CLABSIs & BMT:
Challenges and Strategies for Prevention

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Session Objectives

- Describe current CLABSI definitions with attention to implications for patients undergoing blood and marrow transplant
- Evaluate clinical practice strategies to prevent CLABSIs
- Discuss quality improvement strategies to reduce CLABSIs

- "The very first requirement in a hospital is that it should do the sick no harm."
  - Florence Nightingale

The Cost of CLABSIs

- Significant source of morbidity and mortality
  - Incidence of CLABSIs among BMT patients as high as 7.4 /1000 catheter days
- Approximate cost: $7,000 - $29,000/infection
  - Annual cost up to $2.68 billion
- Pressure for public reporting of and pay for performance incentives
  - Centers for Medicare and Medicaid Services no longer reimbursing hospitals for care required to treat CLABSIs

CLABSI Definition

- A laboratory-confirmed bloodstream infection (LCBI) where a central line was in place for >2 calendar days on the date of event, with day of device placement being Day 1,
  and
- a central line was in place on the date of the event or the day before.
  - Source: http://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf

Defining Laboratory-Confirmed Bloodstream Infections (LCBIs)

- Criterion 1
  - Patient has a recognized pathogen cultured from one or more blood cultures ***and***
  - organism cultured from blood is not related to an infection at another site
- Criterion 2
  - Patient has at least one of the following signs or symptoms: fever (>38ºC), chills, or hypotension ***and***
  - organism cultured from blood is not related to an infection at another site ***and***
  - the same common commensal is cultured from two or more blood cultures drawn on separate occasions

Defining Laboratory-Confirmed Bloodstream Infections (LCBIs)

- Criterion 3
  - Patient ≤ 1 year of age has at least one of the following signs or symptoms: fever (>38°C core), hypothermia (<36°C core), apnea, or bradycardia ***and***
  - positive laboratory results are not related to an infection at another site

  and
  - the same common commensal is cultured from two or more blood cultures drawn on separate occasions

Audience Response Question

- A patient who is Day + 5 following an allogeneic hematopoietic stem cell transplant develops a fever to 38.1ºC. Blood cultures are obtained from both lumens of the double lumen tunneled catheter. One of the blood cultures becomes positive for *E. coli*.
- Does this represent a CLABSI?
- Yes
- No

Audience Response Question

- A patient who is Day + 5 following an allogeneic hematopoietic stem cell transplant develops a fever to 38.1ºC. Blood cultures are obtained from both lumens of the double lumen tunneled catheter. One of the blood cultures becomes positive for *E. coli*.
- Does this represent a CLABSI?
- Yes – Because *E. coli* is a recognized pathogen, this event represents a CLABSI.

Audience Response Question

- A patient who is Day + 5 following an allogeneic hematopoietic stem cell transplant develops a fever to 38.1ºC. Blood cultures are obtained from both lumens of the double lumen tunneled catheter. One of the blood cultures becomes positive for *Staphylococcus epidermidis*.
- Does this represent a CLABSI?
- Yes
- No

Audience Response Question

- A patient who is Day + 5 following an allogeneic hematopoietic stem cell transplant develops a fever to 38.1ºC. Blood cultures are obtained from both lumens of the double lumen tunneled catheter. One of the blood cultures becomes positive for *Staphylococcus epidermidis*.
- Does this represent a CLABSI?
- No – because *Staphylococcus epidermidis* is a common contaminant, it must be present in both cultures for the event to represent a CLABSI

Mucosal Barrier Injury Laboratory-Confirmed Bloodstream Infections (MBI-LCBI)

- First introduced in 2013
- *New to 2014*: required to indicate which of the underlying conditions of the MBI-LCBI criterion was met, if any
  - All CLABSI, whether LCBI or MBI-LCBI, must be reported if CLABSI is part of the institution's Monthly Reporting Plan.

Defining MBI-LCBI

- Criterion 1
  - Patient of any age meets criterion 1 for LCBI with at least one blood culture growing an MBI organism with *no other organisms isolated*
    - See: NHSN Organisms Lists (All Organisms, Top Organisms, Common Commensals, MBI Organisms, & Uropathogens) – accessible at http://www.cdc.gov/nhsn/acute-care-hospital/clabsi/index.html
  - ***and***

Defining MBI-LCBI

- One of the following is met:
  - Is an allogeneic hematopoietic stem cell transplant recipient within the past year with one of the following documented during same hospitalization as positive blood culture
    - Grade III or IV gastrointestinal graft-versus-host disease
    - ≥1 liter diarrhea in a 24-hour period (or ≥20 mL/kg in a 24-hour period for patients <18 years of age) with onset on or within 7 calendar days before the date the positive blood culture was collected
- **OR**

Defining MBI-LCBI

- Is neutropenic, defined as at least 2 separate days with values of absolute neutrophil count (ANC) or total white blood cell count (WBC) <500 cells/mm^3 within a seven-day time period which includes the date the positive blood culture was collected (Day 1), the 3 calendar days before *and* the 3 calendar days after

Example MBI Organisms

- *Bacteroides* spp., *Candida* spp., *Clostridium* spp., *Enterococcus* spp., *Fusobacterium* spp., *Peptostreptococcus* spp., *Prevotella* spp., *Veillonella* spp., or Enterobacteriaceae
  - Note: Refer to the current NHSN Organisms Lists (All Organisms, Top Organisms, Common Commensals, MBI Organisms, & Uropathogens)

Defining MBI-LCBI

- Criterion 2
  - Patient of any age meets criterion 2 for LCBI when the blood cultures are growing only viridans group streptococci with *no other organisms isolated*

  and one of the following
  - Allogeneic hematopoietic stem cell transplant criteria for MBI-LCBI criterion 1

  OR
  - Neutropenia criteria for MBI-LCBI criterion 1

Defining MBI-LCBI

- Criterion 3
  - Patient of any age meets criterion 3 for LCBI when the blood cultures are growing only viridans group streptococci with *no other organisms isolated*

  and one of the following
  - Allogeneic hematopoietic stem cell transplant criteria for MBI-LCBI criterion 1

  OR
  - Neutropenia criteria for MBI-LCBI criterion 1

Audience Response Question

- A patient who has an ANC of 0 and is Day + 5 following an allogeneic hematopoietic stem cell transplant develops a fever to 38.1ºC. Blood cultures are obtained from both lumens of the double lumen tunneled catheter. One of the blood cultures becomes positive for *Enterococcus faecalis*. The other blood culture is positive for *Pseudomonas aeruginosa.*
- Does this event meet MBI criteria?
- Yes
- No

Audience Response Question

- A patient who has an ANC of 0 and is Day + 5 following an allogeneic hematopoietic stem cell transplant develops a fever to 38.1ºC. Blood cultures are obtained from both lumens of the double lumen tunneled catheter. One of the blood cultures becomes positive for *Enterococcus faecalis*. The other blood culture is positive for *Pseudomonas aeruginosa.*
- Does this event meet MBI criteria?
- No – although the patient meets the neutropenia criterion and has one MBI organism present, *Pseudomonas aeruginosa* is not an MBI organism

Audience Response Question

- A patient who has an ANC of 0 and is Day + 5 following an allogeneic hematopoietic stem cell transplant develops a fever to 38.1ºC. Blood cultures are obtained from both lumens of the double lumen tunneled catheter. Both cultures are positive for viridans group *Streptococcus.*
- Does this event meet MBI criteria?
- Yes
- No

Audience Response Question

- A patient who has an ANC of 0 and is Day + 5 following an allogeneic hematopoietic stem cell transplant develops a fever to 38.1ºC. Blood cultures are obtained from both lumens of the double lumen tunneled catheter. Both cultures are positive for viridans group *Streptococcus.*
- Does this event meet MBI criteria?
- Yes – This event meets the neutropenia and organism criteria to be classified as an MBI event

Defining Single Positive Blood Culture (SPBC) Events

- A common commensal organism (e.g. coagulase-negative staphylococci [including *S. epidermidis*], viridans group streptococci) is cultured from a single blood culture with *no other organisms isolated*
  - Note: Refer to the current NHSN Organisms Lists (All Organisms, Top Organisms, Common Commensals, MBI Organisms, & Uropathogens)

Defining Secondary Bloodstream Infections

- LCBI related to an infection at another site
  - Blood and site-specific specimen cultures match for at least one organism in a patient suspected of having an infection
  - Blood and site-specific specimen cultures do not have to match if the site-specific culture is an element used to meet the infection site criterion and the blood isolate is also an element used to meet another criterion at the same infection site
    - Source: Appendix 1. Secondary Bloodstream Infection (BSI) Guide (not applicable to Ventilator-associated Events [VAE]) http://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf

Preventing CLABSIs

- "Let whoever is in charge keep this simple question in her head (not, how can I always do this right thing myself, but) how can I provide for this right thing to be always done?"
  - Florence Nightingale

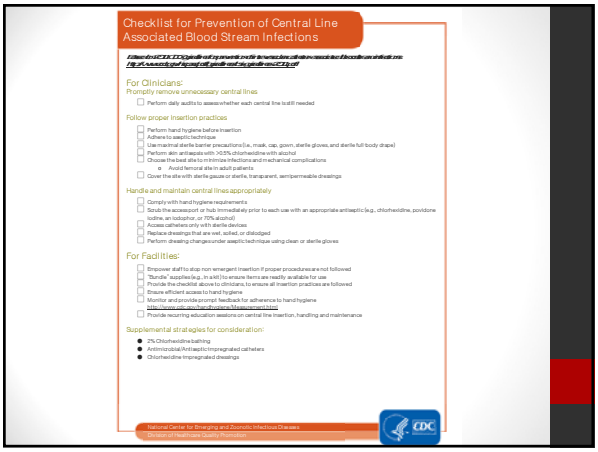
Organizational Obligations

- Empower staff to speak up if proper procedures are not being followed
- "Bundle" supplies (e.g., in a kit) to ensure items are readily available for use
- Ensure efficient access to hand hygiene
- Monitor and provide prompt feedback for adherence to hand hygiene http://www.cdc.gov/handhygiene/Measurement.html
- Provide recurring education sessions on central line insertion, handling and maintenance

CLABSI Prevention Strategies

- Bundles
  - Groups of evidence-based interventions that, when implemented together, result in better outcomes than when implemented individually
- Maintenance care bundles
  - Accessing the line
    - Hand hygiene
    - Scrub access port or hub prior to each access
  - Dressings
    - Change frequency based on dressing type
    - Change promptly if wet, soiled, or dislodged
    - Perform dressing changes under aseptic technique
  - Administration sets and connectors
    - Routine tubing replacement
    - Routine needleless connector replacement

O'Grady, et al. (2011). Guidelines for the prevention of intravascular catheter-related infections. Centers for Disease Control and Prevention. http://www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf


Checklist for Prevention of Central Line Associated Blood Stream Infections

For Clinicians:

Promptly remove unnecessary central lines

- Perform daily audits to assess whether each central line is still needed

Follow proper insertion practices

- Perform hand hygiene before insertion
- Adhere to aseptic technique
- Use maximal sterile barrier precautions (i.e., mask, cap, gown, sterile gloves, and sterile full body drape)
- Perform skin antisepsis with >0.5% chlorhexidine with alcohol
- Choose the best site to minimize infections and mechanical complications
  - Avoid femoral site in adult patients
- Cover the site with sterile gauze or sterile, transparent, semipermeable dressings

Handle and maintain central lines appropriately

- Comply with hand hygiene requirements
- Scrub the accessport or hub immediately prior to each use with an appropriate antiseptic (e.g., chlorhexidine, povidone iodine, an iodophor, or 70% alcohol)
- Access catheters only with sterile devices
- Replace dressings that are wet, soiled, or dislodged
- Perform dressing changes under aseptic technique using clean or sterile gloves

For Facilities:

- Empower staff to stop non emergent insertion if proper procedures are not followed
- "Bundle" supplies (e.g., in a kit) to ensure items are readily available for use
- Provide the checklist above to clinicians, to ensure all insertion practices are followed
- Ensure efficient access to hand hygiene
- Monitor and provide prompt feedback for adherence to hand hygiene http://www.cdc.gov/handhygiene/Measurement.html
- Provide recurring education sessions on central line insertion, handling and maintenance

Supplemental strategies for consideration:

- 2% Chlorhexidine bathing
- Antimicrobial/Antiseptic impregnated catheters
- Chlorhexidine impregnated dressings

National Center for Emerging and Zoonotic Infectious Diseases
Division of Healthcare Quality Promotion

CLABSI Prevention Strategies

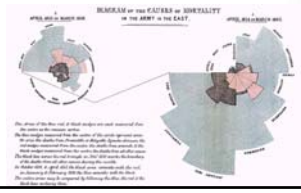
- Chlorhexidine bathing
  - Daily washing with disposable 2% CHG-impregnated washcloths
- Outcomes
  - Reduction in bacteremias involving coagulase-negative staph in critically ill adults and children (Climo et al., 2013; Milstone et al., 2013)
  - No reduction in bacteremias involving MBI organisms (Climo et al., 2013; Milstone et al., 2013)
  - Mixed findings regarding VRE colonization (Bass et al., 2013; Climo et al., 2009)
- Limitations
  - No well designed trials involving adult or pediatric BMT or oncology patients

CLABSI Prevention Strategies

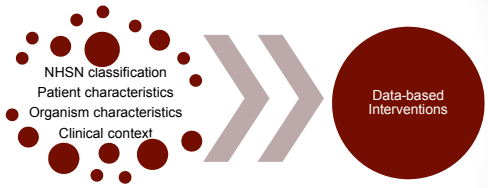
- Chlorhexidine dressings
  - CHG-impregnated sponge placed around the central line insertion site prior to placing the dressing
- Outcomes
  - No reduction in CLABSIs in trials involving critically ill children (Levy, 2005; Miller et al., 2011)
  - Mixed findings among critically ill adults (Arvaniti et al., 2012; Timsit et al., 2012)
- Limitations
  - No well-designed trials involving adult or pediatric BMT or oncology patients
  - No well-designed trials involving adult or pediatric patients with tunneled central venous catheters

Reviewing Data

- "To understand God's thoughts we must study statistics, for these are the measure of His purpose."
  - Florence Nightingale



Know (and Own) Your Data



Reviewing Evidence

Informing Practice

Risks for Bacteremia in BMT Patients

- Allogeneic vs. autologous transplant
- Donor type
- Myeloablative conditioning regimen
- Total body irradiation
- Prolonged neutropenia
- Underlying disease process
- Graft-versus-host disease
- Mucositis
- Immunosuppressive therapy
- Compromised skin integrity

Leading Sources of Bacteremia

Autologous Transplant

- Coagulase negative *Staphylococcus*
- *Enterococcus* species
- *Corynebacterium nos*

Allogeneic Transplant

- Coagulase negative *Staphylococcus*
- *Enterococcus* species
- *Pseudomonas* species

Source: Bock et al. (2013). Bacteremia in blood or marrow transplantation patients: Clinical risk factors for infection and emerging antibiotic resistance. *Biology of Blood and Marrow Transplantation, 19*, 102-108.

Leading Sources of Bacteremia

First 30 Days of Transplant

- Coagulase-negative *Staphylococcus*
- *Enterococcus* species
- α-hemolytic *Streptococci*
- *Escherichia coli*
- *Pseudomonas* species

31 to 100 Days Post-Transplant

- Coagulase-negative *Staphylococcus*
- *Enterococcus* species
- *Pseudomonas* species
- *Escherichia coli*

Source: Bock et al. (2013). Bacteremia in blood or marrow transplantation patients: Clinical risk factors for infection and emerging antibiotic resistance. *Biology of Blood and Marrow Transplantation, 19*, 102-108.

Use Data to Guide Practice

- Review individual cases on a regular basis
- Implement interventions that match identified problems
- Evaluate outcomes of interventions
- Revise and refine interventions

Patient Characteristics

- Length of hospitalization
- Immune function
- Skin integrity
- Presence of GVHD

Clinical Context

- Positive blood culture classification
- Type of organism
- Line type
- Adherence to standard of care

Reviewing Data

- Review all positive blood culture events
  - All positive blood cultures can be clinically significant regardless of classification
  - Focusing solely on CLABSIs can minimize the significance of non-CLABSI events
  - Eliminating non-CLABSI positive blood cultures can result in missed opportunities to:
    - Understand the root cause of these events
    - Identify interventions for improvement
- Review and report CLABSI rates with and without MBI cases included
- Review inpatient and ambulatory events

Keys to Improvement

- "To be "in charge" is certainly not only to carry out the proper measures yourself but to see that every one else does so too; to see that no one either willfully or ignorantly thwarts or prevents such measures. It is neither to do everything yourself nor to appoint a number of people to each duty, but to ensure that each does that duty to which he is appointed."
  - Florence Nightingale

Keys to Improvement

- "Structured, organization-wide approach to understanding and improving work processes"
  - Specific, measurable mission or goal statement
  - Multi-departmental/disciplinary involvement
  - Resource and educational materials
  - Reward/incentive programs
  - Internal and external stakeholders
  - Project champion
  - Feedback-based process and outcome measurement

Source: Compas et al. (2008). Best practices in implementing and sustaining quality of care: A review of the quality improvement literature. *Research in Gerontological Nursing, 1*, 209-216.

Keys to Improvement

- Leadership support
  - Ensure financial resources
  - Support project leaders with the training and time to commit to the project
  - Recognize and support the time needed to conduct a successful project
  - Reinforce expectations as needed as component of organization's commitment to safety

Source: Hughes, R. (2008). *Patient safety and quality: An evidence-based handbook for nurses.* Rockville, MD: Agency for Healthcare Research and Quality. Accessible online at http://www.ahrq.gov/QUAL/nurseshdbk/.

Keys to Improvement

- Effective teams
  - Identified leader and core team members
  - Assigned roles and responsibilities
  - Ensure input/feedback representing various perspectives
  - Team meetings used for specific objectives
  - Work accomplished outside of meetings
  - Clear communication
  - Accountability of team members

Proposing Interventions

- "It is often thought that medicine is the curative process. It is no such thing; medicine is the surgery of functions, as surgery proper is that of limbs and organs. Neither can do anything but remove obstructions; neither can cure; nature alone cures. … And ***what nursing has to do in either case, is to put the patient in the best condition for nature to act upon him***."
  - Florence Nightingale

Proposing Interventions

- Is the proposed intervention consistent with sound nursing practice or current best practice guidelines for BMT patients?
- Does the proposed intervention address the identified problem?
- Does the proposed intervention represent a departure from current institutional practice?
- What additional resources will be required to implement the proposed intervention?

- "The amount of relief and comfort experienced by the sick after the skin has been carefully washed and dried, is one of the commonest observations made at a sick bed."
  - Florence Nightingale

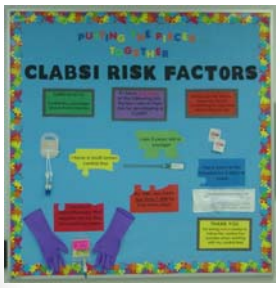
Data-Based Intervention

- Emphasis on supportive cares
  - 1-2-3 initiative
  - Skin care
  - Preventing constipation
- Outcomes
  - Inpatient CLABSI rates
    - 2012: 3.78/1,000 line days
    - 2013: 2.47/1,000 line days
  - 38% reduction in all inpatient positive blood culture events

Promoting Staff Engagement

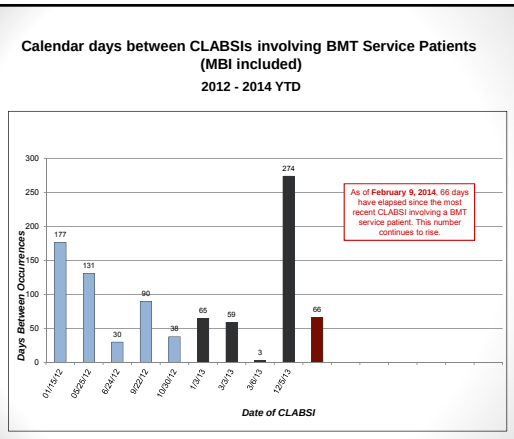
- Communicate on a regular basis
  - Facilitating questions and answers related to the project
- Interact with staff on an ongoing basis
  - Ensuring staff expectations and understanding related to the project
- Promote personal commitment to the project
  - Linking project outcomes to annual goals
  - Sharing personal success stories

Promoting Staff Engagement



Promoting Staff Engagement

- Presenting data related to the project
  - Present data in a consistent, meaningful manner
  - Provide resources for interpreting data
- Relating data to practice
  - Express in outcomes relevant to practice
  - Present in a manner that illustrates benefits to patients
  - Share lessons learned that can be applied to clinical practice



Areas for Ongoing Development

- CLABSI reporting
  - Consistency in application of NHSN CLABSI definitions (Gaur et al., 2013)
  - Documenting MBI-LCBI criteria
- Refining practice
  - Research evaluating interventions for CLABSI reduction in BMT settings
  - Institution-based quality improvement efforts
- Institutional commitment
  - Availability of resources
  - Facilitating implementation of best practice

Summary

- Applying MBI-LCBI criteria can help delineate the nature of bloodstream infections occurring in BMT and other immune compromised patients
- Understanding characteristics of CLABSIs occurring in BMT patients can inform strategies for reducing these infections
- Developing data-based quality improvement projects can engage staff and improve overall care, including reducing CLABSIs

In closing …

- "So never lose an opportunity of urging a practical beginning, however small, for it is wonderful how often in such matters the mustard-seed germinates and roots itself."
  - Florence Nightingale