Prevention and management of Central Line Associated Bloodstream Infections (CLABSI)

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What is an ideal bone marrow transplantation?

Conditioning
Bone marrow transplantation
Engraftment after two weeks
No complications
Lives happily ever after

Source: Wikimedia General Ludd
Life and BMT are not ideal

Patient has other diseases: diabetes, kidney failure, heart disease...
Complications of the underlying disease....
Complications of the treatment...
GvHD
Infections: bacterial, fungal and viral

What complications should we prevent?
What complications can we prevent?
What is the incidence of CLABSI?

„The incidence density was 24.3 CA-BSI episodes per 1,000 NDs in the first period and 16.2 in the second”

„31.5% developed CLABSI, of whom 69.6% died”

„definite central venous catheter infections was 5.31/1000 line days. Staphylococcus epidermidis was the most commonly identified organism”

„43.6% developed BSI, 68% were Gram-positive cocci”

„The pooled mean site-specific incidence density per 1000 neutropenic days was 14.0 for BSI”
Variations in CLABSI rates depend on local practices

When CLABSI rates per 1000 days of the three different ICUs were compared

ICU A 2.95  B 1.13  C 1.26
Adjustment
ICU A  -19%  B  -45%  C  0%\(^1\)

Adjusted for: number of samples taken, support from microbiologic lab for support of CNS positive cultures, exclusion of clinical criterions

If no BC from ALL lumens is obtained up to 25% true positive CLABSI can be missed\(^2\)

Conclusion: Rates of CLABSI between the centers may differ depending also on center practices and CLABSI definition
Knowing center’s CLABSI rate creates BENCHMARK for center

What rates of CLABSI does the published data show

<table>
<thead>
<tr>
<th>Device</th>
<th>No. of studies</th>
<th>No. of catheters</th>
<th>No. of IVD (d)</th>
<th>No. of BSIs</th>
<th>Rates of IVD-related bloodstream infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Venous Catheters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Per 100 devices</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pooled mean</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pooled mean</td>
</tr>
<tr>
<td>1,2 to 4,8 infections in 1000 IVD days</td>
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| Venous Ports | 0,1 infections in 1000 IVD days |

The number of CLABSI may depend on definition of CLABSI by center
What are the recommended practices in HSCT patients

- Recommendations regarding CLABSI in HSCT recipients
- High rate of infections if over 1 in 1000 days of catheter use
- Maximal sterile barrier precautions (AI)
The CVC infection prevention bundle consists of

- hand hygiene
- full barrier precautions
- cleaning the insertion site with chlorhexidine
- avoiding femoral sites for insertion
- removing unnecessary catheters
More guidelines for ICU CLABSIs prevention

Very comprehensive set of guidelines

However almost no data on neutropenic or HSCT patients

Hardly about Care/Nursing aspects
Why every CLABSI matters

![Graph showing survival rates after HSCT]

- Proportion surviving
- Months after HSCT
- No BSI
- BSI
Why every CLABSI matters

Any patient with Staphylococcus in at least one blood culture - reduction of 5-year OS by 17%

Every Staphylococcus epidermidis positive blood culture counts
Why every CLABSI matters

Sepsis vs No Sepsis

- Sepsis: 25% no aGvHD, 8% any aGvHD
- No Sepsis: 8% no aGvHD, 25% any aGvHD

Sepsis vs No Sepsis

- Sepsis: 11% no aGvHD, 3% grade III-IV aGvHD
- No Sepsis: 3% no aGvHD, 11% grade III-IV aGvHD
The analysis included 1981 ICU-months of data and 375,757 catheter-days. The median rate of catheter-related bloodstream infection per 1000 catheter-days decreased from 2.7 infections at baseline to 0 at 3 months after implementation of the study intervention (P≤0.002), and the mean rate per 1000 catheter-days decreased from 7.7 at baseline to 1.4 at 16 to 18 months of follow-up (P<0.002).
How to prevent CLABSI?

„The preferred approach is the CLABSI prevention bundle (AII)”

The CVC infection prevention bundle consists of
• hand hygiene
• full barrier precautions (AI)
• cleaning the insertion site with chlorhexidine
• avoiding femoral sites for insertion
• removing unnecessary catheters

This is mostly „insertion bundle“
### CLABSI prevention bundle in EBMT Centers AD 2012

<table>
<thead>
<tr>
<th>Description</th>
<th>SOP</th>
<th>Current practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>All recommended parameters of the CLABSI prevention bundle are included</td>
<td>28%</td>
<td>21%</td>
</tr>
<tr>
<td>at least 1 not included</td>
<td>72%</td>
<td>79%</td>
</tr>
<tr>
<td>at least 2 not included</td>
<td>38%</td>
<td>31%</td>
</tr>
<tr>
<td>at least 3 not included</td>
<td>19%</td>
<td>7%</td>
</tr>
<tr>
<td>at least 4 not included</td>
<td>8%</td>
<td>0%</td>
</tr>
<tr>
<td>All 5 not included</td>
<td>2%</td>
<td>0%</td>
</tr>
</tbody>
</table>
HSCT patients are not usual ICU patients

Most publications considering the CLABSI prevention are normal ICU based

Can the results be translated to better outcomes in HSCT setting?

HSCT patients differ from general ICU patients when we consider CVC use
Is there room for improvement?

Influence of implementation of guidelines on outcome of HSCT – unknown

Only 21% centers fulfilled the bundle

If one or two missing bundle parts are improved - 93% of centers can reach desired standards

Targeting zero CLABSI in HSCT – is it possible?
CLABSI rate monitoring
2010 - 18% of centers
2011 - 21% of centers.¹

Monitoring of CLABSI rate correlates with implementation of CLABSI prevention bundle for the years 2010 and 2011 – the centers with monitoring have more bundle components (2010: 32% vs 12%, p=0.037 and 2011: 36% vs 15%, p=0.028).¹

The monitoring of the CABSIs rates is an inevitable component of any ‘CVC bundle’
How to prevent CLABSI?

„Post insertion care bundle“ plays pivotal role in HSCT recipients

The use of post insertion care bundle was shown to reduce the risk of CLABSI in normal ICU setting:

„daily inspection of the insertion site; site care if the dressing was wet, soiled, or had not been changed for 7 days; documentation of ongoing need for the catheter; proper application of a chlorohexidine gluconate-impregnated sponge at the insertion site; performance of hand hygiene before handling the intravenous system; and application of an alcohol scrub to the infusion hub for 15 seconds before each entry."

Reduction of CLABSI incidence from 5,7 to 1,1 per 1000 of catheter days¹

Educate and control

88% or studied EBMT centers have education programs for CVC insertion and maintenance¹

1. Standardization of the procedure of dressing change
2. Introduction of training in areas of CVC care eg. dressing change and blood sampling in inpatient, outpatient and non-healthcare (home) settings
3. Monitoring of staff adherence with checklist ²

Decline in CLABSI from 10 to 3 per 1000 CVC days²

Prospective study in pediatric HSCT recipients

Sufficient number of nurses on the ward

The reduction of the number of nurses on the ward leads to an increase in the number of CLABSI.

>95% of planned personnel in service
<95% of planned personnel in service – 1.47 OR for increase of CLABSI rates

Study: Multicenter, prospective, neonatal care ICUs
Global Environmental Cleaning Algorithm

„The central line-associated bloodstream infection rate had a 72% reduction.” and reduction of other healthcare associated infections

Specific measures:

(1) cleaning personnel was retrained to clean very specific high-touch areas

(2) nursing and ancillary staff were trained how to fully clean patients on a daily basis with a skin antiseptic (active ingredient: 0.13% benzalkonium chloride)

(3) there was a re-emphasis on hand washing/sanitation as an integral part of infection control;

(4) all hospital employees involved in patient care went through a 1-hour educational meeting introducing the new infection control process with emphasis on the importance of cleaning all equipment including nursing stations, transport beds, monitors, and other common areas;
Global Environmental Cleaning Algorithm

„The central line-associated bloodstream infection rate had a 72% reduction.” and reduction of other healthcare associated infections

Specific measures:

(5) Isolation protocols were held to strict CDC guidelines including only certain specific infection types (e.g., active tuberculosis or actively draining culture-positive wounds) and not for history of disease only

(6) awake patients were involved in the infection control process by daily signing off on the room cleaning process EVS checklist to ensure compliance; and

(7) compliance was monitored on a systematic and periodic basis by the infection control department by

Limitations: One center retrospective study
The subclavian access is less likely to be a source of CLABSI in HSCT patients\(^1\)

7 – fold lower risk of CLABSI when subclavian access used\(^1\)

Metaanalysis of non HSCT patients shows no differences in CLABSI rates between jugular, subclavian and femoral CVCs\(^2\)

Together over 1700 central lines analyzed

What size of body drape should be used?

<table>
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<tr>
<th>Type of Drape</th>
<th>SOP</th>
<th>Current practice</th>
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<tr>
<td>full body drape (full coverage of bed of patient)</td>
<td>64%</td>
<td>35%</td>
</tr>
<tr>
<td>bigger than small drape (60x60) but not full body</td>
<td>48%</td>
<td></td>
</tr>
<tr>
<td>small drape (60x60 cm or smaller)</td>
<td>17%</td>
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Rational approach: drapes large enough to avoid a chance of contamination with bacteria the end of the guidewire during insertion of CVC with the Seldinger technique.
A formal checklist for CVC insertion was used in 41% of the centers - filled in by an assisting nurse (49%), by the operator (29%) or by an assisting physician (19%).

Checklist in the CVC insertion setting makes only sense if it is filled by a qualified nurse which is empowered to observe the procedure and intervene/stop in case of any violation of the procedure.

This creates culture of safety in which all involved regardles of position in clinical hierarchy can intervene in case of violation of the procedures.
Experience of the inserter

40% of studied EBMT centers had formal requirement for number of insertions before insterers were allowed to work without supervision.¹

It is hard to recommend any number as it is relevant that physician can perform CVC insertion according to the SOP of the center – and the number of supervised insertions to accomplish that goal might depend on earlier education.

Simulation-based learning prior to performing CVC insertions give substantial reductions in the incidence of CLABSI.²

Blood sampling from the „right” lumen of the CVC

Multilumen CVCs - cultures from each available lumen?

83% CLABSI orginated from lumen used for parenteral nutrition and blood products only

17% CLABSI orginated from every other lumen

Ideally sampling from all lumens should be performed to avoid failure in diagnostics

One center study in 44 neutropenic HSCT patients
Skin cleansing with chlorhexidine vs alcohol solution

66% of studied EBMT centers use chlorhexidine solution for skin disinfection prior to CVC insertion.¹

Support of chlorhexidine alone for preventing catheter colonization, but not for preventing bloodstream infection.²

A range of 29 to 43% of articles attributed outcomes solely to chlorhexidine when the combination with alcohol was in fact used.²

Unsubstantiated recommendations for chlorhexidine alone instead of chlorhexidine-alcohol were identified in several practice recommendations and evidence-based guidelines.²

Conclusions: Perceived efficacy of chlorhexidine is often in fact based on evidence for the efficacy of the chlorhexidine-alcohol combination. The role of alcohol has frequently been overlooked in evidence assessments.²

Impact of non-rinse skin cleansing with chlorhexidine gluconate-impregnated or saturated washcloths

Systematic review, limitation – non hematologic ICUs
Ethanol lock vs heparin lock
Taurolidine lock vs heparin lock

Reduction in CLABSI infection was **not achieved with prophylactic 70% ethanol locks** in patients with haematological malignancy and tunnelled CVCs.¹

Locking of long-term tunneled CVC with **taurolidine significantly reduces** catheter-related bloodstream infections in children with cancer (0.4 vs 1.4 CLABSI/1000 days)²

Prospective one center studies, hematologic wards
Conclusions

1. Monitoring of CLABSI rates is a starting point for change
2. 100% compliance with recommendations can usually be made by updating 1 or 2 steps in procedures
3. Most published 1 step changes bring 3 fold decrease in CLABSI rate
4. Publishing the data on HSCT recipients, CLABSI rates and interventions in HSCT setting is crucial for further development
5. What to change? - follow the guidelines and the evidence
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