

Original Article

Anticoagulation free hemodialysis

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Anticoagulant is necessary to prevent filter clotting during dialysis. People who are bleeding or likely to bleed need anticoagulant free dialysis. Most centers use regional citrate anticoagulant or intermittent saline flush for intermittent dialysis. Our method of continuous sterile dialysate infusion as prefilter hemo-diafiltration gives benefit of coagulation free dialysis without anti coagulation. There is minimal additional cost, not labour intensive and very very effective.

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Key words : Heparin free dialysis, hemodiafiltration, pre-filter.

Hemodialysis (HD) requires extracorporeal blood flow, and anticoagulant esp. heparin have traditionally been used during treatment^{1,2}. While this is not problematic for stable outpatients receiving HD, many issues like bleeding from any sources, recent surgery, poly trauma etc. make the use of anti-coagulation during HD a concern. Alternative strategies include heparin-coated dialysis membranes, regional heparinization, regional citrate anti coagulation, saline flush during dialysis etc^{1,2}. While these maneuvers were developed to reduce systemic effects of heparin, saline flush which is commonly used, often led to fiber clotting³⁻⁹. In 2000, anti coagulation-free HD protocol based on aggressive intradialytic normal saline (NS) flushing of the dialyzer is routinely used, fiber clotting still occurs when technician fails to fluid flush on time or in patients with hypercoagulable status. To determine the effectiveness of this approach, we have used continuous high volume saline infusion pre filter with equivalent amount of ultrafiltration utilizing online hemodiafiltration machines.

MATERIALS AND METHODS

A retrospective analysis done on all adults (>18 years) undergoing HD treatments both end-stage renal disease (ESRD) and acute kidney injury (AKI) from June 2018 to September 2018. Patients were excluded from analysis if they received heparin, warfarin or direct thrombin inhibitors or any other anticoagulants. A total of 214 HD sessions in 79 patients received high volume pre filter hemodiafiltration without any anticoagulant in the circuit, in patients who needed anticoagulation free HD.

For each HD treatment, the average blood flow rate recorded. In addition, the amount of total pre filter dialysate infusate volume for each treatment was recorded. Clotting of the circuit was defined by complete or partial clot-

ting requiring replacement of the blood tubing and dialyzer till the completion of treatment. We recorded number of treatments had clotting of the dialysis circuit and whether or not this was associated with access type, dialysis treatment blood flow, and flushing volume.

The Anti Coagulation-free Protocol :

- (i) Priming the hemodialyzer with sterile infusion fluid
- (ii) Recirculating the sterile infusion fluid until all air has been removed from the bloodlines and hemodialyzer, as is done in 5008 HD series machines automatically,
- (iii) During the HD treatment, the hemodialyzer is flushed continuously with huge amount of sterile infusate typically more than 25l in a 4 hour dialysis session. The total volume amount of pre filter sterile infusate fluid depend upon blood flow. Higher the blood flow, more fluid is infused.
- (iv) Unless contraindicated, blood flows maximized achieved by access with out complication. Higher the blood flow, there is less chance of clotting.
- (v) incidence of clotting partial or complete noted and factors leading to clotting noted.
- (vi) Additional fluid infusion given whenever early signs of clotting noted esp. clotting in venous chamber.
- (vii) The infused fluid is drained out from the dialyzer at the dialysate out flow line. Therefore, the blood is mixed with sterile infusate fluid throughout dialyzer except terminal portion. Early sign of clotting detected by detecting clotting in the venous chamber while we give pulse saline infusion, clot seen when blood is washed out.

RESULTS

All HD treatments were performed using Fresenius® dialysis machines (5008) compatible with on-line hemodiafiltration. Blood flow was maximized depending on access status. Huge amount (more than 25 liter per 4hr. session) of sterile infusion fluid continuously flushing filter instead of intermittent flushing with 100ml normal saline in every 15 mins. The infusate volume is linked with

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blood flow, higher blood flow, higher infusate volume. This is a problem, since lower blood flow is more prone for clotting. In some selected version of the machines, infusate volume may be selected manually. At any situations, the infusate volume is always higher than manual saline flush. The only advantage of manual flushing is that, we can see the filter and venous chamber during saline flush whether clotting has occurred or not.

Results and Analysis:

Total number of patients was 79 and number of total heparin free HDF session was given 214.

In 40 patients had average arterial blood flow less than 250 ml/min in all the sessions and had total 71 session of HDF.

And 39 patients had blood flow more than 250ml/min and got 143 session of HDF.

In the group of patients whose arterial blood flow were less than 250 ml/min their average blood flow was 168 ml/min, and total 15 (21%) sessions needed additional flushing and out of them 5 patients had dialyser clotting and dialyzer were discarded.

Out of 25 (62.5%) patients did not need any additional flushing but 5(20%) patients had minor clotting in the venous chamber and dialyzers were no discarded.

With arterial blood flow less than 250 overall there is

5(7%) had circuit clotting. They needed average substitution pre-dilution flushing volume 14.98 liters with average session length 3.7 hours.

In the group of patients who achieved arterial blood flow more than 250 ml/min their average blood flow was 263.59 ml/min and average per session length was 4.2 hours and average flush volume was 17.33 liters. Additional flushing needed only in 6 (4%) sessions and rest 137 (95.8%) sessions needed no additional flushing. Out of 6 only 1 (0.6%) had dialyser clotting and 142 (99.3%) had no clotting and out of 36 (25%) sessions had no circuit clotting even without additional clotting. Patients with blood flow more than 250 ml/min only 1(0.6%) had dialyser clotting and rest 38(99.3%) patients had no clotting.

Out of 79 patients 41(51.89%) having temporary jugular catheter and 5 sessions in them had circuit clotting; 17(21.50%) had femoral catheter and 5 sessions had circuit clotting, 17 (21.50%) had arterio-venous fistula (AVF) and 4(5.06%) had permcath and both group had no circuit clotting.

DISCUSSION

Anticoagulant is an integral part of dialysis, and unfractionated heparin is commonly used. However, for a variety of reasons, anticoagulant free or avoiding systemic effects of it is a necessity. In patients with continuous re-

Parameters	Online hemodiafiltration with pre-dilution blood flow <250 ml /min				Online hemodiafiltration with pre-dilution blood flow ≥ 250 ml /min			
NO. OF PATIENTS	40				39			
TOTAL NO. OF SESSIONS	71				143			
ONLINE prefilter SUBSTITUTION VOLUME per session (approx 4-6 hrs) in liters	14.98 ±1.2				17.33 ± 1.4			
AVERAGE BLOOD FLOW (ml/min)	168±24				263.59 ±32			
Average session length(hrs)	3.7				4.2			
ADDITIONAL MANUAL FLUSHING	Additional FLUSHING DONE with evidence of venous chamber clotting		Additional FLUSHING NOT DONE as there was no venous chamber clotting		FLUSHING DONE with suggestion of venous chamber clotting		FLUSHING NOT DONE as no evidence of venous chamber clotting	
	15/71=21.19%		56/71=78.8%		6/143=4%		137/143=95.8%	
	CLOTTING	NO CLOTTING	CLOTTING	NO CLOTTING	CLOTTING	NO CLOTTING	CLOTTING	NO CLOTTING
	9(60%)	6(40%)	5(20%)	20(80%)	1(0.6%)	142(99.3%)	0	36(100%)
CIRCUIT CLOTTING leading to discard of dialyzers	CLOTTING		NO CLOTTING		CLOTTING		NO CLOTTING	
	5/71=7%		66/71=92.9%		1/143=0.6%		142/143=99.3%	

nal replacement therapy (CRRT) blood flow is low may be around 100ml/min, and regional citrate anticoagulation is commonly practised. However, citrate anticoagulation is not freely available in India. In short or prolonged intermittent therapies, where blood flow can be kept 250ml/min or above, intermittent saline flushing is commonly used. The benefit of saline flushing being we can visualize the filter or venous chamber for any clotting. However, there significant number of fibre clotting (historical control) often due to failure of saline flush in time. Loss of dialyzer and blood is significant. In our current protocol, we infuse saline prior to filter 10-25liters in 4-6 hours session compared to 1.5 to 2.5l saline in saline flush mode. In this method, for every patients on anticoagulant free dialysis we give saline flush during dialysis at 15 mins to see fiber or venous chamber clotting. In patients whose blood flow is less <250 ml/min, we continued saline flush every 30 mins in addition to automated pre-dilutional infusion. In patients whose blood flow is more than 250ml/min, if initial saline flush have any indication of clotting, we continue additional flushing. In patients where there was no initial indication of clotting, we continued pre dilutional HDF only. For 25 to 30 liter sinfusion fluid made up from dialysis concentrate and sterile saline, cost increase will be equivalent to cost of dialysate concentrate in 4 hr session. To our knowledge, this is the first report from

India about pre filter hemodiafiltration used as totally anticoagulant free dialysis protocol.

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