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TEXTBOOK FOR DIALYSIS TECHNICIANS

As per the Latest Guidelines and Syllabus

Highlights

- Covers all practical aspects of dialysis and its related topics
- Includes additional nephrology topics important for dialysis technician
- Special emphasis on clinically relevant and hands on aspects

Narinder Pal Singh
Vineet Behera

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Complications During Hemodialysis

18
CHAPTER

Mohan V Bhojaraja, Dharshan Rangaswamy, Jyothipriya Jyothindrakumar

INTRODUCTION

Patients undergoing hemodialysis may encounter various complications throughout the procedure. These complications can be incapacitating, potentially fostering resistance to dialysis and thereby contributing to increased mortality and morbidity.

COMMON COMPLICATIONS

Intradialytic Hypotension

- **Defined** as a nadir (lowest) SBP <90 mm Hg (most accepted), seen in 5–30% of all dialysis treatments and risk factors being old age, diabetes, low albumin, lower predialysis BP, females and longer vintage.
- **Causes** include volume related-large weight gain, short dialysis time, low target ("dry") weight; inadequate vasoconstriction-high dialysate temperature, autonomic neuropathy, antihypertensives, eating during treatment anemia; cardiac factors and rarely hemorrhage, sepsis, dialyser reaction, hemolysis and air embolism.
- **Management**: Ultrafiltration should be stopped → position the patient in the trendelenburg position → administer IV fluid bolus (rapid administration of hypertonic saline or slow administration of 0.9% saline).
- **Preventive strategies**:
  1. *First-line approach*: Review the dry weight assessment, adjust the timing of antihypertensive medications, refrain from food intake during dialysis, ensure dialysate calcium and magnesium levels are at or above 2.25 mEq/L and 1.0 mEq/L, respectively, restrict interdialytic sodium intake, and reconsider the dialysate sodium prescription.
  2. *Second-line approach*: Evaluate cardiac function, increase the dialysis treatment time and use cool-temperature dialysate.
  3. *Third-line approach*: Midodrine (2.5–5 mg, prior to dialysis), change to other modes of dialysis, and correction of anemia.

Intradialytic Hypertension

- **Major cause** for intradialytic hypertension is volume expansion, although sympathetic overactivity and activation of the renin-angiotensin system also contribute.
- For patients on dialysis, we use self-recorded home BP. If not possible, midweek median intradialytic systolic BP is used, with a target of <140/80 mm Hg.
- **Management**: Reduce target dry weight, start treatment with beta blocker followed by addition of other antihypertensive medications.

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Chest Pain

- Mild chest pain is seen in 1–4% of dialysis with no known cause and no specific treatment.
- **Management:** Stop ultrafiltration → decrease the blood flow rate to equal or less than 200 mL/min → place the patient in a supine position → administer oxygen → document vital signs → visually examine the venous line blood for air bubbles or a port-wine appearance → obtain a 12-lead electrocardiogram → if persistent chest pain, then dialysis should be discontinued.

Dialyser Reactions

Type A reactions (less common): Seen in first few minutes. Mild symptoms include urticaria, cough, wheezing, headache, nausea, vomiting. Severe reactions include hypotension, dyspnea and potentially resulting in cardiac arrest and death.

- Can be **due to** ethylene oxide, AN69-associated reactions, dialysate contamination, reuse heparin and complement fragment release.
- **Management** involves discontinuing dialysis and implementing supportive therapies, such as antihistamines, steroids, and epinephrine.
- **Prevention:** Rinsing of the dialyser, employing effective sterilization techniques, refraining from dialyser reuse, and avoiding the use of polyacrylonitrile (PAN) membranes in patients undergoing ACE inhibitor treatment.

Type B reactions: Occur 15–30 minutes into the dialysis, often improves with continuation of the dialysis. The most common symptoms are dyspnea, nausea, vomiting chest and back pain. They are complement mediated. The treatment is supportive and can be prevented by reuse of the dialyser.

Cramps

- It's a common complication the pathogenesis of which is unknown. The most common causes include hypotension, hypovolemia, high ultrafiltration rate, and use of low-sodium dialysate.
- **Prevention:** Stretching exercises, adjusting dialysate sodium and magnesium, use of biotin, carnitine, oxazepam, vitamin E and quinine.
- **Management:** Treatment with 0.9% saline, hypertonic solutions (saline, glucose and mannitol)

Seizures

- Seizures may result from diverse factors including uremic encephalopathy, dialysis disequilibrium syndrome (DDS), hemodynamic instability during dialysis, dialysis dementia associated with aluminum exposure, air embolism, hypoglycemia, hypocalcemia, and hyponatremia.
- **Emergency intervention** involves discontinuing dialysis and ensuring patient safety. Serum levels of glucose and other electrolytes should be assessed and appropriately adjusted.

Dialysis Disequilibrium Syndrome

DDS is characterized by neurological symptoms affecting patients initiating hemodialysis or those who have missed multiple consecutive sessions.

Risk factors: Elevated blood urea nitrogen (BUN) levels (>175 mg/dL or 60 mmol/L), extremes of age, pre-existing neurologic diseases, encephalitis, and cerebral edema.

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Pathogenesis: Cerebral edema is theorized to be induced by the rapid clearance of urea and other osmoles during hemodialysis, resulting in a swift decline in plasma osmolality and subsequent water movement into neurons.
Clinical manifestations: Restlessness, progressing to confusion, headache, nausea, blurred vision, disorientation, seizures, coma, mania, and potential fatality.
Prevention: For newly initiated hemodialysis patients, commence with short sessions at low blood flow and sodium modeling may be employed for patients with recurrent nonadherence.
Treatment: Halt dialysis and investigate alternative causes. If severe DDS persists despite sodium modeling, consider a trial of hypertonic saline or mannitol. Subsequently, plan for daily, short, low-efficiency dialysis sessions akin to the initiation phase for new dialysis patients.

Headache, Nausea, and Vomiting

- These are nonspecific common symptoms usually in which dialysis is continued, antiemetics and supportive treatment are given.
- **Syndrome of dialysis-associated headache:** Either bifrontal or temporal following dialysis commencement, intensifying throughout the session, and resolving within 72 hours which is attributed to alterations in vasoactive nitric oxide.

Hemolysis

- May be a medical emergency manifested by back pain, tightness in the chest, and shortness of breath with dramatic deepening of skin pigmentation and port-wine appearance of blood in the venous blood line.
- Seen with an obstruction in the blood line and issue with dialysis solution.
- **Management:** Stop blood pump immediately and clamp the blood lines → Severe hyperkalemia may occur, and this may require additional dialysis/antihyperkalemic measures

Air Embolism

- Is a possible disaster that, if not identified and handled promptly, can be fatal.
- **Symptoms:** Dyspnea, cough, chest tightness**,** loss of consciousness, convulsions, and even death.
- **Identification:** Foam is often seen in the venous blood line of the dialyser and churning sound may be heard on auscultation.
- **Management:** Clamp the venous blood line and stop the blood pump → recumbent position on the left side with the chest and head tilted downward → cardiorespiratory support.

SUGGESTED READING

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TEXTBOOK FOR DIALYSIS TECHNICIANS

Textbook for Dialysis Technicians is a comprehensive yet precise textbook for dialysis technicians and nurses which is designed to cover all academically and practically relevant topics based on the requirement of dialysis technicians in various universities. The book provides an overview of the entire nephrology and related topics with an emphasis on the various aspects of dialysis. The book will serve as a great companion to the dialysis technician to learn about nephrology and dialysis and provide appropriate medical care. The key highlights of the book are:

Salient Features

- Topics based on latest curriculum for BSc or Diploma in Dialysis in various universities
- Chapters on practically relevant aspects of dialysis procedure and handling of dialysis machines
- Inclusion of additional aspects like kidney transplantation, interventions, and peritoneal dialysis
- New and recent topics like hemodiafiltration and extracorporeal therapies
- Special care on nursing care including nutrition, infection control, waste management
- Incorporation of latest guidelines, advances, and protocols in the chapters
- Diagrams, flowcharts, and tables in all chapters for better understanding
- Essential for examination preparation and last-minute reviews

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