



وزارة الصحة  
Ministry of Health

# Home Hemodialysis Complications Management

وزارة الصحة  
Ministry of Health

## Table of Contents

1- Introduction.....	3
2- Scope and aim .....	4
3- Targeted population .....	4
4- Methodology.....	4
5- Updating.....	5
6- Conflict of Interest .....	5
7- Funding.....	5
8- Disclaimer.....	5
9- Definitions.....	5
10- Policy .....	6
11- Procedure .....	6
12- Hypotension .....	7
13. Chest Pain During Dialysis.....	8
14- Dialyzer Reaction.....	9
15- Nursing Assisted home hemodialysis.....	10
16- References.....	11

## 1- Introduction

Hemodialysis is the most successful and most commonly used form of organ replacement therapy. Its success and widespread worldwide use attest to its safety. Hemodialysis (HD) is a life-sustaining treatment for patients with kidney failure and severe acute kidney injury (AKI). Home hemodialysis (HHD) is the modality of hemodialysis done in the home. During home hemodialysis, blood flows from the patient's vascular access through a dialysis machine. The dialysis machine cleanses the blood of extra waste and fluids and sends the clean blood back into the body. Home hemodialysis (HHD) was developed in the 1960s in the USA and the UK, and by the early 1970s, 59% of patients on dialysis in the UK and 32% of patients in the USA received dialysis at home, mostly overnight hemodialysis.

Internationally, the number of patients requiring treatment for end-stage kidney disease (ESKD) continues to increase, placing substantial burden on health systems and patients. Home hemodialysis (HD) has fluctuated in its popularity, and the rates of home HD vary considerably between and within countries although there is evidence suggesting a number of clinical, survival, economic, and quality of life (QoL) advantages associated with this treatment. International guidelines encourage shared decision making between patients and clinicians for the type of dialysis, with an emphasis on a treatment that aligned to the patients' lifestyle. There were a number of advantages for patients on home HD including improved survival and QoL and flexibility and potential for employment, compared to hospital HD. Similarly, there were several barriers to patients preferring or maintaining home HD, and the strategies to overcome these barriers were frequently reported. During this type of treatment, several complications may occur, inherent to the dialysis process, such as electrolytic imbalances, hypotension and cramps and due to individual patient responses to treatment and their contributing factors.<sup>3</sup> Thus, the nurse plays a key role in care and continuous observation of patients during hemodialysis session, being able to intervene, when necessary, in order to avoid complications through early detection of potential changes. Three types of hemodialysis can be performed at home. They are:

**Conventional home hemodialysis:** it is done three times a week for three to four hours or longer each time.

**Short daily home hemodialysis:** This is usually done five to seven times a week using new machines designed for short daily home treatment. Treatments usually last about two hours each. Because dialysis is done more often, less fluid generally needs to be removed each time. This reduces symptoms like headaches, nausea, cramping and feeling "washed out" after treatment.

**Nocturnal home hemodialysis:** Long, slow treatments done at night while you sleep. this kind of dialysis is done six nights a week or every other night. Treatments usually last about six to eight hours. You and your care partner are trained over several weeks.

It is also possible to combine daily and nocturnal home hemodialysis. Whether you can combine treatments depends on patient's needs, your medical condition and your machine.

- It is important to note that HHD modality has the flexibility to modulate frequency and duration. In essence, health providers may adjust the dose of hemodialysis to the goals and clinical outcomes that they aspire to achieve. High-intensity hemodialysis (five or more times a week, six to eight hours per session) is known to be associated with:
  - Regression of left ventricular hypertrophy
  - Stabilization of left ventricular remodeling
  - Normalization of blood pressure with reduction of vasoactive medications
  - Augmentation of left ventricular ejection fraction
  - Correction of obstructive sleep apnea
  - Normalization of phosphate levels without dietary restrictions
  - Improvement in kidney-disease-specific quality-of-life scores
  - Term delivery with reduced maternal and fetal complications
  - Minimized interdialytic fluctuations in fluid and biochemistry control
  - Enhanced survival compared with conventional three times per week hemodialysis

## 2- Scope and aim

This protocol makes recommendations on the nursing management of the complications associated with Home Hemodialysis (HHD) treatment and to improve patient safety and the provision of care. An attempt is made to list the steps in sequential order; however, in reality, many of these steps are performed simultaneously depending on the clinical situation.

## 3- Targeted population

Adult end-stage kidney disease patients on hemodialysis with special needs that hinders their ability to visit the dialysis center for hemodialysis. This cohort is usually under other home health care services and require home hemodialysis as renal replacement therapy.

## 4- Methodology

Considering evidence-based hemodialysis complications management, Procedures included here are according to the international guidelines for hemodialysis like KDOQI/KDOQI guidelines. The construction of a search protocol was performed, including objective, guiding question, search strategies (databases and the search order, keywords and intersections), selection of the study (inclusion and exclusion criteria), and strategies for data collection of the studies.

### 5- Updating

The first version of this protocol was created in 2023. This protocol will be updated within 12 months then every three years or whenever needed based on international/national protocols, health policies and guidelines. The feedback of dentists and home health care teams will also be considered in the periodic evaluation and updates.

### 6- Conflict of Interest

This protocol was developed based on current scientific evidence. No financial relationships with pharmaceutical, medical device, and biotechnology companies.

### 7- Funding

No fund was provided.

### 8- Disclaimer

This Clinical protocol is based on literature review for best available protocols and practices for managing home hemodialysis complications and to be used as a guide for management of home hemodialysis complication regimen. It is based on the best information available at the time of writing and is to be updated regularly. This protocol is not intended to be followed as a rigid treatment protocol. It is also not meant to replace clinical judgment of the service providing nurse/nephrologist, but it serves as an adjunct tool to aid in managing home hemodialysis complications. Treatment decisions must always be made on an individual basis.

### 9- Definitions

**9.1 HD - Hemodialysis:** is the removal of waste products and water from the blood through a filter. In clinical use, the uremic toxins are filtered from the blood by a semi-permeable membrane and are carried away from the dialysis fluid.

**9.2 UF - Ultrafiltration:** is a mechanism of fluid transport across this semi-permeable membrane. Ultrafiltration occurs as a result of hydrostatic pressure within the hollow fibers but mainly due to the negative pressure applied outside the hollow fibers. Those solutes that can pass easily through the membrane pores are swept along with water.

**9.3 TMP - Transmembrane Pressure:** is defined as the pressure gradient of the membrane, or the average feed pressure minus the permeated pressure.

**9.4 Extracorporeal circuit:** the path the hemodialysis patient's blood takes outside of the body. It typically consists of plastic tubing, a dialyzer, and a hemodialysis machine.

**9.5 Bloodlines:** a blood tubing which connects the patient to the hemodialysis machine.

**9.6 Dialyzer:** is called the artificial kidney, made up of hollow fibers through which blood passes. These fibers are made up of a semi-permeable membrane designed to remove uremic toxins and fluid from the body.

**9.7 Venous Pressure:** The pressure needs to infuse blood through the venous needle is referred.

**9.8 Arterial Pressure:** This is measured in one of two places. One is between your access & the blood pump (pre-pump arterial pressure). The other is between the blood pump and the dialyzer (post-pump arterial pressure).

### **10- Policy**

Patient selection will be based on the criteria approved by MOH for HHD. Selected patient will have full assessment clinically and for home environment and socially to before enrolling the patient into the service.

**10.1** The hemodialysis nurse should remain at the bedside for the duration of the hemodialysis treatment.

**10.2** All patients must be taught to recognize any unusual signs and symptoms/discomfort and advise to report to the nurse.

**10.3** infection control measures must be strictly implemented at all times.

### **11- Procedure**

Patient must be assessed by physician at first session and medical history to be obtained and documented in the chart. Regular assessment by physician must be done on regular basis and to be documented in the chart.

**11.1** Dialysis Nurse perform HD assessment and re-assessment and documentation of the patient's relevant medical history updates between treatments, e.g. new medications, traditional medicines, new symptoms including vital signs, and the HD machine parameters as follows:

**11.2.1** Asses the vascular access and ensure blood flow is adequate, if not , then to in inform the physician for assessment and treatment.

**11.2.2** Obtain baseline measurements for Blood Pressure, Heart Rate, Respiration, Temperature, and Blood Sugar prior to initiating the treatment.

**11.2.3** Check Vital signs every 30 minutes for the duration of the treatment and more frequently if there are changes in the patient's condition.

**11.2.4** Check Vital signs 15 minutes prior to termination and after treatment.

**11.3** During each HHD treatment the nurse shall ensure the following:

**11.3.1** The patient is thought to recognize and report any unusual symptoms and/or discomfort during home hemodialysis treatment, which include:

11.3.1.1 Dizziness

11.3.1.2 Headaches

11.3.1.3 Feeling flushed

11.3.1.4 Shortness of Breath

11.3.1.5 Chills/Rigors



11. 3.1.6 Weakness

11. 3.1.7 Camps

11. 3.1.8 Nausea

11. 3.1.9 Vomiting

**11.4** Machine safety alarms are tested, active and functioning prior to initiation of HD treatment and monitor these alarm parameters throughout the HD treatment.

**11.5** The connections to the dialyzer and bloodlines and between the patient's access and the extracorporeal circuit are always secured.

## 12- Hypotension

**12.1** During HD treatment the nurse should observe for signs and symptoms of Hypotension, which include:

12.1.1 Patient complains of feeling dizzy, light-headed, nauseous or hot.

12.1.2 Patient may yawn, vomit or become vague or less responsive.

12.1.3 Arterial pressure alarms.

12.1.4 If the patient complains of the above the nurse should immediately take a BP reading and compare it to previous BP readings.

12.1.5 The nurse should also consider the patients' known cardiac status.

**12.2** If the patient complains of any of the symptoms listed in (12) the nurse should do the following:

12.2.1 Turn Ultrafiltration (UF) OFF.

12.2.2 Lay patient flat.

12.2.3 If the patient complains of mild symptoms the nurse may:

12.2.3.1 Leave UF turned off for 5 minutes.

12.2.3.2 Observe the patient closely.

12.2.3.3 Repeat BP again.

12.2.4 If the patient's BP has recovered the UF can be decreased by 0.2L (or more if needed) and treatment continued.

**12.3** If the patient complains of more severe symptoms and/or the systolic BP has dropped by more than 20mmhg the nurse should:

12.3.1 Notify the physician immediately.

12.3.2 Infuse 150 mls saline/online fluid.

12.3.3 Commence O<sub>2</sub> therapy- (If needed)

12.3.4 Saline/On-line infusions can be repeated at 5-minute intervals up to max of 500 mls.

12.3.5 The nurse should measure and record the patients BP after each fluid infusion.

**12.4** If there is no improvement in symptoms and/or BP despite the above measures the nurse should: consider

12.4.1 Albumin Infusion (PRN order should be on system if required)

12.4.2 Contact the Physician

12.4.3 Terminating the treatment.

**12.5** If the patient recovers and there is an improvement in symptoms and BP readings the nurse should:

12.5.1 Recommence UF.

12.5.2 Reduce the UF volume by 0.2L or more if indicated.

12.5.3 Monitor the patients BP closely for the remainder of the HD treatment.

**12.6** If the patient experiences hypotension during any HHD treatment the nurse should:

12.6.1 Document hypotensive episode/s and outcomes during each treatment.

12.6.2 Assess predisposing factors and consider changes to the patient's dry weight, UF goal or antihypertensive agents and document this for future treatments.

12.6.3 Monitor postural blood pressure prior to discharge.

### **13. Chest Pain During Dialysis**

**13.1** If the patient complains of chest pain during HD treatment the nurse should:

13.1.1 Identify possible causes (cardiac V muscular injury).

13.1.2 Check/monitor BP and Heart Rate (assess Quality and Rhythm).

**13.2** If noticeable changes in BP and or heart rate are present from baseline readings the following actions should be taken by the nurse:

13.2.1 Treat hypotension if present.

13.2.2 Reduce blood flow rate 100mls/min.

13.2.3 Administer Nasal oxygen at 4 liters/min.

13.2.4 Consult the physician immediately.

13.2.5 If pain is unresolved or becomes worse inform physician and cease hemodialysis immediately.

**13.3** If no noticeable changes are present from baseline the following actions should be taken by the nurse:

13.3.1 Treat hypotension if present.

13.3.2 Reduce blood flow rate 100 mls/min for 5 minutes and monitor patient

13.3.3 Closely and reassess.

13.3.4 If symptoms resolve increase blood pump speed gradually and continue treatment.



13.3.5 If further episodes of chest pain persist cease hemodialysis and inform physician.

#### **14- Dialyzer Reaction**

**14.1** Causes: Dialyzer reactions refer to all of the abnormal events that occur as a result of the interaction between the blood constituents and the hemodialysis membrane within the dialyzer and are caused by:

14.1.1 Hypersensitivity to the dialyzer sterilant Ethylene Oxide (EO).

14.1.2 Characterized by anaphylactic type symptoms.

14.1.3 Usually begins within the first few minutes of dialysis.

**14.2** Complement activation as a result of blood contact with the dialyzer membrane

14.2.1 Less threatening but more commonly seen.

14.2.2 Symptoms usually occur as soon as the patient's blood is exposed to the dialyzer.

**14.3** Signs/Symptoms (Mild to Severe):

14.3.1 Itching

14.3.2 Burning sensation at the access site

14.3.3 Urticaria

14.3.4 Flushing

14.3.5 Cough

14.3.6 Sneezing

14.3.7 Wheezing, SOB

14.3.8 Abdominal cramps

14.3.9 Diarrhea

14.3.10 Headache

14.3.11 Back and chest pain

14.3.12 Nausea/vomiting

14.3.13 Fever

14.3.14 Chills

**14.4** More severe reactions lead to dyspnea, a sense of impending doom, and hypotension, potentially resulting in cardiac arrest and death.

**14.5** Prevention:

14.5.1 Ensure that the dialyzer is adequately primed with the full priming volume.

14.5.2 If sensitivities occur, consider increasing the priming volume by 1L.

14.5.3 If sensitivities continue, consider an alternate dialyzer manufacturer.

**14.6** In the event of a suspected dialyzer reaction the nurse should do the following:

14.6.1 Immediate termination of dialysis without return of the patient's extracorporeal blood.

14.6.2 NaCl should be infused directly into the patient's vascular access to prevent hypotension if needed.

14.6.3 Monitor vital signs.

14.6.4 Administer Oxygen if the patient is experiencing difficulty in breathing.

14.6.5 Pulse Oximetry monitoring if required.

14.6.6 Notify the Nephrologist.

14.6.7 Intravenous antihistamine and/or steroids and/or epinephrine may be administered once the patient after consulting the physician. Cases of suspected anaphylaxis should be treated as a medical emergency and EMS should be activated.

## **15- Nursing Assisted home hemodialysis**

### **15.1 Contraindications to Home HD**

**15.1.1** Home is inappropriate for home hemodialysis.

**15.1.2** Active sepsis

**15.1.3** Unstable medical conditions (e.g., uncontrolled arrhythmia, seizure disorders).

**15.1.4** Lack of suitable vascular access which includes AVF, AVG, CVC.

**15.1.5** Unstable behavioral problems (e.g., uncontrolled psychosis or anxiety, ongoing injection drug use and alcohol abuse, advanced dementia).

**15.1.6** Contraindication to anticoagulant use during dialysis.

**15.1.7** Conditions that may cause abrupt loss of consciousness (e.g., severe and unstable intradialytic hypotension).

**15.1.8** History of non-compliance.

**15.1.9** Patients with the following medical conditions:

15.1.9.1 Severe sleep apnea.

15.1.9.2 Decompensated heart failure.

15.1.9.3 Uncontrolled ascites.

15.1.9.4 Refractory volume overload.

15.1.9.5 Difficult-to-control hypertension.

15.1.9.6 Symptomatic hypotension, cramps, or nausea on conventional HD.

15.1.9.7 Inadequate control of uremic symptoms on conventional HD.

15.1.9.8 Excessive recovery time after conventional HD.

### **15.2 Acceptance Criteria for Home HD Program**

- 15.2.1** Adult Patients with ESKD who are already on hemodialysis as per nephrologist's assessment and order.
- 15.2.2** Patients who are able to physically and cognitively manage the tasks of care by himself / herself or have a support person.
- 15.2.3** Absence of complications and significant concomitant disease that would cause home hemodialysis to be unsafe or unsuitable.
- 15.2.4** Patients who need hemodialysis and are hemodynamically stable and do not need cardiac monitoring as per nephrologist's order.
- 15.2.5** All patients shall have functioning hemodialysis vascular access which includes AVF, AVG, CVC.
- 15.2.6** All patients must have a caregiver available, whether formal or informal, to support them throughout the home hemodialysis session.
- 15.2.7** All patients must have a suitable home that meets the basic safety requirements for home healthcare staff.
- 15.2.8** All patients must have a suitable home that meets the basic safety requirements for a hemodialysis machine and complies with safety regulations set forth by regulatory bodies such as the Saudi Food and Drug Authority (SFDA), Civil Defense, and other relevant authorities involved in ensuring the safety and security of medical equipment.

### **15.3 Discharge Criteria for Home HD Program**

- 16.3.1** Change in patient preference of dialysis modality
- 16.3.2** Deterioration in medical status.
- 16.3.3** Cannot cope with the burden of home HD.
- 16.3.4** Non-compliance.
- 16.3.5** Insurmountable language barrier.
- 16.3.6** Inadequate family support.

## **16- References**

- 16.1** Daugirdas, J.T., Blake, P.G., Ing. T.S., 5th Edition (2015). Handbook of Dialysis (44th Ed.). Lippincot, Williams & Wilkins, New York.
- 16.2** Molzahn, A. & Butera, E. (2006). Contemporary Nephrology Nursing, Standards of Practice and Guidelines for Care. ANNA, Anthony J. Jannetti Inc., Pitman, New Jersey.
- 16.3** <https://www.kidney.org/atoz/content/homehemo>
- 16.4** Ibrahim A, Chan CT. Managing Kidney Failure with Home Hemodialysis. Clin J Am Soc Nephrol. 2019 Aug 7;14(8):1268-1273. doi: 10.2215/CJN.13931118. Epub 2019 Jul 24. PMID: 31340978; PMCID: PMC6682817.