Decreased Risk of Septicemia or Bacteremia among New End-stage Renal Disease Patients Receiving Hemodialysis with Early Fistula Placement

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Background
- Previous studies suggest better outcomes among end-stage renal disease (ESRD) patients initiating hemodialysis (HD) with arteriovenous fistula (Fistula) versus central venous catheters (Catheter) or arteriovenous grafts (Graft).
- CMS requires all dialysis providers to report vascular access type (VAT) used for HD, which was found to have a high agreement (94%) with VAT reported in medical evidence forms.
- Unlike catheter starts, use of Fistula as HD initiation requires pre-planning, health insurance, and time for the access to mature.
- Insurance coverage has been proposed as a way to reduce infections and increase outcomes.

Study Objective
We looked at incident and prevalent VAT to determine the importance of starting with fistula in lowering the risk of acquiring septicemia or bacteremia.

Study Design
Data Source
- Medicare Enrollment & Final Action Claims Data

Population
- 5% Medicare beneficiary sample
- Incident HD ESRD beneficiaries in 2011-2012
- Age >27
- Full-file for-service coverage (A+4) by Medicare for 2 years prior and 1 year after the start of HD
- Cohort 1: all incident HD ESRD beneficiaries (N=2,022);
- Cohort 2: incident HD ESRD beneficiaries who survived the 2nd year of ESRD (N=1,168) & patients

Study Cohorts Selection
15,383
5% of Medicare ESRD beneficiaries in 2011-2012 who were 67 years old or older

Models and Outcomes
1. Extended Cox proportional hazards model (Cohort 1)
- Exposure: Prevalent (time-dependent) VAT
- Outcome: Days to hospitalization with septicemia (ICD-9-CM 038.xx) or bacteremia (790.7) during follow up
- Control variables: Incident VAT, demographics, chronic conditions, location of 1st HD, Gagne score, prior healthcare utilization

2. Multivariate logistic regression model (Cohort 2)
- Exposure: Incident VAT
- Outcome: Hospitalization with septicemia (ICD-9-CM 038.xx) or bacteremia (790.7)
- Control variables: Demographics, chronic conditions, location of 1st HD, prior healthcare utilization

Results
Cohort 1. Hazards of Hospitalization with Septicemia or Bacteremia by Prevalent VAT

<table>
<thead>
<tr>
<th>VAT Type</th>
<th>Hazard Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter (time-dependent)</td>
<td>0.43 (0.25-0.69)</td>
</tr>
<tr>
<td>Graft (time-dependent)</td>
<td>0.37 (0.25-0.53)</td>
</tr>
</tbody>
</table>

Cohort 2. Risk of Hospitalization with Septicemia or Bacteremia by Incident VAT

<table>
<thead>
<tr>
<th>VAT Type</th>
<th>Relative Risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter</td>
<td>0.85 (0.63-1.17)</td>
</tr>
<tr>
<td>Graft</td>
<td>0.64 (0.43-0.95)</td>
</tr>
<tr>
<td>Fistula</td>
<td>0.27 (0.21-0.37)</td>
</tr>
</tbody>
</table>

Study Cohorts

Cohort 1: 2,392 incident HD ESRD Beneficiaries with at least one VAT report in first 60 days.
- Catheter N=1,900, Graft N=2; Fistula N=410

Cohort 2: 1,608 incident HD ESRD Beneficiaries who survived the 3rd year of ESRD (N=1,185; Graft N=4; Fistula N=356)
- Catheter N=1,185, Graft N=67, Fistula N=356

Excluded: died during 3rd year of ESRD (N=784)

Excluded: no outpatient revenue center claim with vascular access report in 1st 30 days (N=350)

Excluded: no outpatient revenue center claim with vascular access report subsequently (N=2,022; Cohort 1)

Excluded: no outpatient revenue center claim with vascular access report during FU (N=539; Cohort 2)

Data Search:
- 2008-2012 Incident Outpatient, Medicare, FNA Dialysis Claims and Select: 2nd Quart in 2011-2012

Select:
- Beneficiaries with full fee-for-service coverage in 2 years before and 1 year after the start of hemodialysis
- No change in VAT during FU

Hospitalizations:
- Patients were censored: (a) at death; (b) event (hospitalization for septicemia or bacteremia); and (c) end of follow up (end of first year of ESRD)

Survival Analysis:
- Cox proportional hazards model: (Cohort 1)
- Multivariate logistic regression model: (Cohort 2)
- Number of events: 205 for Cohort 1; 44 for Cohort 2

Survival Estimates by Incident Vascular Access

Time to event (median number of days b/w HD start and hospitalization)

Baseline Healthcare utilization (Median reimbursement revenue)

Cohort 1

<table>
<thead>
<tr>
<th>VAT Type</th>
<th>Median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter</td>
<td>$27,944 ($22,417-36,705)</td>
</tr>
<tr>
<td>Graft</td>
<td>$17,998 ($13,291-30,678)</td>
</tr>
<tr>
<td>Fistula</td>
<td>$53,314 ($37,944-77,918)</td>
</tr>
</tbody>
</table>

Cohort 2

<table>
<thead>
<tr>
<th>VAT Type</th>
<th>Median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter</td>
<td>$2,185 ($1,951-2,417)</td>
</tr>
<tr>
<td>Graft</td>
<td>$1,217 ($1,059-2,117)</td>
</tr>
<tr>
<td>Fistula</td>
<td>$17,959 ($1,959-77,918)</td>
</tr>
</tbody>
</table>

Implications
- Reluctance in placing a fistula or a permanent HD for HD could prevent significant infection-related morbidity and, subsequently, costs associated with preventable hospitalizations
- Persistently low use of Fistula at HD initiation among those with full health care coverage prior to ESRD points to the need for better strategies to optimize vascular access in new ESRD patients

Limitations
- Limited generalizability due to a select cohort in terms of age and health insurance
- Unable to exclude patients who were not candidates for permanent VAT due to age, comorbidities, or life expectancy

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Summary
- Among beneficiaries who survived the first year of ESRD, those who initiated maintenance HD with Fistula had a 60% lower risk of hospitalization with septicemia/bacteremia as compared with those who started HD with Catheter (Cohort 2)
- Among all incident HD ESRD beneficiaries, independent of the first VAT, staying on or transitioning to Fistula during the course of HD was associated with 63% risk reduction in preventing hospitalization with septicemia/bacteremia (Cohort 1)
- A high proportion (74%) of the fully covered Medicare ESRD beneficiaries initiated their maintenance HD with catheters, of which 32% continued to use catheters throughout the first year of ESRD treatment (Cohort 2)
- Majority of catheter starts obtained their first HD in an inpatient setting (62%) as compared with 41% of Fistula starts (Cohort 2)