Use of an Intraoperative Checklist to Achieve High Reliability in the Reduction of Neurosurgical Shunt Infections

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Background

- Infection is a frequent complication of neurosurgical shunt procedures in pediatric patients and can lead to increased morbidity, mortality, and healthcare costs.
- The Department of Infection Prevention and Control (IPC) performs SSI surveillance and reports infection data to the National Healthcare Safety Network (NHSN) as an SSI rate (number of infections/100 procedures).
- In October 2014, an increase in baseline shunt SSI was observed.
- A multidisciplinary team comprised of Neurosurgery, Nursing, IPC, Anesthesia, Antimicrobial Stewardship and Performance Improvement was formed to more clearly define the problem.

Objective

- Use the CHOP Improvement Framework to create a sustainable solution to reduce shunt SSI rates.

Improvement Project

- Reviewed current infection rates, prevention practices in the operating room, and evidence-based best practices (SHEA compendium, Hydrocephalus Clinical Research Network Initiative, SPS Collaborative, AORN)
- Developed unique intraoperative paper checklist for use during shunt procedures to collect data on compliance with standardized infection prevention practices (Table 1).
  - Tested the checklist using a series of PDSA cycles.
    - Implemented January 2015.
    - Data from each cycle was used to refine all elements of the checklist and address any challenges or barriers to the data collection process.
    - Finalized July 2015 (also transitioned to Redcap).
- Additional intraoperative observations performed by IPC to monitor staff compliance with using the checklist and to identify other opportunities for improvement within the OR environment.
- Compliance with the checklist and neurosurgical shunt infection rates were monitored over time.

Table 2: Shunt SSI Rates per 100 procedures

Date	Numerator	Denominator	SSI Rate
Pre-checklist Implementation (July 2014-December 2014)	4	78	5.13
Checklist Implementation and Revisions Using PDSA Cycles (January 2015-July 2015)	3	122	2.46
Post-checklist Implementation (August 2015-August 2016)	1	244	0.41

Figure 1: Shunt SSI Control Chart

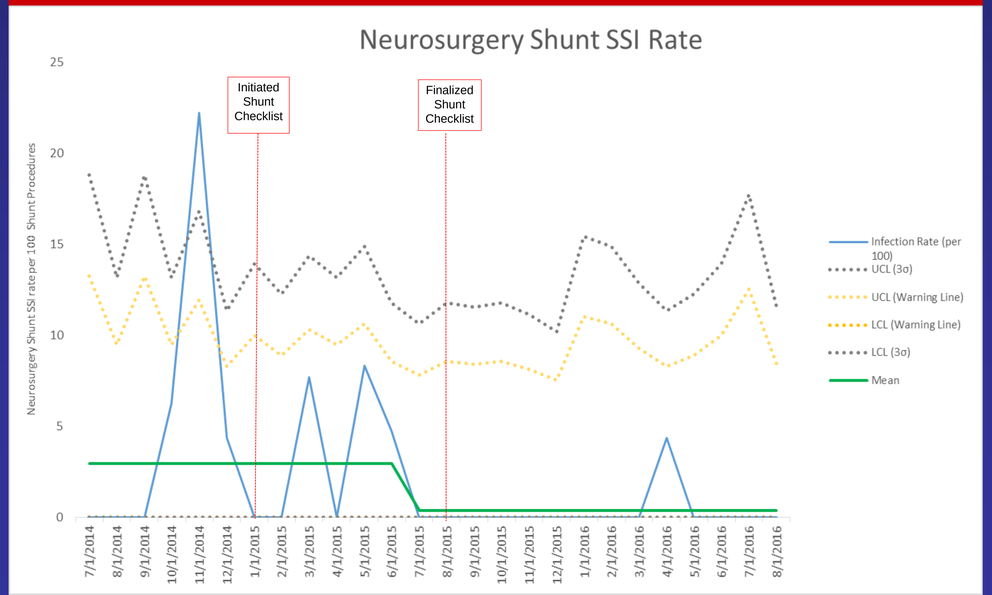

Table 1: Checklist Element Themes

Appropriate hair removal
Pre-operative skin preparation
Appropriate Operating Room attire • Clothing • Hair covering • Mask use • Staff personal belongings
Operating room traffic • Use of barrier signs • Entries and exits during procedures • Number of observers
Concerns about contamination of supplies or equipment
Use of proper infection prevention practices

Results

- We observed a significant decrease in shunt SSI rate following checklist implementation (p value=0.04) (Figure 1, Table 2).
- The checklist was fully adopted and spread to all neurosurgical procedures.

Conclusions

- Utilizing a multidisciplinary team approach to SSI prevention can lead to highly reliable practices.
- Implementation of a standardized checklist resulted in a sustained decrease in the number of neurosurgical shunt SSI from pre-checklist implementation to post-checklist implementation.