LOS in ICU ≥ day of BSI

B. Renaud et al. Am J Respir Crit Care Med 2001; 163: 1584-1590.

Impact of primary and CR-BSI in ICU

	CR-BSI (n=26)	primary BSI (n=28)	secondary BSI (n=42)	all BSI (n=96)
case mortality (%)	38.5	50.0	61.9	52.1
attributable mortality (%)	11.5	28.6	54.8	35.4
95 % CI	(-14 -37)	(6-52)	(36-74)	(23-48)
excess LOS (median days)	14	8	7	9.5

B. Renaud et al. Am J Respir Crit Care Med 2001; 163: 1584-1590.

Impact of primary and CR-BSI in ICU

- reprospective matched cohort study (1992-2000)
  - APACHE II at ICU admission
  - diagnostic category

	cases (n=156)	controls (n=312)	p-value
age (years)	52 ± 18	55 ± 18	0.05
APACHE II	21 ± 8	21 ± 8	0.9
Ac renal failure (%)	25	14	0.001
shock	72	62	0.03
Ac respir failure (%)	90	84	0.1
ventilator days	31 ± 23	17 ± 15	0.001
LOS in ICU	39 ± 31	21 ± 18	0.001
in-hospital mortality (%)	28.8	32.7	0.5

S. Blot et al. ICAAC 2003; K. 138.

Impact of CR-BSI: Conclusions

- important impact on LOS in ICU and hospital
- important increase in medical costs
- likely to cause attributable mortality, but still unproven.

CR-complications in ICU

- local infiltration (47 %) more frequent with peripheral catheters ($p < 0.001$)
- fever (16.5 %) and bacteremia (4.4 %) more frequent with central catheters
- CVC colonisation 24 % (32 per 1000 CVC days)
- risk factors for CVC colonisation
  - nutrition and pressure monitoring
  - jugular vein
  - duration
  - antiseptic and type of dressing

H. Richet. J Clin Microbiol 1990; 28: 2520-2525.

CR-complications in ICU

- randomized controlled study of femoral versus subclavian CVC
  - infectious complications
    (20 versus 3.7 per 1000 CVC days)
    (19.8 % versus 4.5 %)
  - clinical sepsis
    (4.5 versus 1.2 per 1000 CVC days)
    (4.4 % versus 1.5 %)
  - thrombosis (21.5 % versus 1.9 %)
  - similar rates of mechanical complications
    (17.3 % versus 18.8 %)

J. Merrer et al. JAMA 2001; 286: 700-707.

Nosocomial Infective Endocarditis

- 7 - 29 % of all IE cases in tertiary care hospitals; at least half of them due to infected IV devices.

N Engl J Med 2001; 345: 1318-1330.

- 9.3 % of all IE cases were hospital-acquired and not associated with cardiac surgery; all cases associated with hospital-based procedures
  - IV catheterisation (15 / 23)
  - instrumentation of UTI (7/23)
  - liver biopsy (1/23)

Clin Infect Dis 1995; 16-23.

IE following S. aureus bacteremia (n=103)

- 25 % had definite IE (TEE; Duke criteria) at 12 weeks follow-up
  but only 7 % had clinical evidence of IE
- 23 % of catheter-related S. aureus bacteremia had IE
- 65 % of IE cases was nosocomially acquired

V.G. Fowler et al. J Am Coll Cardiol 1997; 30: 1072-1078.

Suppurative thrombophlebitis

- more frequent with peripheral catheters and mainly local signs and symptoms
- incidence with CVC unknown and sepsis overshadows venous occlusion
- persistent bacteremia / fungemia after removal of CVC and institution of appropriate antimicrobial therapy requires active investigation for IE and STPh.

Clin Infect Dis 2001; 32: 1249-1272.

Bacteremia and severe sepsis in ICU

- prospective study of 85 750 admissions to adult wards and ICU in 24 hospitals
- incidence of bacteremia and bacteremic severe sepsis were 9.8 and 2.6 per 1000 admissions (8 and 32 times higher in ICU than in wards).
- severe sepsis occurred in 26 % of episodes (65 % in ICU) and septic shock in 15 % of episodes of bacteremia

C. Brun-Buisson et al. Am J Respir Crit Care Med 1996; 154: 617-624.

Bacteremia and severe sepsis in ICU

- category of micro-organisms was not an independent risk factor for severe sepsis during bacteremie
- risk of death after bacteremia was influenced by
  - age
  - fatal underlying disease
  - presence of severe sepsis or shock
  - source of infection (UTI lower risk)
  - infection with
    - E. coli (OR 0.5; $p < 0.001$)
    - CNS (not different from E. coli)
    - S. aureus (OR 1.5; $p=0.02$)
    - Candida spp or fungi (OR 2.1; p 0.09)

C. Brun-Buisson et al. Am J Respir Crit Care Med 1996; 154: 617-624.

In-hospital mortality rates of BSI in ICU patients

- Retrospective matched cohort studies (1992-2000)
  - APACHE II
  - diagnostic category
- Candidemia: 48 % versus 43 % (p 0.44)
- Pseudomonas aeruginosa: 62 % versus 47 % (p 0.07)
- Enterobacter spp: 34 % versus 39 % (p 0.54)
- AB resistant Gram-neg bacteria: 45 % versus 42 % (p 0.58)
- MSSA: 24 % versus 22 % (p 0.94)
- MRSA: 64 % versus 40 % (p 0.02)

S. Blot et al. Am J Med 2002 / J Hosp Infect 2003 / Chest 2003 / Clin Infect Dis 2002 / Arch Intern Med 2002.

Clinical manifestations of CRI: Conclusions (1)

- clear definitions needed to describe clinical manifestations and to develop appropriate management strategies
- CR and non-CR primary BSI often pooled in surveillance studies
- suspicion of CRI as source of unexplained sepsis in ICU patients often not confirmed

Impact of CRI: Conclusions (2)

- increase in morbidity proven
- increase in length of stay in ICU and hospital proven
- increase in hospital costs proven
- attributable mortality likely but still unproven
- impact of microbial etiology likely but still unproven
- incidence of complications or metastatic foci unknown