International Journal of Infection Control
www.ijic.info ISSN 1996-9783

EXTENDED ABSTRACT

Neurosurgical Surgical Site Infection: Rates and Prevention Strategies

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doi: 10.3396/ijic.V5i2.016.09

Infection rates and micro-organisms

Published reports of post operative central nervous system infection (PCNSI) rates range from 5% - 7%. These infections can manifest themselves as wound, meningitis, subdural empyema, bone-flap infection, and/or brain or epidural abscesses. They are often associated with significant morbidity, resulting in readmission and possible re-operation. Multiple factors can contribute to an increased risk for PCNSI, including male sex and cerebral spinal fluid leak.

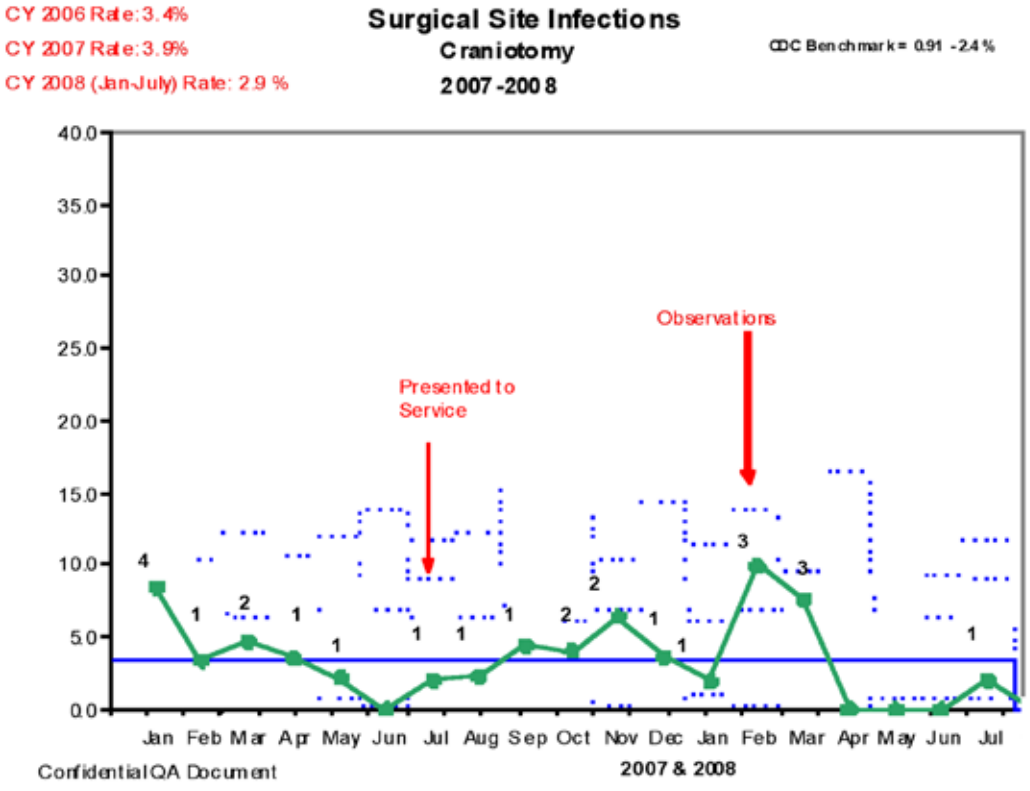

Figure 1. Surgical site infections at craniotomy

Surveillance to establish baseline PCNSI rates in institutions performing neurosurgical procedures is critical to an effective infection and control program. Surveillance of clean surgical procedures and additionally of clean implant procedures can serve as 'canaries in the coal mine' for deeper problems in an operating room. Some of the infection rates in neurosurgery recently seen at University of Michigan Hospitals and Health Centres are given here. Surgical Site Infection (SSI) Rates in Craniotomy at UMHHC are around 3% (Figure 1).

A recent case control study of Craniotomy infections (Sample size = 801 cases with 25 SSIs) revealed that SSIs correlated with the following risk factors:
Gender – Male (p=0.0730)
Certain OR room (p=0.0002)
Multiple craniotomy procedures (p<0.0001)

The micro-organisms found in the craniotomy wounds are shown in Figure 2. The majority (65%) were gram-positives.

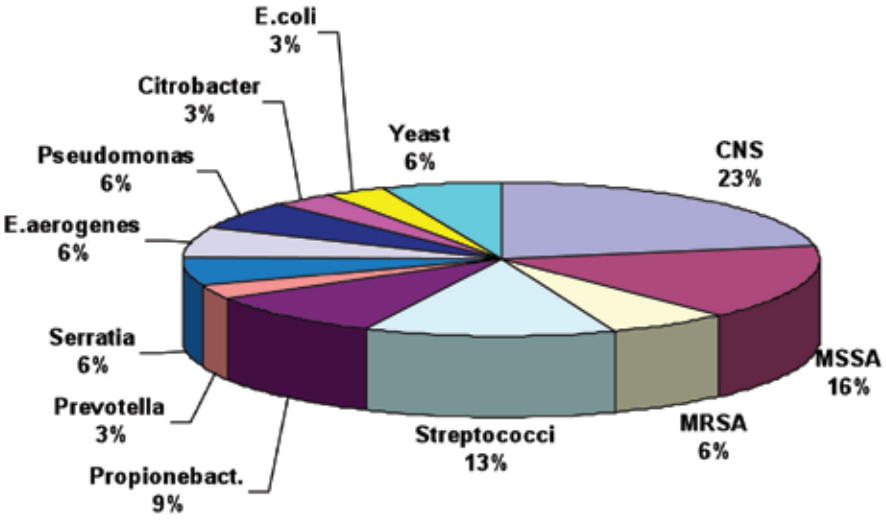

Figure 2. Micro-organisms in craniotomy SSI

Pediatric VP Shunt infection rates at UMHHC have varied from 2.3% to 6.6% (Figure 3).

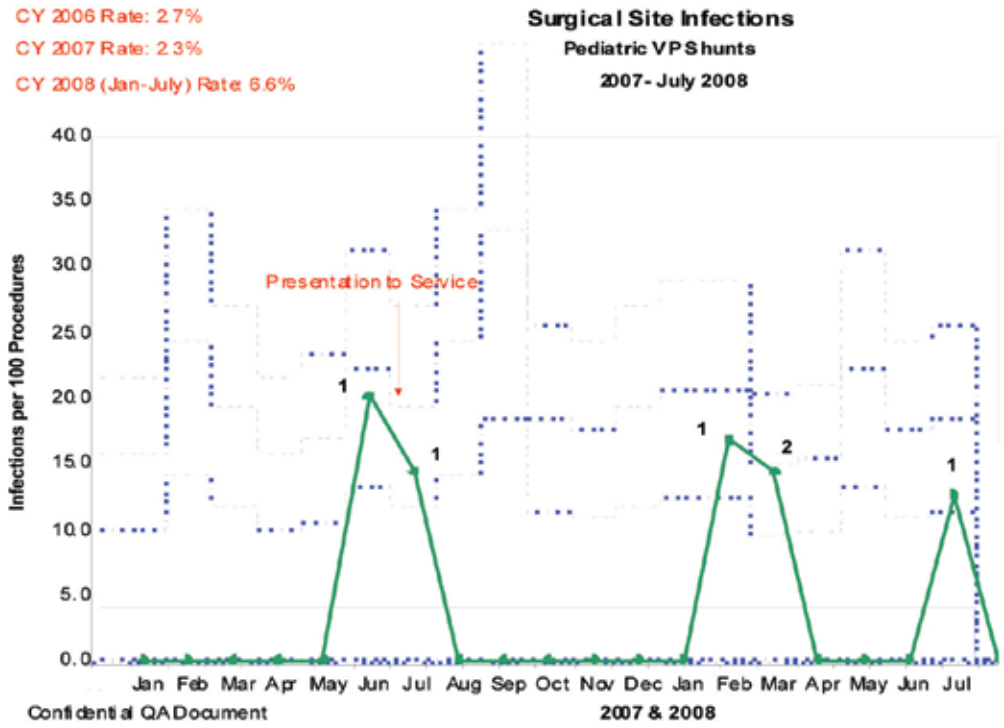

Figure 3. Paediatric VP shunt infection rates

Preventive strategies

There are multiple infection prevention and control strategies that can be adhered to that may directly or indirectly lessen the risk of PCNSI. Among these are the evidence-based infection control protocols. Some of the protocols used at UMHCC to prevent problem infections are given here. Most of the micro-organisms in the SSI originate from the patient's skin; therefore the protocols are mainly directed against those.

As seen above, the insertion of ventriculo-peritoneal shunts in children carries a high infection risk. Therefore, the following protocols have been developed at UMHHC.

The VP Shunt Infection Protocol:

- Sterile field opened close to incision time
- No visitors in the OR
- Restricted room traffic
- Staff requested not to take breaks
- All scrubs double gloved
- Shunt not primed with saline till needed
- Shunt wrapped in bacitracin soaked sponges and minimal handling

The Patient preparation Protocol for VP Shunts:

- Clip hair
- Wipe with alcohol
- Hibiclens (CHG) shampoo – 10 min.
- Rinse sterile water/blot
- Duraprep (3M betadine+IPA) if patient is older than 1 year
- Betadine paint if patient is younger than 1 year
- Ioban (betadine impregnated drape)

In addition, strict adherence should be paid to timing and dosing of appropriate prophylactic antibiotics, judicious hair removal at the operative site, and proper skin preparation of the operative site and draping of the site. Limiting traffic during the operation, properly reprocessed instruments, sterility awareness, and properly attired surgical staff are also components of an effective infection prevention strategy.

Another PCNSI to prevent is ventriculitis, after ventriculostomy drain insertion. Important factors are:

- Tunneled vs. non-tunneled
- Placed in the OR or bedside in the ICU

Risks of ventriculitis/meningitis cited in the literature range from 0 – 22%; most commonly cited about 10%. Important prevention strategies include:

- Maintain closed drainage system
- Minimize entry into system (pay close attention to technique for zeroing transducer and the technique and frequency for system/drainage bag changes)
- Minimize sampling and avoid irrigation
- Standardized training and education, with competency testing.

Conclusion

Successful OR infection control in neurosurgical cases, with reduction or prevention of PCNSI, can have significant rewards for the patient, the surgical team, and the institution. One of the key components to any surgical infection prevention strategy in the OR is that there is a multi-disciplinary approach and everyone is committed equally to the process improvement as a team.

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