

# Investigation and Prevention of *Pseudomonas aeruginosa* Surgical Site Infections Following Ventriculoperitoneal Shunt Placements in Pediatric Patients

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## BACKGROUND

- The Nebraska Healthcare Associated Infections and Antimicrobial Resistance (HA/AR) program was notified in October 2021 of two pediatric patients with cerebrospinal fluid (CSF) cultures positive for *Pseudomonas aeruginosa* (PA) after ventriculoperitoneal (VP) shunt placement.
- The HA/AR program contacted the healthcare facility where the procedures were performed to identify any additional cases.
- Epidemiologic and environmental investigations were undertaken to identify and mitigate potential sources.

A ventriculoperitoneal (VP) shunt is a cerebral shunt that drains excess cerebrospinal fluid (CSF) when there is an obstruction in the normal outflow or there is a decreased absorption of the fluid. Cerebral shunts are used to treat hydrocephalus. These shunts drain the CSF into the peritoneal cavity, the atrium, or the pleura; thus, appropriately called ventriculoperitoneal, ventriculoatrial, and ventriculopleural shunts.



Figure:1

*Pseudomonas aeruginosa* lives in the environment and can be spread to people in healthcare settings when they are exposed to water or soil that is contaminated with these germs (Figure:1)

## REFERENCES

- Centers for Disease Control and Prevention – National Healthcare Safety Network – Surgical Site Infection Events [https://www.cdc.gov/nhsn/pdfs/pscmanual/pscmanual\\_current.pdf](https://www.cdc.gov/nhsn/pdfs/pscmanual/pscmanual_current.pdf)

## DISCLOSURE

- The authors of this study have no relevant conflicts of interest to disclose related to the content of this poster.

## METHODS & RESULTS

Epidemiologic investigation revealed that water from this sink that tested positive for PA had been used to moisten chlorhexidine-gluconate-impregnated surgical hand antiseptics sponges for pre-operative bathing activities in the operating room (OR) prior to surgical skin antiseptics preparation.

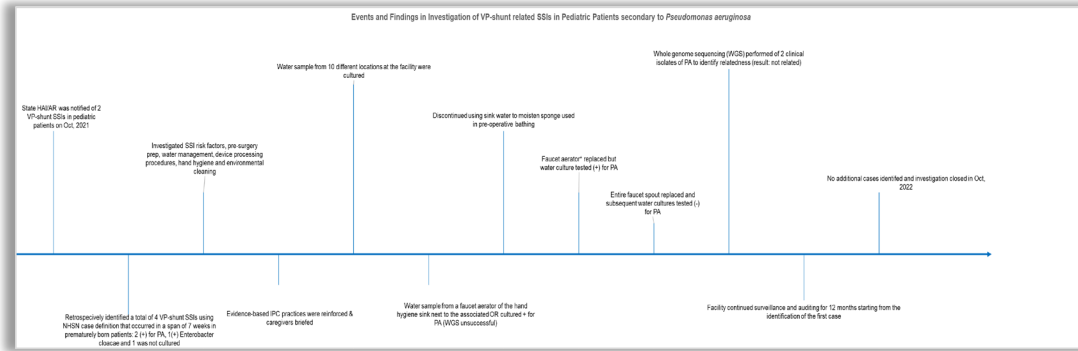


Figure:2

\*Aerator is a device placed at the end of the outlet to affect the stream of water and has the potential to serve as a reservoir for waterborne pathogens. Drops of water can be retained and buildup such as sediment or scale can support bacterial growth.

## CASE DEFINITION

The Centers for Disease Control and Prevention's National Healthcare Safety Network (CDC/NHSN) definition of healthcare-associated meningitis or ventriculitis includes at least **ONE** of the following criteria (CDC/NHSN Surveillance Definitions; January 2023) [424-425]:

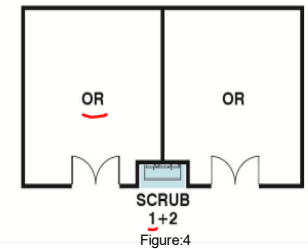
Criterion 1	Criterion 2 (Patient >1 year of age)	Criterion 3 (Patient ≤1 year of age)
Patient has organism(s) identified from cerebrospinal fluid (CSF) by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment for example, not Active Surveillance Culture/Testing (ASC/AST)	Has at least <b>two</b> of the following:  i. fever (>38.0°C) or headache ii. meningeal sign(s)* iii. cranial nerve sign(s)*	Has at least <b>two</b> of the following elements:  i. fever (>38.0°C), hypothermia (<36.0°C), apnea*, bradycardia*, or irritability* ii. meningeal signs* iii. cranial nerve signs*
<b>And at least one of the following:</b>		
a. increased white cells, elevated protein, and decreased glucose in CSF (per reporting laboratory's reference range). b. organism(s) seen on Gram stain of CSF. c. organism(s) identified from blood by a culture or non-culture based microbiologic testing method which is performed for purposes of clinical diagnosis or treatment, for example, not Active Surveillance Culture/Testing (ASC/AST). d. diagnostic single antibody titer (IgM) or 4-fold increase in paired sera (IgG) for organism		
* With no other recognized cause		

Figure:3

## DISCUSSION

A prompt and collaborative approach in addition to implementation of several evidence-based containment strategies based on prior similar HAIs were found to be effective in preventing additional cases. These strategies included but were not limited to:

- Hand hygiene compliance within and outside of the surgical suite
- Evaluation of environmental cleaning and disinfection practices within the surgical suite
- Review of nationally recognized SSI prevention guidelines and cross-referencing interventions with current practices and population served
- Water management practices
- Testing of water samples from the sink aerators in OR for PA
- Continued and increased surveillance and review of all SSIs
- Facility participation in an on-site infection control assessment and response (ICAR) visit using the standardized CDC ICAR tool for acute care hospitals to review any known deviations from standard practices
- Involvement of the facility leadership, physicians, cleaning staff and caregivers at all levels in the decision making about patient safe



Hand hygiene scrub sink (Figure:4) and aerator next to OR where cases were performed. Figure used with permission from the Facility Guidelines Institute ([www.fgiguideines.org](http://www.fgiguideines.org)).

## LIMITATIONS

- One limitation was the inability to compare the organism identified in the water to the organism identified in the clinical sample by whole genome sequencing to confirm water as the source of this outbreak.

## CONCLUSIONS

- Although no definite source was identified, this investigation suggests that pre-operative bathing with non-sterile water in the OR was likely associated with PA SSI cases.
- A multifaceted IPC intervention can be successful in preventing additional cases even when a confirmed source is not identified.