Anticoagulation guidelines for chronic and acute hemodialysis patients

Transplant, Urology & Nephrology Directorate

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SECTION 1

1.1 <u>Anticoagulant drugs</u>- interfere with clotting and are used to prevent and treat thrombosis. Anticoagulation is essential during haemodialysis to prevent clotting of the dialyser and extracorporeal circuit (Nasstrom *et al.* 2005)

1.2 <u>Rationale:</u> To provide guidelines for nurses assessing, planning, monitoring and evaluating anticoagulation during each haemodialysis session.

1.3 <u>Scope:</u> This guideline applies to all staff working within the dialysis unit within Beaumont Hospital. It is intended as a guide towards best practice for all members of the multidisciplinary team involved in the care of the renal patient's Haemodialysis treatment and the prevention of clotting of the extracorporeal circuit.

1.4 <u>Principles (Beliefs):</u> The Directorate of Transplantation, Urology and Nephrology has a responsibility to ensure Hospital Guidelines are developed where required/appropriate and implemented effectively. It is intended as a guide towards best practice for all members of the multidisciplinary team involved in the care of the renal patient with a central venous catheter.

SECTION 2

Adequate anticoagulation in hemodialysis procedures relies on knowledge of the basic principles of haemostasis and notably the clotting cascade. The aim of this guideline is to provide nursing and medical staff with information and guidelines surrounding the prevention of coagulation of the extracorporeal circuit during a haemodialysis session.

2.1 <u>Roles and responsibilities of medical and nursing personnel:</u>

- The medical team must prescribe heparin or enoxaparin on the patients dialysis drug Kardex if the dose is outside the anticoagulation protocol.
- The dialysis nurse must follow the protocol for the administration of heparin in hemodialysis patients. Any change from the protocol will need to be prescribed by a doctor.
- The dialysis nurse must be aware of the signs of clotting in the extracorporeal circuit-

a) Extremely dark blood
b) Shadows or black streaks in the dialyser
c) Foaming with subsequent clot formation in drip chambers and venous trap.
d) Rapid filling of transducer monitors with blood.
e) "Tetering" (blood in the post dialyser venous line segment that is unable to continue into the venous chamber but falls back into the line segment).
f) Presence of clots at the arterial side header.

SECTION 3

Anticoagulation of dialysis circuits is a routine part of every workday for hemodialysis practitioners. Anticoagulant drugs interfere with clotting and are used to prevent and treat thrombosis. The main anticoagulant drugs used in hemodialysis are described below.

3.1 Heparin (Unfractionated Heparin) (UFH) –

- Binds itself to antithrombin (a natural anticoagulant) heparin enhances its activity by inactivating thrombin and clotting factors Xa, IXa, XIa and XIIa.
- Is a systemic anticoagulant with an action time of 3-5 minutes (EBPG, 2002).
- Has a half life of 30-120 minutes. Half life is increased in renal failure patients as 35% of heparin is excreted via the kidneys.
- The effect of heparin is measured as the increased time taken for clot formation under controlled conditions. (Fisher, 2007)
- The traditional assay is "activate partial thromboplastin time" (APTT) which is carried out in the lab.
- For haemodialysis purposes whole blood activated clotting time (WBACT) measurement is used- the aim is 120 seconds or 150% of pre dialysis value.
- An allergic reaction is possible if patients are sensitive to pork (Davenport, 2003)
- Concurrent use of heparin with aspirin, Clopidogrel or NSAIDs may increase the risk of bleeding.
- **Heparin has an antidote- protamine.**

3.2 Low Molecular Weight Heparin (LMWH)

LMWHs work by inhibiting factor Xa. In patients with normal renal function, LMWH have the advantages over UFH in providing more predictable anticoagulation, without the need for monitoring of antiXa activity. However LMWH accumulate in renal failure, and should be used with caution in

patients with GFR <30mls/min. In patients at low risk of bleeding, they can be used in the chronic dialysis setting. In general they should **NOT** be used in patients with **acute renal failure** or in patients who are acutely ill or who are at **increased risk of bleeding**.

3.3 Warfarin

Warfarin is an anticoagulant. Warfarin is a synthetic derivative of coumarin, a chemical found naturally in many plants, notably woodruff. Warfarin partially blocks the re-use of vitamin K in your liver. Vitamin K is needed to make clotting factors that help the blood to clot and prevent bleeding. Vitamin K is found naturally in certain foods, such as green leafy vegetables. Warfarin reduces the body's ability to make blood clots. It can help stop harmful clots from forming and keeps clots from getting larger. Warfarin begins to reduce blood-clotting within 24 hours after taking the drug. The full effect may take 72 to 96 hours to occur. The anti-clotting effects of a single dose of warfarin last 2 to 5 days.

3.4 Protamine Sulphate

Protamine sulphate can be used to counteract the anticoagulant effect of heparin: before surgery; after renal dialysis; after open-heart surgery; if excessive bleeding occurs and when an overdose has inadvertently been given. Must be administered by slow intravenous injection over a period of about 10 minutes.

3.5 Administration

Patient assessment prior to commencing anticoagulant therapy

- Patient dry weight
- Patient current medication- anticoagulant, antiplatelet medication
- Patient recent Hb and Hematocrit level, WBC
- Anaemia treatment
- Dialysis access

- Duration of dialysis
- Optimum blood pump speeds achieved
- Medical/Surgical history- bleeding/clotting disorders, malignancies,
- Pre or post surgical intervention
- Previous anticoagulant therapy
- Surface area of dialyser
- Patient due to have a blood transfusion on dialysis

3.6 Management of patients Pre & Post OP/ Very high risk of bleeding

Heparin free dialysis should be initiated.
Regular saline flushes: 100mls every 40-60 mins should be implemented; this extra fluid should be calculated in the overall Ultrafiltration value.
Or
Rinse dialyzer with 5000 IU to 20000 IU of heparin, flush system with 1L to 2L saline.

Management of patients with Acute renal failure

Heparin free dialysis should be initiated after central venous catheter insertion. Minimal heparin should then be administrated (see section 3.8)

3.7 Protocol for administration of heparin by nurses during haemodialysis for patients with a low risk of bleeding

Bolus injection dosage 30-50 iu/Kg
Continuous infusion 800- 1500 iu/HR (EBPG, 2002)
Example: *Patient weight is 70Kg and has 3 hours dialysis receives:*
Bolus = 30 X 70Kg = 2100 IU
Infusion = 1500 X 3hr = 4500 IU
(See administration of bolus and infusion in section 3.14)

3.8 Protocol for administration of heparin by nurses during haemodialysis for patients with a high risk of bleeding.

E.g.: Patients receiving warfarin, low platelets
Bolus injection dosage **10-25 IU/Kg**
Continuous infusion 10-22 IU/Kg/hr
Example: *Patient weight is 70Kg and has 3 hours dialysis receives*:
Bolus = 10 X 70Kg = 700 IU
Infusion = 10 X 70Kg X 3hrs = 2100 IU
(See administration of bolus and infusion in section 3.14)
For patients receiving warfarin, Standard oral anticoagulation with an INR

between 2 and 3 is insufficient to prevent clotting during haemodialysis. (Ziai et al, 2005).
Heparin dose must be individualized.

3.9 Administration of enoxaparin during haemodialysis for patients with a low risk of bleeding

Bolus dose only
0.70-1mg/kg
(Saltissi et al, 1999, Cari guidelines, 2005, Fischer, 2007)

3.10 Administration of enoxaparin during haemodialysis for patients with a high risk of bleeding.

E.g.: Patients receiving warfarin/ low platelets
Enoxaparin must not be administered to patients with a high risk of bleeding

3.11 Management of heparin – induced thrombocytopenia (HIT)

Type 1 HIT is characterised by a reduction in platelet count occurring within 5 days after initiation of heparin. It is transient on continuation of heparin and has no clinical consequences.
Type II HIT a more severe complication of heparin treatment that is antibody mediated. Despite thrombocytopenia, thrombosis is the main risk to the patient.
If type II HIT is suspected it should be confirmed by laboratory assay and heparin must be avoided. Low molecular weight heparins should also be avoided as there may be cross-reactivity with heparin. Established systemic alternative anticoagulation in patients with HIT is performed with Danaparoid, Lepirudin, or Argatroban (Fischer 2007).

Danaparoid for haemodialysis (2-3 sessions / week) patient's ≥ 55kg
Give 3750 units IV bolus prior to first and second dialyses (2500 units for patients < 55kg)
Give 3000 units before third dialysis and take a blood sample for anti-Xa level. Before forth and subsequent dialysis give the following Danaparoid IV bolus as per anti-Xa level

<0.3	3000 units	(2000 units if patient < 55kg)
0.3-0.35	2500 units	(1500 units if patient < 55kg)
0.35-0.4	2000 units	(1500 units if patient < 55kg)
>0.4	0 units however if a fibrin thread appears in the bubble chamber, 1500 units may be given	

The anti-Xa level during dialysis is expected to be 0.5-0.8 units / mL

Lepirudin for patients on continuous dialysis (CRRT). Give a loading dose of 0.2 mg / kg.
Infuse via syringe driver at 15 micrograms / kg / hour adjusted to APTT 1.5 – 2.5
A 1mg/mL solution may be made. Syringes should be changed every 12 hours
Argatroban – contact Pharmacy for further information

3.12 How to administer protamine sulphate in an emergency.

- Send blood sample for APTT, ACT, and antiXa.
- Protamine sulphate is a solution containing 10mg/ml. ideally the dose should be guided by blood coagulation studies.
- Limited data suggest that 1ml (10mg) of protamine sulphate will neutralize approx 1400 IU heparin.
- The dose of protamine should be reduced if more than 15mins have elapsed since IV heparin has been stopped.
- Maximum single injection should not exceed 50mg of protamine at one time.
- Protamine should be administered over a 10 minute period as a slow IV injection. The rate of infusion should not exceed 5mg/min.
- The efficacy of protamine should be monitored 5 -15 mins after administration.
- Rebound bleeding can occur after 2-4 hours (and up to 10 hours) when heparin dissociates from the protamine

3.13 Monitoring effectiveness of anticoagulant

- Monitoring venous pressure
- Monitoring Trans Membrane Pressure (TMP)
- Observing dialyser for signs of clotting (Clotting grades of the dialyser)

Grade	Adjustments to anticoagulation
1) <25% clots in dialyser and venous chamber	Check CBC, Monitor access, Observe for clotting next dialysis
2) 26-50% clots in dialyser and venous chamber	Check CBC, Monitor access. Increase loading dose by 5iu /kg
3) 51-75% clots in dialyser and venous chamber, rise in TMP	Check CBC, Monitor access. Increase loading dose by 10iu /kg
4) >76& clots in dialyser and venous chamber with marked rise in TMP**.**	Check CBC, Monitor access. Increase loading by 10iu/kg +/_ increase infusion dose by 100iu /hour

- If clots are evident on either dialyser or in venous bubble trap, review the patient's EPO therapy.

- **If haemorrhage (increased bleeding) occurs reduce the continuous infusion of heparin enoxaparin dose by 25 % and observe**

3.14 Procedure for administering heparin

Equipment: 20ml (Luer lock syringe), 2ml Braun syringe, Access needle X 2, Heparin vial, Saline, ID sticker

Action
Assess patients condition
Assess patients anticoagulation prescription
Wash hands
Collect equipment required
Draw up bolus injection and label syringe
Draw up continuous infusion injection, make syringe up to 20ml with NaCl and label the syringe
Check both drug preparations with another staff nurse
Place the 20ml syringe with heparin solution into the heparin mechanism on the dialysis machine and prime the heparin
Set the continuous infusion rate to 5mls/hr
Set the stop time for patients with CVC = no stop time Set the stop time for patient with Arteriovenous fistula to 20 minutes * Stop times maybe increased in some patients if the heparin prescription is deemed necessary to avoid coagulation of the extracorporeal circuit.
The bolus injection of Heparin should be administered through the access of the CVC or the arterial fistula needle followed by a saline flush of 10mls. The first needle that goes in should be chosen for administering the bolus dose.
3-5 minutes should be allowed prior to commencing dialysis
Commence dialysis and commence the continuous heparin infusion together
Discard all waste as per unit policy

3.15 **Procedure for administering enoxaparin.**

Enoxaparin should be administered into the arterial port of the extra corporal circuit at the beginning of dialysis.

SECTION 4

DEVELOPMENT AND CONSULTATION PROCESS –

CONSULTANT SUMMARY	
Date PPPG issued for consultation	17th January 2012
Number of versions produced for consultation	1
Committees/meetings where PPPG was formally discussed	Dates: 17th January 2012

Where Received	Summary of Feedback	Actions/Response
17/1/2012- Renal policy review meeting		**Completed**

SECTION 5

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APPENDIX 1

PROTOCOL FOR ADMINISTRATION OF HEPARIN TO PATIENTS ON HAEMODIALYSIS

UNFRACTIONATED HEPARIN (UFH) TO PATIENTS WITH LOW/NORMAL RISK OF BLEEDING

Heparin Bolus dose: 30 – 50 IU/Kg
Continuous infusion: 800- 1500 IU/Hr

UFH TO PATIENTS WITH HIGH RISK OF BLEEDING

Heparin Bolus dose: 10- 25 IU/Kg
Continuous Infusion: 10- 22 IU/Kg/Hr

ENOXAPARIN TO PATIENTS WITH LOW/NORMAL RISK OF BLEEDING

0.70- 1 mg/Kg given as a bolus dose only

ADJUSTMENTS TO ANTICOAGULATION

Grade	Adjustments to anticoagulation
1) <25% clots in dialyser and venous chamber	Check CBC, Monitor access, observe for clotting next dialysis
2) 26 – 60% clots in dialyser and venous chamber	Check CBC, monitor access, increase loading dose by 5IU/Kg
3) 51- 75% clots in dialyser and venous chamber, rise in TMP	Check CBC, monitor access. Increase loading dose by 10IU/Kg
4) >76% clots in dialyser and venous chamber with marked rise in TMP	Check CBC, monitor access. Increase loading dose by 10Iu/Kg+/- increase infusion dose by 100 IU/Hr.

- **If haemorrhage (increased bleeding) occurs reduce the continuous infusion of heparin enoxaparin dose by 25 % and observe**