Evaluation of the Relationship between Bloodstream Infections and Hemodialysis Catheters

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Capital Health Regional Medical Center

Bloodstream Infection Event
(Central Line-Associated Bloodstream Infection and non-central line-associated Bloodstream Infection)

Although there has been a 46% decrease in CLABSIs in hospitals across the U.S. from 2008-2013.

It is estimated 30,100 new central line-associated bloodstream infections (CLABSI) still occur in U.S. acute care facilities each year.

CLABSIs are serious infections typically causing a prolongation of hospital stay and increased cost and risk of mortality.

https://www.cdc.gov/nhsn/pdfs/pscmanual/4psc_clabscurrent.pdf
Catheters

- The presence of a central venous catheter appears to be a significant risk to acquiring a bloodstream infection (Patel & Kallen, 2013).

- Data reported from both the CDC and NHSN indicate that the risk is nine times higher in patients with catheters than those with fistulas and five times higher than those with AV Grafts (Klevens, et al., 2008).
• Preventing CVC and other vascular related blood stream infections in hemodialysis patients has been identified as a priority by the US Department of Health and Human Services (Patel, et al, 2013).

• As a result NHSN Bloodstream infection rates will be added as a reporting measure in the Pay for Performance by CMS in 2014 and in 2016 will be a clinical measure.

• In 2012 our renal network asked those units with the highest bloodstream infection rates to participate in a program.

CUSP
Comprehensive Unit-Based Safety Program was developed and launched.

Program Goals:
1. Lower the number of positive blood cultures.
2. Reduce the number of catheters in use
   • Since catheters are reported to be linked to increased risk of infection and increased morbidity and mortality

• Our unit was included in this group because of our high catheter rates as well as a high number of positive blood cultures.
Pre CUSP Data
All + Blood Cultures vs. Infections of Dialysis Access

Our All Positive Blood Culture Rate averaged 2.42 (Goal 1.27)
Our Access Related Positive Blood Culture Rate averaged 1.39 (Goal 0.88)

1.27 CMS Average All Positive Blood Cultures
0.88 CMS Average Access Related Infections

CMS Goals for Vascular Access:
Prevalent rate for AVF 65%
The number of patients with Catheters >90 days should be <10%

Pre CUSP data Showed
• AVF rate was 46%
• Catheter rate was 37%
• 34% of those catheters in for more than 90 Days

2014 Dialysis Facility Report
CMS Survey FY 2015
Targeting Our Actions

When starting this project it was important to have a good understanding of exactly what issues we needed to address. For purposes of this presentation I will divide our activities into two categories: Infection control risks and vascular access related issues. In this presentation I will describe some of these findings along with our plans to address them.

Evaluation of Infection Risks

- Review of all blood culture reports
- General Demographics and comorbidities
- Healthcare Associated Infections (HAI)
  - Nursing Home Residence
  - Hospitalizations
- Socioeconomic Status
- Nursing Care/practice
- Antibiotic Stewardship
Dialysis Facility Report

• Surveillance data collected at the facility level provides information to quickly identify problems and target actions (Kleven et al., 2015).

• While participating in the CUSP we continually compared the data from our unit to that provided by CMS, the renal network and NHSN.

• We used this data both as a benchmark and a way to identify areas to focus on.

Finding/Plan

• Careful evaluation of all positive blood cultures was done.
  – Determination of potential cause
  – Evaluation for appropriate treatment
  – Assurance of accurate reporting in NHSN data base
**Capital Health Regional Medical Center Renal Dialysis**

Located in the City of Trenton
Opened in 1970

Chronic Out-Patient census 140-160 patients

Total Number Treatments done yearly
   Acute 3,000+
   Chronic 20,000+

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**All Patients - Demographics**

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>State</th>
<th>Region</th>
<th>Nation</th>
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<tbody>
<tr>
<td>Age/yrs</td>
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<td>63.7</td>
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<td>41.5</td>
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<td>3.8</td>
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<td>Hispanic</td>
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<td>12.4</td>
<td>37.7</td>
<td>16.6</td>
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2013 Dialysis Facility Report
### All Cause ESRD

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<tr>
<td>Diabetes</td>
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<td>42.1</td>
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<td>Hypertension</td>
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<td>16.2</td>
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<td>11.7</td>
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<tr>
<td>Other/Unknown</td>
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<td>13.8</td>
<td>13.1</td>
<td>14.3</td>
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<tr>
<td>Missing</td>
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<td>1.1</td>
<td>1</td>
<td>1.9</td>
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2013 Dialysis Facility Report

### New Patient Characteristics

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<thead>
<tr>
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<th>2012</th>
<th>State</th>
<th>Region</th>
<th>Nation</th>
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<tr>
<td>CHF</td>
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<td>25.9</td>
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<td>23</td>
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<td>35.0</td>
<td>42.4</td>
<td>39.3</td>
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2013 Dialysis Facility Report
### New Patient Characteristics

<table>
<thead>
<tr>
<th>Comorbidities</th>
<th>2011</th>
<th>2012</th>
<th>State</th>
<th>Region</th>
<th>Nation</th>
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<td>10.2</td>
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<td>9.6</td>
<td>8.0</td>
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<td>ETOH</td>
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<td>1.9</td>
<td>1.8</td>
<td>1.6</td>
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<td>Drug Dependence</td>
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<td>3.7</td>
<td>1.1</td>
<td>1.2</td>
<td>1.1</td>
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<tr>
<td>Inability to Ambulate</td>
<td>19</td>
<td>3.7</td>
<td>9.5</td>
<td>10.5</td>
<td>7.1</td>
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</table>

2013 Dialysis Facility Report

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### Healthcare Associated Infections (HAI)

- Nationally **14% of all** dialysis patients live in Nursing Homes.  
  (Emerging Issues, 2010)
- On the average **all dialysis patients spend 13.3 days/year** in the hospital.  
  (CDC HAI factsheet)
- This increased exposure to potential Healthcare Acquired Infections (HAI) increases the risk of antibiotic resistant organisms and complicates effective treatment.
Healthcare Associated Infections (HAI)

- Chronic hemodialysis patients are vulnerable to infections for many reasons. Being immunosuppressed and requiring access to their blood stream three times a week puts them at high risk (Kleven, Tokars & Andrus, 2005).
- Other risk factors associated with increased risk are poor hygiene, having another infection, iron overload, being older, and having diabetes (Lincoln, 2011).

CMS Data: Percentage of Nursing Home Patients doubled in 2013 remaining twice the National average

<table>
<thead>
<tr>
<th>State</th>
<th>Region</th>
<th>US</th>
</tr>
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<tbody>
<tr>
<td>13.7</td>
<td>11.2</td>
<td>7.7</td>
</tr>
<tr>
<td>32.7</td>
<td>22.7</td>
<td>15.9</td>
</tr>
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</table>

2014 Dialysis Facility Report
CMS Survey FY 2015
CMS Data: Altered Mobility Status

Mobility Status is a strong predictor of morbidity and mortality

Inability to Ambulate

2014 Dialysis Facility Report
CMS Survey FY 2015

CMS Data: Diagnosis Associated with Hospitalization

18.3% of our admissions were related to Septicemia in 2013
Compared to 12.5% for the State and 11% for the US

2014 Dialysis Facility Report
CMS Survey FY 2015
CMS Data: Causes for Infection

- **Access related Infection** rates remain higher than state and essentially equal to regional and US rates.
- **Hepatitis B** rates higher than regional and state levels put equal to US rates.
- **Hepatitis Other** rates lower than region, state and US.
- **Metastatic** (local infection that preceded bacteremia or fungemia) rates are higher than region, state and US.
- **Pneumonia** rates are higher than region, state and US.
- **Tuberculosis** rate are lower than region, state and US.
- **Other Infections** were similar to region and state but higher than US levels.

Our Findings/Plan

- In reviewing data provided by our renal network quarterly, it become obvious that most of our positive blood cultures were not related to access infections.
- Many of these positive blood cultures were associated with pneumonia, open wounds, and other problems associated with aging and medically complex patients.
Socio-economic Issues:
Access to health care is associated with improved outcomes

• In 2012

**44.4% patients**
that started dialysis had no insurance  
(Compared to 8.2% State, 5.7% Network, and 7.0% for the Nation)

• As of 12/31/13

**13% patients remain uninsured**

2013 Dialysis Facility Report

Our Findings/Plan

• The high acuity of our patients is demonstrated by the fact that 30% live in Nursing Homes, this is more than twice the national average.

• Besides being generally debilitated, many have tracheotomies, peg tubes and open wounds, predisposing them to acquiring nosocomial infections.

• To address this issue
  – we continually work to create better working relationships with the Nursing Homes.
  – Wound care consults, medication reconciliation, and dietary consultations are all coordinated.
  – We are also involved in assisting with palliative and hospice care when indicated.
Our Findings/Plan

• Ultimately effective use of antibiotics is a key to reducing positive blood cultures.
  – It is essential that patients receive a complete cycle of antibiotics when warranted.
  – Careful evaluation of drug levels and length of treatment are regularly assessed for patients receiving antibiotics.
  – Ongoing collaboration with the hospital pharmacists assures dosage adjustments needed to achieve therapeutic levels.
  – Since many of our patients are transferred between various providers of care it remains an important aspect of care.

Our Findings/Plan

• On the average 13% of our patients are uninsured.
• We have focused on
  – creating working relationships with the various clinics, primary care physicians and vascular surgeons needed to facilitate care for this generally underserved population.
  – We are hoping that by addressing the needs of our patients more globally we will have some impact on infections acquired by these two populations.
Our Findings/Plan

- NHSN criteria counts all positive blood cultures, this includes contaminated specimens.
- In reviewing each blood culture results we became aware that some of the contaminated positive cultures were drawn in other units and facilities. We could have no impact on these.
- So we focused on
  - reducing the number of contaminated specimens drawn in our institution.
  - Our hospital infection control team reviewed policies with all hospital staff.
- Overall the impact was minimal but it was worthwhile to consider.

Understanding the NHSN Data

All Positive Blood Cultures (includes contaminations)

All Blood Stream Infections are being counted by CMS

Only Positive Blood Cultures Related to Dialysis Access

Our ID Data was reporting dialysis access only

Misdiagnosed catheter related blood stream infections can result in premature removal of vascular access which impacts future options for new access creation (Kallen, 2013)
Our Findings/Plan

- Due to the complexity of our patient population it became obvious that it was beyond our scope to fix all of the possible causes of positive blood cultures.
- We refocused our efforts towards the reduction of access related infections, feeling that this was an area that we could have a direct impact on outcomes.

Our Findings/Plan

- **Catheter Care Practice**: The literature often cites a relationship between catheter care and infection rates

- Utilizing current CDC recommendations we reviewed our policies and re-evaluated our practice using peer evaluations.
  - We have been using chlorhexadine on our catheters since 1982
  - Our staff has been following Scrub the Hub practice for quite a while
  - Our staff are required to complete yearly competencies on access care.

- Finding no issues we determined that there was no need to change our nursing practice.
  - One thing to highlight here is the makeup of our staff. It is made up of RN’s (Registered Nurses), LPN’s (Licensed Practical Nurses) and only one PCT (Certified Patient Care Technician). This staffing is only possible because the unit is a part of a hospital that supports ratios based on the patient acuity. Staffing mix is not a focus in this paper but needs to be considered as a possible variable in the care being delivered (Thomas-Hawkins, Flynn & Clarke, 2008; Wash, 2013).
Our Findings/ Access Infection Rate

- Our units overall Access Related infection rate for 2015Q2 according to NHSN is 0.63 (per 100 patient months) this is significantly lower than the NHSN average of 0.88.
- Our catheter infection rate (1.04) remains at half of the national average (2.52) and has been steadily declining.
- Our AVF’s still have the lowest rates but the data below shows that there is little difference in infection risk between an AVG (0.91) and catheter (1.04).
Evaluation of Potential Barriers to Catheter Reduction

- Limited access to health care
- Vintage: Years on Dialysis
- No sites available
- Low Catheter Infection rates
- No reduction in mortality or morbidity
- Patient Preference

Our Findings/Plan

- Our unit has had catheter rates over 30% for a long while. There are a variety of possible reasons for this, the most obvious is that most of our patients start dialysis with a catheter. Explanations for this are varied but I am sure that access to health care, lack of insurance coverage and the fact that many of our patients have comorbid conditions requiring them to live in Long Term care facilities all impact on our high catheter rates.
Our Findings: New Start Access Status

• Of the 27 new patients started in 2012
  – 48% had not seen a nephrologist
    Compared to 34% State and 27 % Nationally
  – 6% started with AVF
    Compared to 35% State and 32% Nationally
  – 94% started with a catheter
    Compared to 77% State and 75% Nationally

• Of prevalent patients in 2012
  – 32% had catheters in place >90 days
    (Compared to 9% State and 10% Nationally)

2013 Dialysis Facility Report
• CMS has determined that an AVF as the best access. It was based on cost of interventions and hospitalizations (Patel et al, 2013).

• Currently on average an AVF will remain problem free for the first three years, then will often require ongoing interventions to keep them working. The useful life expectancy depending on location is from 3-7 years (Deaver, 2015).

• The average AVG which has a higher risk of infection than and AVF, will often require angioplasties to keep them working sooner and have a useful life expectancy of 1-2 years (Deaver, 2015).

### Vintage: Average Years on Dialysis

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our Unit</td>
<td>6.35</td>
<td>6.1</td>
<td>6.5</td>
</tr>
<tr>
<td>Region</td>
<td>4.6</td>
<td>4.6</td>
<td>4.7</td>
</tr>
<tr>
<td>State</td>
<td>4.4</td>
<td>4.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Nation</td>
<td>4.7</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>Years above Regional Average</td>
<td>1.75</td>
<td>1.5</td>
<td><strong>1.8</strong></td>
</tr>
<tr>
<td>Years above State Average</td>
<td>1.95</td>
<td>1.6</td>
<td><strong>1.8</strong></td>
</tr>
<tr>
<td>Years above National Average</td>
<td>1.65</td>
<td>1.3</td>
<td><strong>1.7</strong></td>
</tr>
</tbody>
</table>

Data from Dialysis Facility Reports- 2012-2015
Our Findings/Vintage Years

According to the USRDS (2014-Survival data table 5-1) 54% of incident hemodialysis patients are expected to be alive after three years.

In looking at our data from Dialysis Facility Report 2016 the national average for total years on dialysis was 4.8 years. This means if an AVF is placed it should last long enough to exceed their life expectancy.

If an AVG is placed at the initiation of dialysis, they will need at least one more before they reach 5 years.

The patients in our unit historically are live longer. Most recent data from the 2016 Dialysis Facility Report shows the average to be 6.5 years; that is 1.7 years longer than the national average of 4.8 years.

Our Findings/No Sites Available

- The most important information shown is that 50% of the patients are either refusing access placement or have no other access options. All of these patients have had catheter longer than one year, with 60% of them longer than 5 years.
Our Findings/ No Sites Available

• As you can see, 21% of our catheter patients have exhausted all possible sites. What does not show in the pie chart is that of the 29% who are listed as refusing, many have had previous accesses that have failed.
• So it is reasonable to say that the longer you live on dialysis the more likely you will have a catheter.

Our Findings/ No benefit AVG

• As show earlier in our catheter data- 50% of our patients with catheters have had them for longer than 1 year with 60% having them longer than 5 years.
• Most of our long term catheter patients have had several attempts at access placement making the likelihood of AV fistula creation unlikely.
• Recommending placement of an AVG
  – adds unnecessary risk of anesthesia and surgery with no real reduction in infection risk.
  – No improvement in mortality.
Our Findings / Patient Preference

• Most of these long term patients are well aware of the risks and are very comfortable in assuming them (see, Shugart, Lamb, et al, 2014).
• Our patients are quick to say they have not had any problems with their catheters so why would they want to change.
• We honor our patient’s right to make an informed decision in spite of the penalties we may incur.

Our Findings / Infection Rates and Catheter Prevalence

As our infection rates continue to decline it is becoming increasingly apparent that positive blood cultures are not always linked to the number of catheters being used in our dialysis center.

Infections result from a variety of sources and certainly utilization of proper aseptic technique is essential to minimize transmission and exposure to infectious agents.
In Summary

Ultimately at the end of our CUSP project we did reduce our overall positive blood culture rates but our catheter rate remained unchanged at 34%.

In reviewing the data it appears that there are many things that impact infection rates that are out of our direct control. Impacting these will require coordination with other health care providers.

However, we did identify that we have a very low rate of access infections. That is something that we in the unit have a great deal of control over and are very proud of.

In our unit having a catheter poses no greater risk of infection than having an AVG.

In the end our patients are sicker and living longer.

*I think that speaks volumes about the care we provide to those with more complex medical needs.*

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In Summary

- As the dialysis population continues to grow so does the population of patients whose care is too complex to be managed in a free standing unit. Due to their medical and psychosocial needs a hospital setting is often the best and only place able to provide the care needed. This level of complexity makes meeting some of the Conditions for Coverage more challenging.
In Summary

We can document that we provide safe and effective care inspite of our high catheter rate.

So then, why are units like ours, a inner city, hospital based, not for profit dialysis center, at risk for having a reduction in payment because we do not meet the QIP goals for AVF’s and catheters?

Perhaps it is time to look at other indicators that might be more beneficial.

Where are we today
Number of new Starts
AVF verses Catheter

2015
Patients started
37 with catheters
11 with AVF

2016
Patients started
37 with catheters
11 with AVF

New starts with AVF
New starts with Catheters

(Total) Cath Rate
NHSH Data:
All Positive Blood Stream Infections
Up to Feb, 2017

NHNN Data:
Access Related Blood Stream Infections (ARB)
Data Up Feb, 2017
Comparative data:
All + Blood Cultures vs. Infections of Dialysis Access

10/8/2015

Capital Health Regional Medical Center
Relationship between Access Related Bloodstream and Non-access related Infections Year by Year

Blood Cultures, Access Infections Only
Areas for Future Evaluation

- Utilization of button hole cannulation techniques
- Changing Locking solution
  - Removal of heparin
    - Possible link to bacterial growth
  - Utilization of Cathflo in problem catheters
- Changing CVC site to SVC
  - Has lowest infection rates
- Working with Clinic and new patients
  - Placement of access earlier
- Surgeons
  - Work to streamline referral process
    - Initiate workup prior first visit
      - Vein mapping, etc.
- More Peritoneal Referrals
- Eventually
  - Vein preservation- hospital wide

References

- CDC: Information on HAI (Hospital Acquired Infections) [http://www.cdc.gov/hai/pdfs/stateplans/factsheets/nj.pdf]
- USRDS-Survival Data Table 5.1 [http://www.usrds.org/2014/view/v2_05.aspx]