

Patients at risk of VND quotation	Reference
Venous needle dislodgement is a potentially life-threatening complication of dialysis that can happen to anyone in any dialysis setting throughout the world.	Hurst ⁴¹ Axley, B et al ⁴³
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 ¹⁸
Low/Poor lighting in the room	Hurst J ^{11,37} Mactier et al ¹⁵
Patients experiencing restlessness towards the end of the dialysis Restlessness throughout	Hurst J ^{11,12, 37} Mactier et al ¹⁵ Liback-Pedersen L ¹³ Polaschegg H-D ² VA Patient Safety Advisory ¹⁶ VA Patient Safety Advisory ¹⁷
Patients with frequent blood pressure drops or muscle cramps	McCabe M ^{8a} Axley, B et al ⁴³
Patients covering the access during dialysis, this includes patients who are cold, sleeping, and are typically patients in beds	Hurst J ^{11,12,37} Lindley E ¹⁰ Polaschegg H-D ^{1,2} Sandroni S ⁴ Liback-Pedersen E ¹³ Almen ⁷ VA Patient Safety Advisory ¹⁶ VA Patient Safety Advisory ¹⁷ Axley, B et al ⁴³
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 ^{8,8a} VA Patient Safety Advisory ¹⁶
If venous pressure before treatment is below 25mmHg, the patient should be regarded as “high risk” for VND	RPA. Keeping Kidney Patients Safe ⁴⁵
Patients on nocturnal and/or home dialysis	Axley, B et al ⁴³
Patients with history of VND	McCabe M ^{8a}
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 ^{8a} Mactier et al ¹⁵ Van Waeleghem, J-P et al ⁹ Liback-Pedersen E ¹³ Polaschegg H-D ² VA Patient Safety Advisory ¹⁶ VA Patient Safety Advisory ¹⁷ Axley, B et al ⁴³
Patients with fistulas located other than cephalica or brachia, e.g. locations which are not visible easily submitted to friction	Van Waeleghem, J-P et al ⁹ Mactier et al ¹⁵

Patient with known small blood leakage oozing around the venous needle	Van Waelegheem, J-P et al ⁹ McCabe M ^{8a}
Patients with diabetes and frequent hypoglycemic episodes during HD therapy	McCabe M ^{8a}
All patients dialyzing with limited or without supervision e.g. Sleeping, Nocturnal Self care/Low care Home Isolation rooms in clinics, ICU	Van Waelegheem, J-P et al ⁹ McCabe M ^{8a} 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 Waelegheem 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.	VA Patient Safety Advisory ¹⁶ VA Patient Safety Advisory ¹⁷ Sandroni S ³ Almen ⁷ Polaschegg H-D ¹ Van Waelegheem JP et al ²⁶ Polaschegg H-D ¹⁸ Pennsylvania Safety Advisory ³⁵ Axley, B et al ⁴³ Ribitisch, W et al ⁴⁴
Incidence and severity of incidents of VND	
1/126 718 treatments, a catastrophic hemorrhage with 33% mortality = 136 deaths/year (=2/week) 1/62 500 serious bleeding (include cath & needles = 2/day) 5% has a needle come out (=200/day) 6.1% VND incidents (review of all type of incidents 562 over 1 year)	Sandroni S ⁴ VA Patient Safety Advisory ¹⁶ RPA Renal Physicians association ¹⁹ Pennsylvania Safety Advisory ³⁵ Almen ⁷ Derek White, Gambro ²⁰

0,1% VND incidence rate	T. Court: Physicist engineer (PhD) Gambro R&D ²¹ Derek White, Gambro ²⁰ Robin Fields, Probuplica ²⁵ Peter Laird ³⁹ Martin Lascano ⁴⁰ Hurst ⁴¹
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.	
Cost related to VND	
VND Costly complication	Hurst ²² Hurst ⁴¹
Minor VND 522-1183\$/blood transfusion	
Sever VND 4 days hospital/blood/EPO/Plasma expanders... 114 000\$ and up	
Liability costs	
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:

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