**MACHINE ALARAM DURING DIALYSIS**

**Hemodialysis System components:**

**1.Extra-corporeal blood circuit**

**2.Intra-corporeal blood circuit**

**1.Blood circuit consist of:**

* **An access(needles or catheters).**
* **Blood tubing**
* **Blood pump**
* **Heparin pump**
* **Dialyzer**

**Role of the blood circuit to deliver blood to the dialyzer at the prescribed flow rate and then return the blood to the patient.**

**2. Dialysate circuit consist of:**

**The function of the dialysate circuit:**

* **To prepare dialysate from concentrate and water**
* **To deliver it to the dialyzer at the prescribed (generally 35 -37 c) and flow rate**
* **To control fluid removal from the patient**

**Safety monitors in hemodialysis machine**

**Alarms in HD machine**

**1. Blood alarms**

**2. Dialysate alarms**

**3. Other alarms**

**Blood alarms:**

* **Arterial pressure (100 to 200 MMhg)**
* **Venous pressure**
* **Trans membrane pressure**
* **UF pump**
* **Blood leak**
* **Air foam detector**

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| **Low arterial pressure** | **High arterial pressure** |
| * **Blockage of the arterial blood from the patients access** * **Compressions or kink in the arterial blood line** * **Wrong position or infiltration of the arterial needles** * **Blood pump set at a rate higher than the vascular access can supply** * **Hypotension** * **Vasoconstriction (lightening of the patients blood vessels)** * **Poor working central catheter** | * **A blood line separation (if the upper limits is set below zero)** * **A leak between the patient and the monitoring site** * **A drip in the blood pump speed** * **Infusion of saline or medicines** |

**Management of AP alarm:**

**Check the arterial tubing for kinks ,clotting, or clamps**

**Check the needle position and access clots**

**Ensure that the transducer protector is dry.**

**Management of high vp alarm**

**Check venous tubing for loose connections, kinks ,clots or loose clamps**

**Ensure that the transducer protector is dry replace it if necessary.**

**Check access point for clotting and needle position.**

**Press reset to reset alarm. If it is unable send machine to technician**

**Trans membrane pressure**

* **It is the difference pressure between blood and fluid compartment**
* **The pressure must be positive.**
* **The capacity range (-400 +350 )mmHg**
* **Today, the uf control sets the UFR which is used to calculate a TMP**

**TMP=UFR/KUF ( Ultra filtration rate)**

**The higher the TMP due to the higher the UFR**

**High TMP = more than 500**

**Low TMP = -25 or less**

**Management of high TMP**

* **check the dialysate lines for kinks.**
* **Check the shun connectors with dialyzer.**
* **Press reset to reset alarm. If it is unable**

**send machine to technician**

* **Or lower the uf goal will reduce tmp**

**Management of low tmp**

* **Ensure that the transducer protector is dry**

**Replace it if necessary.**

* **Check the dialysate lines for kinks.**
* **Check the dialysate line filter screen to**

**Make sure it is clean**

* **Press reset to reset alarm. If unable to send machine to technician**
* **Or increase the uf goal will raise tmp**

**Uf pump**

* **Uf pump the removes water from the close loop through the dialyser membrane**
* **It creates negative pressure in dialysate side of the dialyser versus the blood side.**

**Causes of uf pump alarm**

**UF pump is not connected or is not pulsing properly.**

**Management of UF pump alarm**

**Take machine out of service and send Machine to Technician.**

**E –Blood LEAKAGE**

**Blood –Leak Detector**

* **The blood leak moniter allows detection of blood leaks and prevention of dialysate contamination by blood downstream of the dialyzer.**
* **This moniter functions by transmitting filtered or unfiltered light through a column of effluent dialysate that exited dialyzer.**

**Causes of Blood Leak**

* **Teare of leak in the dialyzer membrane cause RBCs to leak into thedialysate, interrupting the light transmission.**
* **The sensitivity of moniter is .0.2 of 0.35 ml of blood per liters of dialysate.**
* **Moniter triggers visual and audible alarms , immediately deactivating blood pump.**

**Management of Blood Leakage Alarm**

* + **Stop the blood pump.**
  + **Clamp the venous line.**
  + **Follow your clinic’s procedures for a blood leak to stop the treatment without returning the patient’s blood.**

**F –AIR FOAM DETECTOR**

* + **Air –form detection monitors blood in in the venous tubing for the presence of air, form, and microbubbles.**
  + **The usual volume of air needed to active alarm 60ml 125ml.**

**Causes of Air Leak**

* **Empt saline bag.**
* **Under-filled drip chambers.**
* **Disconnect in the extracorporeal circuit.**
* **Needle removed with the blood pump on.**

**Management of Air leakage Alarm**

* **Clamp the line befor air reaches the patient**
* **Stop the pump .**
* **Put the patient in Trendelenlenburg.**
* **Put patient on left side position.**
* **If ordered , give saline and oxygen.**
* **Activate code if needed.**

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| **2. Dialysate alarms** |
| 1. **CONDUCTIVITY ALARM** |
| 1. **TEMPERATURE ALARM** |

**A-CONDUCTIVITY ALARM**

* **The conductivity measurement is an estimate is an estimate of total ionic content of dialysate ,and does not measure or reflect specific ions.**
* **The conductivity monitoring ensures proper water ;concentrate ratio of the dialysate**
* **The normal range is 13 to15 ms/cm.**

**Causes of conductivity alarm**

* **Dialysate container empty**
* **Change in electrolyte concentration of dialysate**
* **Abnormal water inlet pressure**
* **Water leaks or puddles beneath the mixing chamber**
* **Concentration line connector unplugged**

**Management of conductivity alarm**

1. **Check to see if dialysate flow is on ;**

* **Make sure the supply of concentrate is adequate**
* **Make sure the concentration has been mixed properly , (i.e. bicarbonate mixed well with ro water)**

1. **Verify that concentrate connectors are**

**sucking concentrate if not:**

* **Turn off dialysate flow and disconnect the concentrate suction connectors from their wands**
* **Check for clogged filter screen in the connectors**

**Handles , especially the bicarbonate connector**

* **Check that o rings on the tips of the concentrate connectors are not damaged or missing**
* **Reconnect the connector to the wand and turn on dialysate flow and recheck the connectors for suction**
* **If suction is present , allow 5 minutes for conductivity to reach the normal level.**

1. **If conductivity alarm ongoing**

* **Discontinue treatment and remove patient from the machine**
* **Send machine to the technician**

**Temperature alarm**

* **The dialysate temperature monitor by heat sensor that near the dialyser**
* **The usual recommended temperature range is 35 to 38o C**

**Highi temperature Alarm**

* **Normal red blood cells (RBCs) begin to hemolyze or Protein denaturing at 42oc.**

**Management of high temp alarm**

* **Male sure that water is flowing to machine.**
* **Check water supply to machine for excess temperature and correct if nessary.**
* **If heat disinfection was recently performed, place machine in rinse cycle to decrease temperature.**
* **Check the Temperature value in the “machine screen” . Re-enter it if necessary and allow five minutes for the temperature to stabilize.**
* **Check that the dialysate flow at drain line is 500 ml/min+ 50ml.**
* **If high temp still alarm discontinue TX & send machine to the techinican.**

**high temperature alarm**

* **normal red blood cells (rbcs) begin to hemolyze or protein denaturing at 420c**

**management**

* **Make sure that water is flowing to machine**
* **Check water supply to machine for excess temperature and correct if it is necessary**
* **If heat disinfection was recently performed by place machine in rinse cycle to decrease temperature**
* **Check the temperature valve in the machine screen re enter it if necessary and allow five minutes for the temperature to stabailize**
* **Check that the dialysate flow at drain line in 500 ml/min +50 ml**
* **If high temp still alarm discontinue tx and send machine to the technician.**

**Low temperature Alarm**

* **Colder dialysate temperature are used to prevent hypotensive episodes during HD.**
* **When dialysate is too cool, the patient will feel cold and less diffusion will occur.**

**Management of Low Temperature Alarm**

* **Check the machine in Dialysis status and the dialysate flow is on.**
* **Make sure the heater in switch on position” on the back panel”**
* **Check the water supply to the machines for excessively cold temperature and correct.**
* **Check the temperature value in the “machine screen “. Re-enter it necessary and allow five minutes for the temperature to stabilize.**
* **If Low Temperature still alarm discontinue treatment &send machine to the technician.**

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| **3. Other Alarms** |
| **A-FLOW PUMP** |
| **B-WATER DEFICIENCY** |
| **C-POWER FALURE** |
| **D-HEPARIN ALARM** |

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| **A-FLOW PUMP** |

* **A flow pump controls that dialysate flow to the dialyzer.**
* **The patients nephrologist prescribes the rate.**
* **Dialysate flow rates range from 0-1,000ml/min.**
* **Higher dialysate flow rates improve dialyzer efficiency up to about 800ml/min**

**Causes of Flow pump Alarm**

* **Low water pressure**
* **Dialsate pump failure**
* **A blockage in the dialysate flow path.**

**Management of Flow pump Alarm**

* **Sent machine to the technician.**

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| **B-WATER DEFICIENCY** |

* **Patients are exposed to large volumes of water during each HD Tx.**
* **The purity of the water essential to exposure to aluminum, chloramines, endotoxin, and bacteria.**

**Causes of Water Deficiency Alarm**

* **A water inlet valve alarm has occurred**
* **The machine is not receiving enough water.**

**Management of Water Deficiency Alarm**

* **Inspect the treatment water source supplying the machine .**
* **Correct as required.**
* **If water deficiency still alarm send machine to the technician.**

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| **C-POWER FALURE** |

* **The battery sets off an alarm on the machine.**
* **All system and monitors are now OFF.**
* **The system is no longer FAILSAFE.**

**Causes of Power Failure Alarm**

* **Machine is unplugged.**
* **Machine failure.**
* **Power outage.**

**Management of Power Failure Alarm**

* **Do not pump blood from patient into the system .**
* **Recirculate blood manually for maximum of 15 to 30 min.**
* **Disconnecte the venous clamp to return blood with introduce Hepain manually.**
* **If power failure still alarm send machine to the technician.**

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| **D-HEPARIN ALARM** |

* **Heparin, is required to prevent thrombosis in blood circuit.**

**Cause of Heparin Alarm**

* **Heparin syringe not correctly held in place.**
* **Hepain line not connected correctly or kinked.**
* **Arterial line not inserted into occlusion clamp.**

**Management of Heparin Alarm**

* **Check heparin grip handle and line .**
* **Insert arterial line to occlusion clamp.**
* **If alarm still ongoing:**
* **Switch off the heparinization.**
* **Heparinize manually.**
* **Call biomed to fix it.**