<table>
<thead>
<tr>
<th>Patients at risk of VND quotation</th>
<th>Reference</th>
</tr>
</thead>
</table>
| Venous needle dislodgement is a potentially life-threatening complication of dialysis that can happen to anyone in any dialysis setting throughout the world. | Hurst\(^4\)\(^1\)  
Axley, B et al\(^4\)\(^3\) |
| Patients with a well functioning AV fistula e.g. p > 25mmHg, amounts to 50% of all AV fistulas. | Polaschegg H-D\(^1\)  
Polaschegg H-D\(^1\)\(^8\) |
| Low/Poor lighting in the room | Hurst J\(^1\)\(^1\),\(^3\)\(^7\)  
Mactier et al\(^1\)\(^5\) |
| Patients experiencing restlessness towards the end of the dialysis  
Restlessness throughout | Hurst J\(^1\)\(^1\),\(^1\)\(^2\),\(^3\)\(^7\)  
Mactier et al\(^1\)\(^5\)  
Liback-Pedersen L\(^1\)\(^3\)  
Polaschegg H-D\(^1\)\(^2\)  
VA Patient Safety Advisory\(^1\)\(^6\)  
VA Patient Safety Advisory\(^1\)\(^7\) |
| Patients with frequent blood pressure drops or muscle cramps | McCabe M\(^8\)\(^a\)  
Axley, B et al\(^4\)\(^3\) |
| Patients covering the access during dialysis, this includes patients who are cold, sleeping, and are typically patients in beds | Hurst J\(^1\)\(^1\),\(^1\)\(^2\),\(^3\)\(^7\)  
Lindley E\(^1\)\(^0\)  
Polaschegg H-D\(^1\)\(^2\)\(^8\)  
Sandroni S\(^4\)  
Liback-Pedersen E\(^1\)\(^3\)  
Almen\(^7\)  
VA Patient Safety Advisory\(^1\)\(^6\)  
VA Patient Safety Advisory\(^1\)\(^7\)  
Axley, B et al\(^4\)\(^3\) |
| Patients with extensive hair growth around the access points, which makes fixation of the needles more difficult. Patients with skin conditions; allergies to patches, eczemas, extensive sweating | Van Waeleghem, J-P et al\(^9\)  
McCabe M\(^8\)\(^,8\)\(^a\)  
VA Patient Safety Advisory\(^1\)\(^6\) |
| If venous pressure before treatment is below 25mmHg, the patient should be regarded as “high risk” for VND | RPA. Keeping Kidney Patients Safe\(^4\)\(^5\) |
| Patients on nocturnal and/or home dialysis | Axley, B et al\(^4\)\(^3\) |
| Patients with history of VND | McCabe M\(^8\)\(^a\) |
| Patients who are mentally, cognitive, neurological impaired  
Ex. Dementia, patients not understanding the implications of a VND, reduced sensitivity  
Patients who are uncooperative  
Patients who are agitated | McCabe\(^8\)\(^a\)  
Mactier et al\(^1\)\(^5\)  
Van Waeleghem, J-P et al\(^9\)  
Liback-Pedersen E\(^1\)\(^3\)  
Polaschegg H-D\(^2\)  
VA Patient Safety Advisory\(^1\)\(^6\)  
VA Patient Safety Advisory\(^1\)\(^7\)  
Axley, B et al\(^4\)\(^3\) |
| Patients with fistulas located other than cephalica or brachea, e.g. locations which are not visible easily submitted to friction | Van Waeleghem, J-P et al\(^9\)  
Mactier et al\(^1\)\(^5\) |
### Patient with known small blood leakage oozing around the venous needle

Van Waeleghem, J-P et al.\(^9\) McCabe M.\(^{46}\)

### Patients with diabetes and frequent hypoglycemic episodes during HD therapy

McCabe M.\(^{46}\)

### All patients dialyzing with limited or without supervision e.g. Sleeping, Nocturnal Self care/Low care Home Isolation rooms in clinics, ICU

Van Waeleghem, J-P et al.\(^9\) McCabe M.\(^{46}\) Almen\(^7\) Sandroni S. EDTNA disc. Forum.\(^{10}\) Lindley E\(^{10}\) Hurst J\(^{11,12,37}\) VA Patient Safety Advisory\(^{16}\) VA Patient Safety Advisory\(^{17}\) Axley, B et al.\(^{43}\)

### Minimizing the risk of VND requires a combination of human skills, vigilance and technology

Van Waeleghem JP et al.\(^{26}\)

### Patient and staff awareness is important

Hurst\(^{37}\) Axley, B et al.\(^{43}\)

### High acuity patients and patients with an altered mental status have a higher risk of VND

Martin Lascano\(^{40}\)

### VP alarm failed to detect VND until significant blood loss

Pressure drop caused by a cannula slipping: such event is usually too small to be detectable by the venous pressure monitor

VP measuring is an unreliable method for detecting needle dislodgement

Venous needle dislodgement during hemodialysis without triggering the venous pressure alarm was reported in an online medical device safety report from 1998

Study to examine the success rate of VND detection in different types of dialysis access, using the venous pressure monitoring system. Only 29% of fistula VNDs were detected related to discrepancies in pressure.

### Incidence and severity of incidents of VND

<table>
<thead>
<tr>
<th>Event</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/126 718 treatments, a catastrophic hemorrhage with 33% mortality = 136 deaths/year (=2/week)</td>
<td>Sandroni S.(^4) VA Patient Safety Advisory(^{16}) RPA Renal Physicians association(^{19}) Pennsylvania Safety Advisory(^{35}) Almen(^7) Derek White, Gambro(^{20})</td>
</tr>
<tr>
<td>1/62 500 serious bleeding (include cath &amp; needles = 2/day) 5% has a needle come out (=200/day)</td>
<td></td>
</tr>
<tr>
<td>6.1% VND incidents (review of all type of incidents 562 over 1 year)</td>
<td></td>
</tr>
</tbody>
</table>
0.1% VND incidence rate

1/500,000 death

3% of treatments bleeding leading to corrective action (0.9% complete VND)

Post VND higher mortality risk due to infections

VND incidents are underreported

VND remains the most common cause of preventable death in dialysis and is a serious risk for the home patient.

414 episodes of fatal VND episodes are likely an underestimate

Without doubt VND is the most unexpected and potentially life-threatening complication in dialysis.

<table>
<thead>
<tr>
<th>Cost related to VND</th>
</tr>
</thead>
<tbody>
<tr>
<td>VND Costly complication</td>
</tr>
<tr>
<td>Minor VND 522-1183$/blood transfusion</td>
</tr>
<tr>
<td>Sever VND 4 days hospital/blood/EPO/Plasma expanders... 114 000$ and up</td>
</tr>
<tr>
<td>Liability costs</td>
</tr>
<tr>
<td>Cost of blood transfusion 522-1183$/transfusion</td>
</tr>
</tbody>
</table>

**Cost of blood transfusion 522-1183$/transfusion**

Shander\(^{23}\)

**Minimization of undetected VND**

Minimization of undetected VND episodes can be aided by use of blood loss detection devices

Martin Lascano\(^{40}\)

**Cost of blood transfusion 522-1183$/transfusion**

Shander\(^{23}\)

**Blood transfusion related to 16% higher long term mortality**

Surgenor\(^{24}\)

**Only Hospital-operated facilities must report events under the Act 13 of the Medical Care Availability and Reduction of error Act of 2002 (freestanding dialysis clinics are excluded)**

Pennsylvania Safety Advisory\(^{35}\)

**Electrical Safety**

Further a direct electronic sensor such as a moisture or enuresis detector is not suitable since research have shown that a DC 5 V power supply could cause a micro shock by ionization in the skin.

Akihiro T et al\(^{36}\)

**Literature list**

Review includes the following publications:


   a. Risk Assessment Tool Dundee


11. Hurst, J, Keep an Eye On Your Needle, Kidney Times #312


16. Patients Safety Advisory; Veteran Health Administration Warning System; Published by VA Central Office; October 21, 2008

17. Patient Safety Alert, Health Administration Warning System; Published by VA Central Office; July 6, 2010


20. Derek White, Gambro; Oral presentation EDTNA Congress Florence 2007 (Oral presentation)


27. Tricia West, R.N., BSN, MBA/HCM, PHN, LNC, Knowledge is Power.

28. News coverage NBC


34. Olsson P. Sundström M. Annotated Pro Publica Articles (25, 29-33)


40. Dr. Martin E. Lascano, Michael Bradley Andersen RN, Cleveland Clinics; Venous Needle Dislodgement Prevention in Hospital Based Hemodialysis. Abstract ASN November 2011


