

# Prevention of Peripheral Intravascular Device-Related Infections

Dr. Stephen McBride, Auckland, New Zealand  
A Webber Training Teleclass

## Prevention of Peripheral Intravascular Device-Related Infections

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## Background

- Devices allowing direct access to the vascular compartment have revolutionised modern medical practice
- Intravascular device use is widespread in hospitalised patients
- Infections associated with these devices carry significant associated morbidity, mortality and cost

## Outline

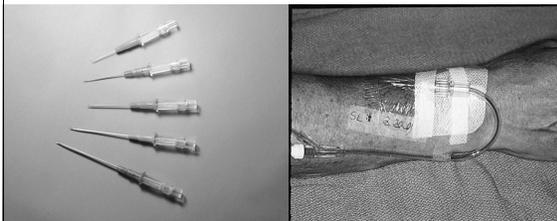
- Peripheral IV devices
- Infectious complications of peripheral IV devices
- Relative importance of peripheral IV device-related infections
- Review CDC guidelines
- Quality assurance strategies

## Definitions

- IVD = IntraVascular Device
- PIVC = Peripheral IntraVascular Catheter
- PICC = Peripherally Inserted Central Catheter
- CVC = Central Venous Catheter
- BSI = BloodStream Infection

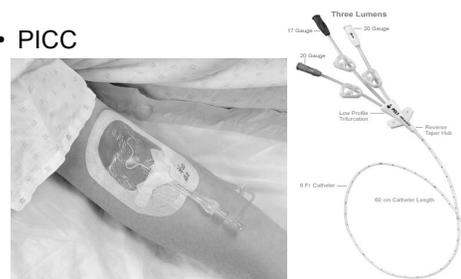
## PIVC types in common use

- Short PIVC



## PIVC types in common use

- PICC



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#### Infective complications of PIVC's

- Phlebitis
  - Common
  - Up to 26% of PIVC's depending on definition of phlebitis
  - Suppurative (infective) phlebitis affects 0.2 to 2% of PIVC's
    - Tagalakis et al, 2002
  - Literature on morbidity/mortality/cost of phlebitis almost non-existent!

#### Infective complications of PIVC's

- BSI
  - Uncommon but frequently severe
  - Literature demonstrates substantial morbidity, mortality and cost of IVD-related BSI
  - Much of the literature focuses on CVC-associated BSI's, less information on PIVC-associated BSI's

#### Infective complications of PIVC's

- Metastatic infection
  - Endocarditis
  - Osteoarticular infections
  - Infections at other sites

#### BSI rates for different device types

- Recent meta-analysis
  - Maki DG, Kluger DM, Cmich CJ. Mayo Clin Proc. 2006 Sep;81(9):1159-71.
  - Included prospective, English-language reports from 1966 to 2005
  - Reports pooled BSI rates from studies for different types of IVD

#### BSI rates for different device types

Device type	BSI/1000 catheter days
Plastic short PIVC	0.5
Inpatient PICC	2.1
Non-tunneled/cuffed CVC	2.7
CVC chlorhexidine/silver sulphadiazine coated	1.6
CVC minocycline/rifampicin impregnated	1.2

#### PIVC-related infections

- Relative importance depends on usage in your situation
  - Literature emphasises CVC-related infection
  - In our 2006 study (unpublished data) on adult medical wards, 98.8% of catheter-days were PIVC's, and 1.2% were CVC's
  - Using Maki *et al's* pooled mean BSI rates, *for our situation* PIVC-associated BSI would be expected to be >45x more common than CVC-associated BSI

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## PIVC-related infections

- Using data from the same study, 54.4% of patient days on internal medicine wards were associated with an IVD-day
- Our institution has ~900 beds
  - If all areas had similar rates of IVD prevalence, this equates to ~490 IVD days each day
  - We should expect approximately one IVD-related BSI per 4 days!
  - If 50% of these were preventable, we could prevent 45 IVD-related BSI's per year

## Preventing infection

- Many IVD-associated infections are preventable
  - Multiple studies have shown various interventions to result in significant reductions in IVD-related infections, particularly BSI

## Preventing infection

- Most recent CDC guidelines on preventing IVD-related infections published 2002
  - O'Grady et al. MMWR, 2002/51(RR10);1-26
- Suggests a number of evidence-based strategies to prevent IVD-related infections

## CDC guidelines

- Quality assurance
  - Quality assurance programmes
  - Use of standardised, adequate aseptic techniques for IVD insertion/maintenance
  - Experienced staff inserting and maintaining IVD's
  - Adequate staffing levels
  - Specialist "IV teams" monitoring IVD's

## CDC guidelines

- Insertion site
  - Lower infection rates in
    - Upper limb vs. lower limb
    - Hand veins vs. wrist / antecubital fossa
- Catheter material
  - Teflon or polyurethane better than PVC or polyethylene

## CDC guidelines

- Hand hygiene
  - Washing with either waterless alcohol solution or antibacterial soap
  - No touching of puncture site after cleaning
  - Gloves not required for infection control, but are required for universal precautions

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## CDC guidelines

- Skin antisepsis
  - Perform prior to puncture
  - Chlorhexidine superior to alcohol or iodine in CVC studies
- Catheter replacement
  - Guidelines suggest replacement at 72 hours but acknowledge little difference in infection rates at 96 hours

## CDC recommendations

- Education of healthcare workers
- Encouraging patients to report IVD-related symptoms
- Daily inspection / palpation of IVD site
- Hand hygiene (need not removed by gloves)
- Aseptic technique for insertion and use
- Sterile transparent or absorbent dressing over insertion site

## CDC recommendations

- Do not use antimicrobial ointments on insertion sites
- Do not submerge catheter under water
- Change dressing if wet/dirty/loose
- Aim for lowest infection risk in terms of site selection/catheter type/insertion technique
- Promptly remove unnecessary IVD's

## CDC recommendations

- Replace PIVC's every 72-96 hours
- Remove IVD's if phlebitis, infection or malfunction
- Use PICC if IV therapy will exceed 6 days
- Use upper limb sites in preference to lower limb
- Change lower limb PIVC's for upper limb as soon as possible

## Quality assurance

- Multiple different approaches found to be effective in the literature
  - Approaches to prevention of IVD-related infection need to be tailored to local situation
  - Requires adequate surveillance to ensure effectiveness

## Quality assurance

- The "IV team" approach
  - Soifer *et al* (Arch Intern Med, 1998)
  - Randomised, controlled trial of IV team management of IVD's vs. house staff management
  - Significantly lower rate of inflammation (7.9% vs. 21.7%,  $p < 0.001$ ) and significantly lower BSI rate (3 vs. 0,  $p = 0.004$ ) in patients cared for by IV team

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#### Quality assurance

- “IV team” strategy pros
  - Evidence-based
  - Benefit shown in reducing BSI as well as phlebitis
- “IV team” strategy cons
  - Resource intensive
  - Cost intensive

#### Quality assurance

- The “Staff education” approach
  - Multiple publications have shown that educational programmes can reduce IVD-related infections by half to 2/3
  - Collignon *et al* (Med J Aust, 2007) reported 8-year education programme
    - Rate of IVD-related BSI fell from 0.6/1000 patient days to 0.3/1000 patient day, and from 2.3/1000 discharges to 0.9/1000 discharges

#### Quality assurance

- “Staff education” approach pros
  - Evidence-based/effective
  - Lower cost than dedicated staffing for IV team
- “Staff education” approach cons
  - Requires ongoing education due to staff turnover/throughput
  - Efficacy decreased by staff fatigue

#### Quality assurance

- The “patient education/staff reminders” approach
  - Myself and colleagues became frustrated at PIVC’s being left in situ unnecessarily
  - Developed 2 low-cost interventions suited to local conditions
    - Educational pamphlet for patients
    - Reminder stickers for medical and nursing staff

#### Quality assurance

- Low cost – utilising existing materials and staff
- Developed criteria for IVD necessity
- Assessed numbers of IVD’s and number of unnecessary IVD’s daily over 14 days
  - Prior to interventions being carried out
  - During pilot introduction of interventions

#### Quality assurance

##### • Results

	Baseline	Intervention	p value
<b>Total patient days</b>	1148	1153	
<b>Total IVD days</b>	625 (54.4%)	506 (43.9%)	p=0.0032
<b>Necessary IVD days</b>	391 (34.1%)	361 (31.3%)	p=0.3137
<b>Unnecessary IVD days</b>	234 (20.4%)	145 (12.6%)	p<0.0001

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#### Quality assurance

- “Patient education and staff reminders” approach pros
  - Simple and low-cost
  - Effective in reducing unnecessary IVD days
- “Patient education and staff reminders” approach cons
  - May be less effective than other strategies
  - Staff adherence to interventions will fatigue
  - Data on hard outcomes lacking

#### Surveillance

- Quality assurance processes require appropriate outcome measures
- Surveillance is therefore vital
- BSI's viewed by many as critical indicators
- Results of surveillance should inform ongoing quality assurance processes and be fed back to practitioners inserting/caring for IVD's

#### Summary

- IVD-related infections are preventable
- The relative importance of PIVC and CVC-related infections depends on their relative utilisation
- Guidelines exist for prevention of IVD-related infection
- Locally appropriate quality assurance programmes and infection surveillance are of paramount importance

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