

Catheter-associated Bloodstream Infections

T.D.Chugh,
BLK Memorial Hospital,
New Delhi



Format

- Introduction
 - Epidemiology
 - Pathogenesis
 - Diagnosis
 - Prevention
 - Summary
-

Introduction

- IV devices essential for the care of critically-ill patients
- Upto 80% hospitalized patients get IV therapy
- India 1000BC, China 100BC
- IV 1832; plastic cath 1945; CA-BSI 1947

Complications

- Infections: 5-26%
 - Mechanical: 5-19%
 - Thrombosis: 2-26%
 - Overall: 15%
-

Infectious Complications

- Contamination: 16%
 - Colonization: 5-30%
 - Infection: exit site, tunnel, pocket, hub, BSI (CA, infusate)
-

Epidemiology

- CDC USA: >150m IVC/yr, >5m CVCs, 3-8% lead to BSI. ICUs: 5-8 per 1000 cath days
- 80,000 episodes/yr, each US\$ 28,000
- Attributable mortality 10-35% (OR 20.45, CI 95%)
- **50% infections preventable**
- 8 Developing Countries, 55 ICUs, 12.5 cases/1000 cath days (7.8 – 18.5)

MMWR, 2002
Ann. Int
Med, 2006
EID, 2007

Medical Audit

- 28% lines in ED unjustified
- 33% 'idle lines'
- Technic operator-dependent and long learning curve, 58% no formal training
- 36% no prior clinical or lab check
- 50% medical registrars & 33% medical SHO, no gowns

Pathogenesis

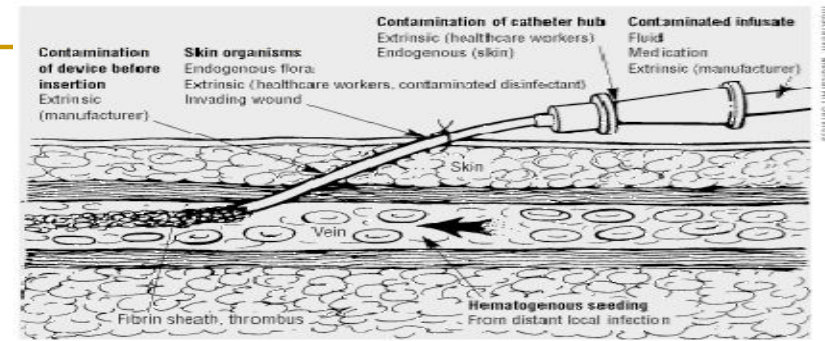


Figure 1. Sources of intravascular catheter-related infection. The chief sources are skin flora, contamination of the catheter hub, contamination of infusate, and hematogenous colonization from a distant site of infection.

Adapted, with permission, from Maki.¹

- Adherence: physicochemical process, thrombin sheath factor, tissue proteins
- Colonization, quantitative threshold, quorum sensing, biofilm, infection
- Non-tunneled, tunneled, extra/intraluminal
- Patients skin, hands of HC personnel, GNB, yeasts, translocation
- Type and density of flora

Definition

- It should be diagnosed **only when other sources of infection** have been excluded and cultures of catheter tip and bloodstream demonstrate significant number of identical organisms.
-

Diagnosis

- Clinical: suspicion, daily examination, unreliable
 - Laboratory:
 - Removal of IVD
 - Qual/semiquant/Quant culture of cath segment with BC
 - IVD in situ
 - Paired Quant BC, DTP, AOLC, endoluminal brush
-

Definite CRBSI:

- At least one peripheral positive blood culture with a positive semiquantitative (>15 cfu per catheter segment) catheter tip culture with the same organism and antibiogram
 - Positive hub or site culture growing an identical organism as the peripheral blood
 - Positive paired central and peripheral blood culture growing the same organism where the central blood culture is positive less than 2 hrs earlier than the peripheral blood culture (DTP) or has 5 times more growth of the peripheral blood culture
-

DTP

- QBC: gold standard
- Blot et al(1998)
- Volume, simultaneous, preincubation time (inoculum ratio)
- Sens 82%, spec 88%, PPV 75%, NPV 92%(QBC)
- Long term cath, prior AB therapy, AB coated cath

Meta-analysis of Diagnostic Studies

- Initial review 185, only 51 included
- Paired QBC (Q 0.89, CI 0.99), AOLC (Q 0.89, CI 0.91), cath segment quant culture (Q 0.87, CI 0.93) semi-quant culture cath segment (Q 0.84, CI 0.88)
- 10 studies of DTP analysed:
 - DTP performed well for long-term CVC (sens 0.85, sp 0.81)

DTP Studies

- Raad et al: S/S short-term cath was 0.81 and 0.92, long-term S/S 0.93 and 0.75 (Ann Int Med, 2004)
 - Rijnders et al: 60 bed, surg/med ICU. DTP “not useful in ICU”, High False +ve(CCM,2001)
 - Seifert et al: 49 episodes of BSI in 235 Ca. 18 CA-BSI, 31 with unknown portal of entry, DTP useful (JCM,2003)
-

Microbiology of CA-BSI

	Per cent of cath with	
Organism	Colonisation	BSI
CONS	54	16
<i>S aureus</i>	13	27
Enterococci	2	11
GNB	23	34
<i>Candida</i> spp	6	9

Prevention

- Full-barrier precautions
- Hand hygiene
- Skin preparation: 2% aqueous chlorhexidine gluconate
- Semipermeable clear adhesive dressings
- Daily assess need for cath, oral therapy
- Education-based interventions
- Empower nurses to correct physicians

IJCCM, 2003

Chugh, 2007

MMWR, 2002

Prevention:1

- Impregnated caths, dressings.
 - CSS/RM: 2-5 fold less, meta-analysis, cost-effective, AMR
 - EXT/Int surface
 - CRBSI > 2%
- Antimicrobial-anticoag flush solutions
 - Vanco + heparin
 - Minocycline + EDTA
- Ag impregnated collagen cuffs
- Cath hub with Iodine-alcohol
- Cath site: least subclav, most femoral, jugular
- Cath material: teflon and polyurethane
- In-line filters
- Systemic Ab prophylaxis

Management

- IDSA, ACCCM, Society for Healthcare Epidemiology of America, CDC
 - Evidence-based recommendations (CID, 2001)
 - Too many variables
-

Summary

- Baseline data, multicentric study
 - **How reliable is DTP ?**
 - Protocols, education modules for medics and paramedics, empower nurses
-



Thanks