DIALYSIS MENTOR-DPSI-12/2011

MANAGEMENT OF POISONING

BY

P.DAVID BALU(P.BALAKRISHNAN)
DR.T.THIAGARAJAN
N.RAVISANKAR
RL.BHAT

DIALYSIS PERSONNEL SOCIETY OF INDIA
Management of poisoning

Treatment options

- **Dialysis** can be an effective way to treat some patients exposed to poisons or drug overdose. HD can also enhance poison elimination and correct electrolyte abnormalities and metabolic acidosis rapidly. PD is much less effective and rarely used in small children.
- **PD** is not effective in removing the blood, being one eighth to one fourth as efficient as hemodialysis. In spite of that, when HD is difficult to institute quickly, such as in small children, a prolonged session of peritoneal dialysis can be a valuable treatment for poisoning.
- **HD** is the therapy of choice for water soluble drugs, especially those of low molecular weight along with a low level of protein binding, which will diffuse rapidly across the dialyser membrane. HD is not very useful in removing lipid solute drugs with large volumes of distribution or drugs extensive protein binding.
- **Hemoperfusion** is a process whereby blood is passed through a circuit containing an adsorbent such as charcoal, carbon, or polystyrene resin. Drugs that bind to the adsorbent are more effectively cleared by hemoperfusion than by HD. Hemoerfusion can also eliminate protein bound and lipophilic toxins and drugs.

Elimination of poisons in **HD**

- Poisons less than 500 Daltons molecular weight
- Low degree of protein binding Poisons
- Water soluble poisons
- Small volume of distribution

Elimination of poisons in **Hemoperfusion**

- Large molecular weight poisons
- High protein bound poisons
- Lipid soluble poisons

Indications for **Hemoperfusion**

- Severe clinical intoxication
- Clinical deterioration
- Prolonged coma
• Poisoning with substances with delayed actions
• Impaired renal or liver clearances
• Known toxic levels of a dialyzable drug

**Importance of volume distribution**

• The volume distribution is the theoretical volume into which a drug is distributed. Distribution is the movement of an absorbed drug from the site of administration and absorption to other locations in the body. The distribution of a drug will continue until its concentration in the plasma and tissues reaches equilibrium.

• Volume distribution is dependent upon the, protein binding, tissue binding, lipid solubility, polarity, the capillary permeability of various organ, the volume of the body water, perfusion rates and redistribution.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Specific properties</th>
<th>Effect of Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein binding</td>
<td>High percentage</td>
<td>Decreased</td>
</tr>
<tr>
<td></td>
<td>Low percentage</td>
<td>Increased</td>
</tr>
<tr>
<td>Tissue Binding</td>
<td>High percentage</td>
<td>Decreased</td>
</tr>
<tr>
<td></td>
<td>Low percentage</td>
<td>Increased</td>
</tr>
<tr>
<td>Lipid Solubility</td>
<td>High Degree</td>
<td>Increased</td>
</tr>
<tr>
<td></td>
<td>Low Degree</td>
<td>Decreased</td>
</tr>
<tr>
<td>Polarity</td>
<td>Polar</td>
<td>Decreased</td>
</tr>
<tr>
<td></td>
<td>Non polar</td>
<td>Increased</td>
</tr>
<tr>
<td>Capillary Permeability</td>
<td>Increased</td>
<td>Increased</td>
</tr>
<tr>
<td></td>
<td>Decreased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Volume of body water</td>
<td>Increased</td>
<td>Increased</td>
</tr>
<tr>
<td></td>
<td>Decreased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Perfusion rates</td>
<td>Increased</td>
<td>Increased</td>
</tr>
<tr>
<td></td>
<td>Decreased</td>
<td>Decreased</td>
</tr>
<tr>
<td>Redistribution</td>
<td>Increased</td>
<td>Increased</td>
</tr>
<tr>
<td></td>
<td>Decreased</td>
<td>Decreased</td>
</tr>
</tbody>
</table>

• The effect of renal failure on the distribution of a drug is related to the increased fluid volume and decreased amount of protein binding that occurs in uremic patients. While this decreased protein binding may be related to hypoalbuminemia, it is probably more directly attributable to the uremic state.

• In uremia, distribution is hypothesized that abnormal binding sites are created in proteins, and also that small, retained molecules competitively displace drugs from normal binding sites. The result of these mechanisms is the increased plasma concentration of normally protein binding drugs.

**Technical Requirements**

• Discuss with nephrologist about the patient’s clinical situation. Assist nephrologist to perform Hemoperfusion/HD.
• Arrange catheter kit, sterile gowns, and sterile trays if Hemoperfusion/HD is contemplated.
Choose high flux membranes with biocompatible membrane for HD/Hemoperfusion.

Available hemoperfusion cartridges are activated carbons, ion exchange resins, or nonionic exchange macro porous resins. Sorbent particles have been rendered biocompatible by coating the surface with a polymer membrane. Seek nephrologist before order hemofilter.

Arrange blood tubings. Setup and priming procedure should be followed by manufacturer’s instructions.

The hemoperfusion cartridge must be primed in a vertical position with an arterial facing down.

If decided to use Gambro’s NORIT type of sorbent, this cartridges be rinsed initially with 500ml of 5% dextrose normal saline to load the charcoal with glucose to prevent subsequent hypoglycemia.

If Gambro’s hemofilter is primed with 5% D solution, the cartridge is rinsed with 2 liters of heparinised normal saline at a flow rate of 50-150ml/mt.

In rinsing Clark hemofilters, the final liter of rinsing fluid be passed through the cartridge at 300ml/mt.

Hemoperfusion requires anticoagulation approximately 6000-1000iu/treatment. Some heparin is adsorbed by charcoal. Monitor anticoagulation as for HD.

Usually, 3 hours of hemoperfusion is enough to substantially lower the blood levels of most poisons and saturated a cartridge. Cartridge may need to change every 4 hours in the course of continuous treatment.

Seek advice from nephrologist for better care and cure

Performing HD for poisoning may contribute hypophosphatemia, hypokalemia, metabolic alkalosis and disequilibrium syndrome.

In hemoperfusion, mild thrombocytopenia and leucopenia may occur but levels usually return to normal within 24 hours, post Hemoperfusion.

Monitor patient carefully and carry out nephrologist order.

<table>
<thead>
<tr>
<th>Drugs/Toxins</th>
<th>M.wt/ Vd / Binding</th>
<th>HD / HP / Antidote</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Acetaminophen</td>
<td>154 / ------- /w.s +Pb</td>
<td>YES/ YES / NAC</td>
<td>HP should be performed within 4 hours after ingestion. Check LFT. Carry out Neph.order</td>
</tr>
<tr>
<td>2.Aspirin</td>
<td>180 / 0.15L/kg / 50%PB</td>
<td>HD/gastric lavage,oral charcoal+ alk.diuretics</td>
<td>HD, if exceeds serum level&gt;80mg/dl. Monitor sign and symptoms, report to nephrologist</td>
</tr>
<tr>
<td>3.Phenobarbital</td>
<td>234/ 0.5L/kg / 50%PB</td>
<td>MDAC+Alk.Diuretics/HD /HP</td>
<td>Consult nephrologist Monitor patient.</td>
</tr>
<tr>
<td>4.Digoxin</td>
<td>173 /8L/kg for normal,4.2L/kg for dialysis patients/25%</td>
<td>HD /HP</td>
<td>Consult nephrologist</td>
</tr>
<tr>
<td>Protein bound.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td><strong>5. Ethylene glycol</strong></td>
<td>62 / water soluble</td>
<td>----/-----/ethanol / Fomepizole. Monitor Pt. very closely, check potassium, calcium, bicarb and urine routine and report to nephrologist. Patient with severe metabolic acidosis, renal failure and serum level of ethylene glycol more than 50mg/dl may required HD.</td>
<td></td>
</tr>
<tr>
<td><strong>6. Methanol</strong></td>
<td>32 / Water soluble</td>
<td>HD----/ethanol / Fomepizole</td>
<td></td>
</tr>
<tr>
<td><strong>7. Isopropanol</strong></td>
<td>60 / Water soluble</td>
<td>HD----/--------</td>
<td></td>
</tr>
<tr>
<td><strong>8. Lithium carbonate</strong></td>
<td>7 / water soluble/0.8</td>
<td>HD/ HDF/------</td>
<td></td>
</tr>
<tr>
<td><strong>9. Mushroom poisoning</strong> (alpha-amanitin and phalloidin)</td>
<td>900/--------/--------</td>
<td>HD/HP/PP</td>
<td></td>
</tr>
<tr>
<td><strong>10. Paraquat (herbicide)</strong></td>
<td>257/--------/--------</td>
<td>Gastric lavage,AC/HP/PP</td>
<td></td>
</tr>
<tr>
<td><strong>11. Phenytoin(Aconvul)</strong></td>
<td>252/0.64/ PB</td>
<td>HD-poor, HP-Moderate</td>
<td></td>
</tr>
<tr>
<td><strong>12. Sodium valporate(sedative)</strong></td>
<td>166/ ---/ PB</td>
<td>HFHD+HP</td>
<td></td>
</tr>
<tr>
<td><strong>13. Meprobamate(sedat)</strong></td>
<td>218/-----/LS+PB</td>
<td>HD/HP</td>
<td></td>
</tr>
<tr>
<td><strong>15. Carbamazepine</strong></td>
<td>236/-----/-------</td>
<td>HFHD/HP</td>
<td></td>
</tr>
<tr>
<td><strong>16. Theophylline</strong></td>
<td>180/0.5l/kg/56%PB</td>
<td>MDAC/HD/HP</td>
<td></td>
</tr>
<tr>
<td><strong>17.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>