



Impact of Normal Saline Flush Volume and Patient Factors on Clotting During Hemodialysis



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Background:

Clotting of the extracorporeal circuit is a common complication during hemodialysis (HD), particularly in patients with acute kidney injury (AKI) or end-stage kidney disease (ESKD). The standard normal saline solution (NSS) flush protocol typically involves intermittent flushing with 50–100 mL of 0.9% sodium chloride every 30–60 minutes to reduce clotting risk. This study evaluated the effect of NSS flush volume on circuit clotting and identified patient-related predictors.

Methods:

A total of 309 HD sessions were prospectively analyzed in patients with AKI (52.6%) and ESKD (47.4%). NSS flushes were administered as either 100 mL every hour or 200 mL every two hours. The primary outcome was the incidence of extracorporeal circuit clotting. Secondary analyses assessed associations with sex, kidney disease type, and vascular access. Incidence rate ratios (IRRs) with 95% confidence intervals (CIs) were calculated using multivariable, multilevel mixed-effects Poisson regression.

Results:

The overall clotting rate was 5.18 events per 100 sessions. Clotting occurred at rates of 6.1 and 4.4 per 100 sessions in the 100 mL and 200 mL groups, respectively, with no significant difference (adjusted IRR 0.87; 95% CI: 0.27–2.77). Male sex (adjusted IRR 0.16; 95% CI: 0.03–0.74), ESKD versus AKI (adjusted IRR 0.03; 95% CI: 0.01–0.12), and use of arteriovenous fistulas (vs. grafts or catheters; $p < 0.01$) were significantly associated with lower clotting risk.

Table 1. Baseline patient characteristics

Characteristics	Total N
Gender	
Male	23 (60.5)
Female	15 (39.5)
Comorbid diseases	
Diabetes mellitus	12 (31.6)
Hypertension	27 (71.0)
Dyslipidemia	15 (39.5)
Indication of dialysis	
Acute kidney injury	20 (52.6)
End stage kidney disease	18 (47.4)
Vascular access type	
AV fistula	13 (34.2)
AV graft	4 (10.5)
Double lumen catheter	13 (34.2)
Permanent catheter	8 (21.1)
Treatment	
Blood transfusion	8 (21.1)
NSS flush	
100mL	23 (60.5)
200mL	15 (39.5)
Median follow up (session), IQR, min-max	5.5 (3, 8), 1-10

*IQR; interquartile range, AV; arterio-venous.

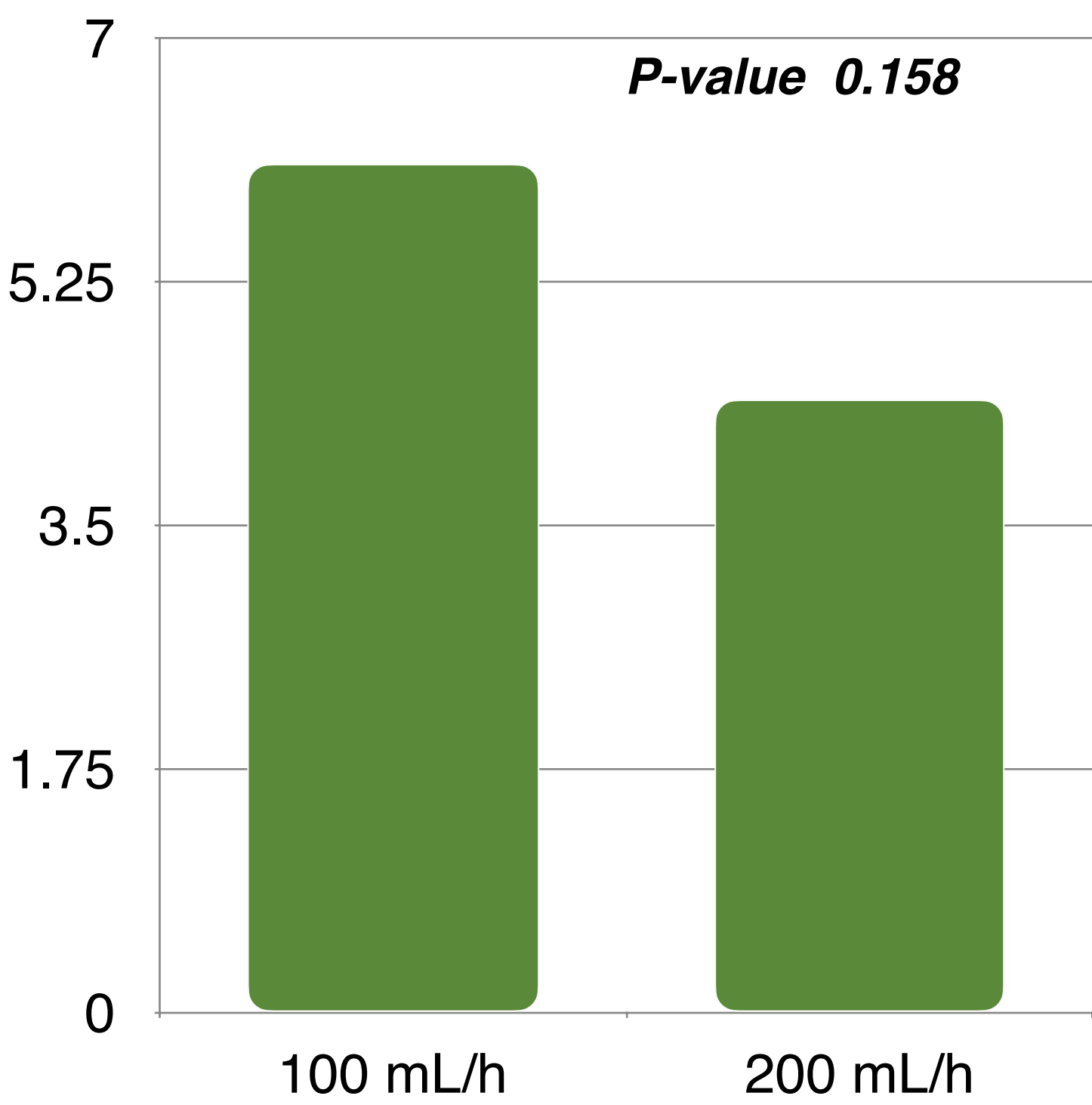


Figure 1. Effect of NSS flush volume on clotting rate (per 100 sessions)

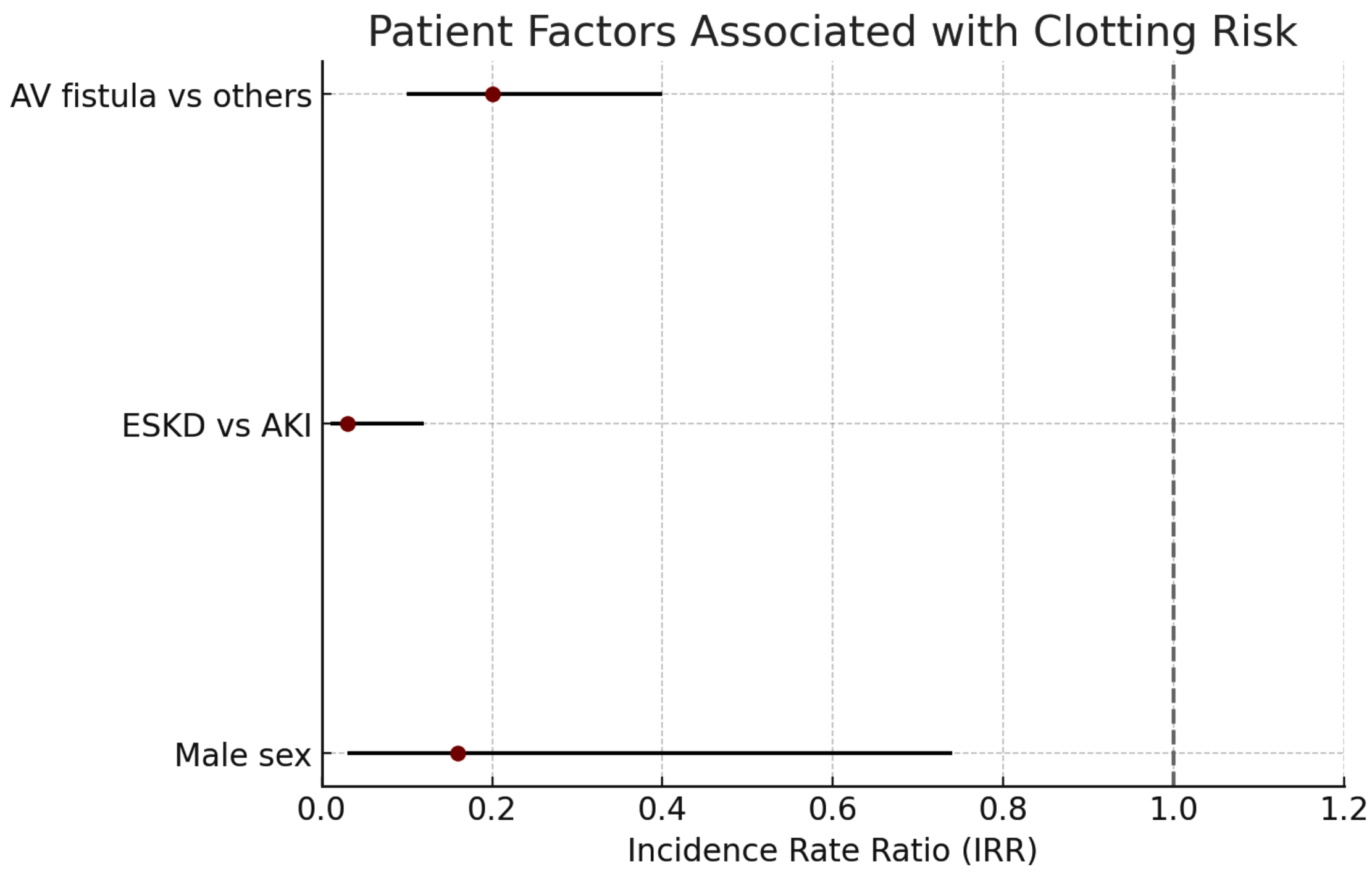


Figure 2. Multivariable analysis: Factors associated with circuit clot formation

Table 2. Factors associated with circuit clot formation

Characteristics	Total Events	Patient-sessions	Incidence (100 patient-sessions)	Univariable analysis Crude IRR (95%CI)	p-value	Multivariable analysis Adjusted IRR (95%CI)	p-value
Gender							
Female	9	79.0	11.4	1 (reference)		1 (reference)	
Male	7	230.0	3.0	0.06 (0.01-0.48)	0.007	0.16 (0.03-0.74)	0.019
Comorbid diseases							
Diabetes mellitus	3	50.0	6.0	1.09 (0.0913.15)	0.945	6.72 (0.82-55.13)	0.076
Hypertension	11	186.0	5.9	2.66 (0.24-29.29)	0.424	0.81 (0.17-3.90)	0.797
Dyslipidemia	7	118.0	5.9	0.75 (0.08-6.56)	0.791	0.92 (0.25-3.34)	0.893
Indication of dialysis							
Acute kidney injury	10	68.0	14.7	1 (reference)		1 (reference)	
End stage kidney disease	6	241.0	2.5	0.04 (0.01-0.31)	0.002	0.03 (0.01-0.12)	<0.001
Vascular access type							
AV fistula	3	8.0	37.5	1 (reference)		1 (reference)	
AV graft	2	2.0	100.0	18.68 (0.85-412.11)	0.064	12.66 (1.30-123.21)	0.029
Double lumen catheter	9	18.0	50.0	5.70 (0.41-79.38)	0.196	15.65 (2.99-81.98)	0.001
Permanent catheter	2	3.0	66.7	4.50 (0.18-111.96)	0.359	11.79 (1.78-78.29)	0.011
Treatment							
Blood transfusion	1	53.0	1.9	0.20 (0.02-1.90)	0.161	0.19 (0.02-1.53)	0.118
NSS flush							
100mL	9	148.0	6.1	1 (reference)		1 (reference)	
200mL	7	161.0	4.4	0.42 (0.13-1.39)	0.158	0.87 (0.27-2.77)	0.808

Conclusions:

Increasing NSS flush volume from 100 mL to 200 mL does not significantly reduce circuit clotting during HD. Patient-specific factors, particularly vascular access type, have a greater impact and should inform preventive strategies.

Clinical Application:

Routine use of high-volume NSS flushes (200 mL every 30–60 minutes) during intermittent HD is not necessary for most patients. Instead, focus should be placed on identifying and addressing patient-specific risk factors for circuit clotting—particularly type and quality of vascular access (e.g., small-bore catheters, poor blood flow rates, or access recirculation).