Predialysis Vascular Access Planning

Jennifer HANKO
Consultant Nephrologist
Belfast Health and Social Care Trust
Vascular Access Society of Britain and Ireland (council)

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Overview

- Vein preservation
- Timing of access creation
- Appropriate modality selection
- Ultrasound mapping
Vein Preservation
Vein Preservation

- Predialysis access planning starts from the first time a patient at risk of ESRD is assessed
Vein Preservation

- Dorsum of hands
- Dominant arm
- Non-dominant arm ‘only if life-or-death emergency’
Vein Preservation

- How NOT to preserve veins!
  - Avoid PICC + SC lines
Vein Preservation

- How TO preserve veins!
Vein Preservation

- How TO preserve veins

Please show this card when getting blood tests carried out or if admitted to hospital.

_____________________________ may need haemodialysis in the future.

To help preserve the patient’s veins, please only take blood from the back of their hands or their ____________ arm.

Signature __________________________
Timing of Access Creation
Timing of Access Creation

- Renal Association Guidelines 2011

3. Timing of creation of vascular access (Guidelines 3.1-3.2)
   - Guideline 3.1
     - We suggest that planning for access should commence when patients enter CKD stage 4. (2C)
   - Guideline 3.2
     - We recommend that the exact timing of placement of vascular access will be determined by rate of decline of renal function, co-morbidities and by the surgical pathway. (1C)
Timing of Access Creation

- Guidelines
  - Estimated time to dialysis
    - Within 1 yr of anticipated need for HD (KDOQI 2000)
    - Within 6 m of HD (KDOQI 2006)
  - Estimated GFR
    - <25 in KDOQI 2000, <15 in 2006
    - <15-20 in CSN guidelines 2006
### Timing of Access Creation: Should Age be a Consideration?

- 11,290 patients with eGFR <25

<table>
<thead>
<tr>
<th></th>
<th>6m</th>
<th>1yr</th>
<th>2yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All</strong></td>
<td>15%</td>
<td>25%</td>
<td>40%</td>
</tr>
<tr>
<td><strong>18-44 yo</strong></td>
<td>32%</td>
<td>47%</td>
<td>67%</td>
</tr>
<tr>
<td><strong>85-100 yo</strong></td>
<td>8%</td>
<td>11%</td>
<td>17%</td>
</tr>
</tbody>
</table>

O’Hare et al. Kid. 2007; 71: 555-561
Timing of Access Creation: Should Age be a Consideration?

Younger patients have a faster decline in renal function

<table>
<thead>
<tr>
<th>Age Group (Yrs)</th>
<th>Median Annual Change in eGFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-44</td>
<td>-3.4</td>
</tr>
<tr>
<td>45-54</td>
<td>-3.6</td>
</tr>
<tr>
<td>55-64</td>
<td>-3.2</td>
</tr>
<tr>
<td>65-74</td>
<td>-2.2</td>
</tr>
<tr>
<td>75-84</td>
<td>-1.9</td>
</tr>
<tr>
<td>85-100</td>
<td>-1.3</td>
</tr>
</tbody>
</table>

O’Hare et al. KI. 2007; 71: 555-561
Ratio unnecessary:necessary access by eGFR – a) eGFR<25, b) eGFR<20, c) eGFR<15

If all with eGFR <25 had AVF creation...

- **Unnecessary : necessary AVFs at 2 yrs**
  - 5:1 for those aged 85-100
    - Referral at eGFR <15 ratio 1.5:1
  - 0.5:1 for those aged 18-44

O’Hare et al. KI. 2007; 71: 555-561
Timing of Access Creation: Should Age be a Consideration?

- Probably
- Younger patients
  - Will almost certainly end up on dialysis
  - Reasonable to plan VA at eGFR <25
- Older patients
  - Consider different threshold, e.g. <15
  - Plus possible other criteria such as proteinuria, rate of change, etc
  - More likely to have an acute decline; therefore, essential to have ‘contingency plan’ for those starting with CVC
Appropriate Modality Selection
Appropriate Modality Selection

- Modality options
  - Peritoneal dialysis
  - Haemodialysis
  - Home haemodialysis
  - Pre-emptive live donor transplant
  - Conservative care
Appropriate Modality Selection

- Patient education
- Independent RRT modalities promoted
  - PD and home HD
    - Improved outcomes for patients
    - Cost savings to healthcare systems
- If no contraindications, modality selection guided by patient choice
Appropriate Modality Selection

- Two studies have explored relationship between predialysis RRT choice following education and actual RRT start modality
    - British Columbia, Canada
  - Liebman et al. AJKD. 2012;59(4):550-557
    - Rochester, New York, USA
## Appropriate Modality Selection

<table>
<thead>
<tr>
<th>Methods</th>
<th>British Columbia</th>
<th>Rochester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Retrospective cohort studies</td>
</tr>
<tr>
<td>Inclusion criteria</td>
<td>Started dialysis</td>
<td>Received education session</td>
</tr>
<tr>
<td></td>
<td>&gt;3m nephrology</td>
<td>Commenced dialysis</td>
</tr>
<tr>
<td></td>
<td>≥1 RRT education session</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimum 3m dialysis</td>
<td></td>
</tr>
<tr>
<td>Exclusion criteria</td>
<td>Any prior history RRT</td>
<td>PD choice ≤2 wk before dialysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Known CI to PD</td>
</tr>
<tr>
<td>Education</td>
<td>Multidisciplinary predialysis clinics</td>
<td>Single visit</td>
</tr>
</tbody>
</table>
# Appropriate Modality Selection

<table>
<thead>
<tr>
<th>Results</th>
<th>British Columbia</th>
<th>Rochester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident patients</td>
<td>1340</td>
<td>1800</td>
</tr>
<tr>
<td>Included patients</td>
<td>508 (38%)</td>
<td>217 (12%)</td>
</tr>
<tr>
<td>Excluded patients</td>
<td>429 &lt;3m nephrology 257 no RRT ed session 146 prior RRT</td>
<td>6 started dialysis &lt;2w 2 PD CI 2 conservative</td>
</tr>
</tbody>
</table>
## Appropriate Modality Selection

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<thead>
<tr>
<th>Results</th>
<th>British Columbia</th>
<th>Rochester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 508</td>
<td>N = 217</td>
</tr>
<tr>
<td><strong>Modality choice</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HD</td>
<td>127 (25%)</td>
<td>41 (19%)</td>
</tr>
<tr>
<td>PD</td>
<td>114 (22%)</td>
<td>124 (57%)</td>
</tr>
<tr>
<td>‘Undecided’</td>
<td>249 (49%)</td>
<td>52 (24%)</td>
</tr>
<tr>
<td>Other (Cons or LDTx)</td>
<td>18 (4%)</td>
<td></td>
</tr>
<tr>
<td><strong>Modality commenced</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HD</td>
<td>341 (67%)</td>
<td>150 (69%)</td>
</tr>
<tr>
<td>PD</td>
<td>167 (33%)</td>
<td>67 (31%)</td>
</tr>
<tr>
<td><strong>HD start per group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HD choice</td>
<td>120 (94%)</td>
<td>40 (98%)</td>
</tr>
<tr>
<td>PD choice</td>
<td>41 (36%)</td>
<td>65 (52%)</td>
</tr>
<tr>
<td>Undecided</td>
<td>170 (68%)</td>
<td>45 (87%)</td>
</tr>
</tbody>
</table>
Appropriate Modality Selection

- Predictors of failure to start PD
  - British Columbia
    - Cardiovasc dis
      - OR 2.36 (1.02-5.43)
    - Serum albumin
      - OR 0.92 (0.86-0.98)
  - Rochester
    - Age >75
      - OR 4.00 (1.03-15.8)
    - Employed
      - OR 0.16 (0.04-0.64)
    - Glomerular disease causing ESRD
      - OR 0.31 (0.95-1.0)
Appropriate Modality Selection

- Reason for HD or PD choice (BC) (n = 241)
  - 62% (n=150) recorded
    - 70% (105/150) of these were ‘patient preference’

- Total
  - 44% (105/241) patient preference
  - 8% (19/241) social reasons
  - 11% (26/241) medical reasons
Appropriate Modality Selection

- AVF creation prior to HD start (BC)
  - 79% (95/120) in those who chose and started HD
  - 50% (85/170) undecided who started HD
  - 41% (17/41) chose PD but started HD
  - 7% (5/73) chose and started PD
Appropriate Modality Selection

- Summary / recommendations
  - Ensure modality decisions made and recorded
  - Patients who are uncertain / do not wish to decide re modality will almost certainly commence HD and should have proactive vascular access assessment +/- referral for AVF creation
  - Patients at high risk of failing PD should have vascular access assessment
Ultrasound Mapping: A Systematic Approach
US Mapping: Evidence

- Non-randomised studies (often with historical controls)
  - Identifies veins not seen on physical exam (esp in obese)
  - Identifies areas of scarring within veins
  - Increases proportion pts receiving AVF
  - Increases pts successfully dialysing via AVF

- General recommendations
  - Cephalic vein >2-2.5 mm
  - Radial artery >1.5 mm

Wong et al, Euro J Vasc Endovasc Surg 1996
Allon et al, KI 2001
Gibson et al, KI 2001
Malovrh, AJKD 2002
Kakkos et al, Vasc Endovascular Surg 2011
US Mapping: Evidence

- Ultrasound vessel mapping recommended by KDOQI (level B) and European Vascular Access Society (level II)

KDOQI. AJKD. 2006
www.vascularaccesssociety.com
Routine Preoperative Vascular Ultrasound Improves Patency and Use of AVF for Hemodialysis: RCT

- 218 patients randomized: 106 clinical, 112 ultrasound
- Ultrasound group lower rate of immediate failure
  - 4% vs 11%, \( P = 0.028 \)
- Primary AVF survival: no difference at 1 year
  - Ultrasound 65%, clinical 56%, \( P = 0.081 \)
- Assisted primary AVF survival better for the ultrasound group at 1 year
  - 80\% versus 65\%, \( P = 0.012 \)
- “NNT” with US to prevent one AVF failure = 12

Ferring et al. cJASN 2010;5:2236-44
RCT: Routine preoperative ultrasound results in higher assisted patency at 1 year

Ferring et al. cJASN 2010;5:2236-44
US Mapping: A Systematic Approach

- Pt reclining / warm room
- History / Exam
  - Bilateral BPs
  - Allen’s test
- Mapping
  - Non-dominant arm mapped first
US Mapping: A Systematic Approach

- **Veins**
  - Every 5cm marked from wrist crease and from ACF
  - Patency confirmed along entire length
  - Diameter + depth recorded every 5 cm
  - Diameter measurements repeated with tourniquet
  - Branches, scarring, etc identified
  - Subclavian vein: patency / augmentation

- **Arteries**
  - Diameter, wave form, velocity, blood flow volume measured
    - Brachial and radial arteries
  - Arteries followed for any evidence stenosis

- Process repeated on dominant arm if suitable vessels not identified
Systematic US Mapping – Case

- 46 yo female
  - Presented 6/12/11 with headache, BP 190/105, creat 600 umol/l
  - Left handed: advised to preserve R arm veins
  - BP controlled

- Renal biopsy 14/12/11: IgA, 50% glomerulosclerosis

- Diagnosis: advanced CKD due to IgA nephropathy

- US mapping 15/12/11
Case

Probable advanced CKD
HTN

Patient Name
Unique identifier
DOB
Referring Consultant

Tiny and tortuous

High arterial bifurcation on R

Deep branch 0.29
Triphasic
70.1 cm/s
61 ml/m

Sup branch 0.3
Triphasic
58.3 cm/s
78 ml/m

RA 0.23
Triphasic
41.4 cm/s
12 ml/m

Access options: Preserve R arm veins -> for PD
Surgeon:
Systematic US Mapping - Case

- Patient education
  - Discussed only ‘2 out of 6 options’ for AVF creation with insufficient time for AVF maturation
  - Importance of avoiding central lines
  - Recommended PD as initial modality
  - Best treatment: live donor kidney transplant (sister at bedside)

- Agreed plan
  - PD
  - Right arm vein preservation critical
  - Explore options for LD transplant
Systematic US mapping - Case

- PD catheter inserted 24/12/11
- Commenced PD training 3/1/12

- Live donor transplant 5/11/12
Systematic US Mapping - Benefits

- Choosing ‘best’ vessels
- Potentially done earlier to guide vein preservation + modality selection
- Opportunity for patient education
- ‘Second opinion’
- Reinforces that access is something we take seriously
US Mapping: A Systematic Approach

- NOT ultrasound mapping in isolation!
- Complex process involving large multidisciplinary team
  - Patients and their families
  - Predialysis staff
  - Nephrologists
  - Surgeons
  - Radiologists
  - Dialysis unit staff
  - Vascular access staff
US Mapping: A Systematic Approach

- Ultrasound vascular mapping and follow-up
  - Best performed by someone with an understanding of all aspects of renal care who is willing to act as access coordinator / facilitator
Did outcomes improve in Vancouver with a systematic approach to vascular mapping and access coordination?
Conclusions

- Preserve veins!!!

- Ensure appropriate, timely modality selection

- Patients ‘undecided’ re modality or those at high risk of failing PD should be referred for vascular access assessment +/- access creation

- Consider access planning
  - eGFR <25 in younger patients / predicted time to dialysis 2 years
  - eGFR <15 in older patients / very slowly progressive
Conclusions

- Routine preoperative ultrasound mapping prior to AVF creation is the recommended standard of practice
  - Increasing evidence to support its efficacy

- Mapping should be performed systematically by someone with an understanding of all aspects of renal care who is willing to act as an access coordinator / facilitator
  - Benefits beyond choosing best vessels