Postoperative Care

Routine postoperative care

Vital signs

Blood pressure, pulse, and respiration should be recorded every 15-30 minutes until stable and then hourly until the patient is discharged from the recovery room. The frequency of vital sign measurements thereafter depends upon the nature of the operation and the patient's course in the recovery room. When an arterial catheter is in place, blood pressure and pulse should be monitored continuously. Continuous electrocardiographic monitoring is indicated for most patients in the recovery room and if at risk continue postoperatively.

Postoperative Fluid & Electrolyte Management

Postoperative fluid replacement should be based on the following considerations**: (1)** maintenance requirements, **(2)** extra needs resulting from systemic factors (eg, fever, burns), **(3)** losses from drains, and **(4)** requirements resulting from tissue edema and ileus (third space losses).
In other wards **When planning fluid/electrolyte orders, three questions must be answered:**
1. What are the patient's existing deficits?
2. What is the basal requirement?
3. What are the ongoing losses?

The degree of dehydration (deficit) can be estimated using the ***2-4-6*** *rule*. The patient who is mildly dehydrated (e.g., thirsty, decreased urine output, dry skin, normal blood pressure with minimal orthostatic change) has a fluid deficit of 2% of total body weight. If the dehydration is more pronounced and includes orthostatic blood pressure changes and decreased skin turgor, the free water deficit is approximately 4% of total body weight. When hypotension at rest is present and oliguria is profound, the deficit is 6% of total body weight.
Replacement of pre-existing loss is best accomplished over 24 hours, with one-half of the replacement given over the first 8 hours and the remainder over the ensuing 16 hours. This approach should be modified for older patients with the potential for congestive heart failure who cannot tolerate large volume infusions. Conversely, in younger patients who are being prepared for emergency surgery, the deficit can be replaced quickly.

Surgical patients frequently have catheters, fistulas, and drains, all of which are sources of ongoing fluid and electrolyte loss. Unless these losses are replaced, dehydration and electrolyte/acid-base imbalances will result. The volume lost can be measured, while the electrolyte composition can be estimated. If the source of the loss (i.e., a fistula) is unknown, a sample of the effluent should be analyzed for electrolyte composition. Once the electrolyte content is known, an appropriate replacement fluid can be selected. Look to the table below.

Composition of gastrointestinal secretions (mM l^{-1})

	Na	K	Cl	HCO_3
Saliva	10	25	10	30
Stomach	50	15	110	–
Duodenum	140	5	100	–
Ileum	140	5	100	30
Pancreas	140	5	75	115
Bile	140	5	100	35

General rule for the replacement of lost fluid:

- Fever and insensible loss (lung and perspiration), replaced by glucose water. The amount of fluid lost in feverish patient is calculated by giving 250 ml/24 hrs for every 1 degree increase in the temperature.
- GIT secretions by normal saline if small amount or ringer lactate if to replace large amount. Also, add potassium.
- The urine is generally replaced by glucose water. If you want to replace it perfectly take a sample of urine for measuring the concentrations of the electrolytes.

Daily maintenance requirements for sensible and insensible loss in the adult are about 1500- 2500 mL (1.5 ml/Kg/hr) depending on the patient's age, sex, weight, and body surface area. A rough estimate can be obtained by multiplying the patient's weight in kilograms times 30 (eg, 1800 mL/24 h in a 60-kg patient).
Another method for calculating the daily requirement is as follow:
For the first 10 kg body weight: 100 mL/kg/day or 4ml/Kg/hr
PLUS for the second 10 kg body weight: 50 mL/kg/day or 2ml/Kg/hr
PLUS for weight above 20 kg: 20 mL/kg/day or 1ml/Kg/hr
The total amount per day is divided by 24 hours to determine hourly rate.

Maintenance requirements are increased by fever, hyperventilation, and conditions that increase the catabolic rate.
For patients requiring intravenous fluid replacement for a short period (most postoperative patients), it is not necessary to measure serum electrolytes at any time during the postoperative period, but measurement is indicated in complicated cases (patients with extra fluid losses, sepsis, preexisting electrolyte abnormalities, or other factors). Assessment of the status of fluid balance requires accurate records of fluid intake and output and is aided by weighing the patient daily. As a rule, 2000-2500 mL of 5% dextrose in normal saline or in lactated Ringer's solution (Glucose saline) is given daily for adult patient. Potassium should usually not be added during the first 24 hours after

surgery, because increased amounts of potassium enter the circulation during this time as a result of operative trauma and increased aldosterone activity.
In most patients, fluid loss through a nasogastric tube is less than 500 mL/d and can be replaced by increasing the infusion used for maintenance by a similar amount. About 20 meq of potassium should be added to every liter of fluid used to replace these losses. One must remember, however, that with the exception of urine, body fluids are iso-osmolar and that if large volumes of gastric or intestinal juice are replaced with normal saline solution, electrolyte imbalance will eventually result (hyperchloremic acidosis) .Ringer is preferred if to give large quantities.
Whenever external losses from any site amount to 1500 mL/d or more, electrolyte concentrations in the fluid should be measured periodically, and the amount of replacement fluids should be adjusted to equal the amount lost.
Losses that result from fluid sequestration at the operative site are usually adequately replaced during operation, but in a patient with a large retroperitoneal dissection, severe pancreatitis, etc, third space losses may be substantial and should be considered when postoperative fluids are given.
Fluid requirements must be evaluated frequently. Intravenous orders should be rewritten every 24 hours or more often if indicated by special circumstances. Following an extensive operation, fluid needs on the first day should be reevaluated every 4-6 hours. Insensible fluid losses associated with an open abdomen can reach 500 to 1000 mL/hour.

K E Y P O I N T S

• Under pathologic conditions, interstitial space fills with edema fluid and constitutes part of the third space
• Increased number of osmolals in one compartment causes flow of water into that compartment, decreasing oncotic pressure
• Because body secretions are formed by components in the intravascular space, fluid loss due to fistulas, diarrhea, and drains ultimately leads to intravascular dehydration
• Fluid and electrolytes normally lost through three routes: urine output, gastrointestinal loss, and insensible loss
• Decreased intravascular pressure after traumatic or surgical stress leads to increased secretion of aldosterone, causing physiologic oliguria; use of diuretics to increase urine output illadvised— may worsen dehydration, and loss of sodium and water
• Most intravenous fluids contain small amount of dextrose (5%, or 50 g/L), providing limited calories (4 kcal/g dextrose = 200 kcal/L), preventing protein catabolism
• Dextrose also added to some solutions (e.g., D5 × 1⁄2 NS making them isosmotic, to avoid RBC lysis on infusion
• Replacement of pre-existing loss usually accomplished over 24 hours, with one-half of replacement given over first 8 hours, and remainder over next 16 hours

Composition of crystalloid and colloid solutions (mM l^{-1})

Solution	Na	K	Ca	Cl	Lactate	Colloid
Hartmann's	130	4	2.7	109	28	
Normal saline (0.9% NaCl)	154			154		
Dextrose saline (4% dextrose in 0.18% saline)	30			30		
Gelofusine	150		<1	150		Gelatin 4%
Haemacel	145	5.1	6.26	145		Polygelin 75 g l^{-1}
Hetastarch						Hydroxyethyl starch 6%

Position in bed

The postoperative orders should describe any required special positioning of the patient. Unless doing so is contraindicated, the patient should be turned from side to side every 30 minutes until conscious and then hourly for the first 8-12 hours to minimize atelectasis.

Mobilisation

Early mobilisation is encouraged. Unless there are specified orders to the contrary, all patients are encouraged to get up and move around as much as their underlying condition will allow. Obvious exceptions to this policy include patients with epidural catheters and those with severe multiple injuries. The aim of early mobilisation is to encourage good pulmonary ventilation and to reduce venous stasis. For those who cannot mobilise, physiotherapy should be provided to help with breathing and measures taken to either increase venous flow (pneumatic calf compression devices) or reduce risks of deep vein thrombosis (heparin). The timing of any planned heparin administration will depend on the nature of the procedure and the risks of haemorrhage from that procedure.

Diet

Most of the patients can tolerate liquids by mouth shortly after full return to consciousness (hours) then gradually shift to solid food. The majority can reach full oral intake within 4 days.

Care of the Wound

By 48 hours after closure, deeper structures are completely sealed off from the external environment (epitheliazation complete). Sterile dressings applied in the operating room provide protection during this period. Dressings over closed wounds should be removed on the third or fourth postoperative day. If the wound is dry, dressings need not be reapplied; this simplifies periodic inspection. Dressings should be removed earlier if they are wet, because soaked dressings increase bacterial contamination of the wound. Dressings should also be removed if the patient has manifestations of infection (eg, fever, unusual wound pain). Any drainage from the wound should be examined by culture and Gram-stained smear. Removal of the dressing and handling of the wound during the first 24 hours should be done with aseptic technique. Medical personnel should wash their hands before and after caring for any surgical wound. Gloves should always be used when there is contact with open wounds or fresh wounds.

Management of Drains

Drains are used either to prevent or to treat an unwanted accumulation of fluid such as pus, blood, or serum. Drains are also used to evacuate air from the pleural cavity so that the lungs can reexpand. When used prophylactically, drains are usually placed in a sterile location. Strict precautions must be taken to prevent bacteria from entering the body through the drainage tract in these situations. The external portion of the drain must be handled with aseptic technique, and the drain must be removed as soon as it is no longer useful. Drains should usually be brought out through a separate incision, because drains through the operative wound increase the risk of wound infection.

Deep venous thrombosis prophylaxis

Many postoperative patients are not immediately ambulatory. In these individuals, it is important to provide prophylactic therapy to reduce the risk of DVT and PE (**see Table 1**). Prophylaxis should be started preoperatively in patients undergoing major procedures because venous stasis and relative hypercoagulability occur during the operation.

Table 1. Prophylaxis for deep venous thrombosis and pulmonary embolus

Patient group[a]	**Surgery type**	**Prophylaxis**
Low risk	Minor	None
Low or moderate risk	Major	GCS, SQH-12, or IPC
High risk	Major	SQH-8 or LMWH[b]
Highest risk	Major	SQH-8/12 or LMWH + IPC

[a]**Low risk**, age less than 40 years, no risk factors; **moderate risk,** major surgery & age less than 40 years or minor procedure with risk factors or between 40 and 60 years of age; **high risk,** major procedure over age 40 or with risk factors, or minor procedure over age 60 or with risk factors; **highest risk,** age greater than 40 years, multiple risk factors present, major procedure.
[b]Can use IPC if risk of hematoma or infection is high.
GCS, graded compression stockings; **IPC**, intermittent pneumatic compression**; LMWH**, low molecular-weight heparin; **SQH-8,** subcutaneous heparin every 8 hours; **SQH-12**, subcutaneous heparin every 12 hours.

Mechanical prophylaxis includes graded compression stockings and intermittent pneumatic compression devices.

Unfractionated heparin, 5,000 units subcutaneously, starting 2 hours before surgery and continuing every 8 to 12 hours postoperatively, markedly decreases the incidence of DVT after general surgery. No increase in major hemorrhagic complications is observed with this regimen, although the rate of wound hematoma is higher.

Low molecular-weight heparins, such as enoxaparin (1 mg/kg subcutaneously every 12 to 24 hours. These agents have a clinical efficacy

that is nearly equivalent to that of intravenous heparin and they do not require frequent measurement of coagulation times.

Warfarin is indicated in some lower extremity orthopaedic procedures and in certain high-risk patients (i.e., antithrombin III deficiency). Dosing is usually targeted to an INR of 2.0 to 3.0. This method of prophylaxis carries a significantly higher rate of major postoperative bleeding (5% to 10%) than low-dose heparin and is usually not indicated in general surgery patients.

Pulmonary toilet

Pain and immobilization in the postoperative patient decrease clearance of pulmonary secretions and alveolar recruitment. Patients with inadequate pulmonary toilet can develop fevers, hypoxemia, and pneumonia. Early mobilization, cough and deep breathing exercises are indispensable to avoid these complications.

Medications

Antiemetics. Postoperative nausea is common in patients after general anesthesia and in patients receiving narcotics.

Ulcer prophylaxis. Patients with a history of peptic ulcer disease should have some form of ulcer prophylaxis in the perioperative period, either with acid-reducing agents or with cytoprotective agents, such as sucralfate. Routine ulcer prophylaxis in patients without a history of peptic ulcer disease has only been of proven benefit in those with a coagulopathy or prolonged ventilator dependence; however, it is a common practice to use antiulcer agents in all patients who are nil per os (n.p.o.) for a prolonged period of time.

Pain control. Inadequate pain control can slow the recovery or contribute to complications in postoperative patients. Individuals whose pain is poorly controlled are less likely to ambulate and may take shallow breaths, contributing to atelectasis and interfering with the clearance of pulmonary secretions. Pain can also contribute to tachycardia and relative hypertension, increasing myocardial work and possibly increasing the risk of cardiac complications.Start with simple analgesia as paracetamol to NSAIDs to tramadole to petheine to morphine. Epidural analgesia may be needed for continuous pain relief.

Antibiotics. Surgeon preferenceoften dictate the use of postoperative antibiotics in particular cases.

Laboratory tests. Postoperative laboratory tests should be individualized;

A complete blood count should be obtained in the immediate postoperative period and on subsequent postoperative days in any procedure in which

significant blood loss occurred. This test is also useful on subsequent postoperative days if concern of infection arises. Serial hematocrits should be ordered in any patient in whom there is concern for ongoing blood loss.

Serum electrolytes, blood urea nitrogen, and creatinine are important postoperatively in patients who are n.p.o. or are receiving large volumes of intravenous fluids, total parenteral nutrition, or transfusions. In patients with large transfusion requirements, it is important to obtain frequent calcium and magnesium measurements.

Coagulation studies are important in patients who have had insults to the liver or large transfusion requirements.

Chest x-rays are necessity after any procedure in which the thoracic cavity is entered or when central venous access is attempted. CXRs on subsequent postoperative days should be considered on an individual basis if significant pulmonary or cardiovascular disease is present.

Specific considerations in postoperative care

Cardiovascular disease

Coronary artery disease (CAD)

Control of precipitants

Avoidance of stressors that may exacerbate ischemia through increased myocardial oxygen consumption.

Acute hypertension increases oxygen demand by increasing ventricular wall stress.

Pain control is critical in CAD patients, as pain can precipitate tachycardia and hypertension.

Oxygen should be administered in the early postoperative period to maximize the oxygen content of the blood.

Anemia should be avoided in patients with known CAD, as it decreases the oxygen-carrying capacity. Transfusions should be considered when the hemoglobin falls below 9.0.

Monitoring

Patients at high risk for perioperative myocardial morbidity should bemonitored in the early postoperative period.

Congestive heart failure

The etiology of CHF should be determined, recognizing the strong association with ischemic cardiac disease. Patients with poor preoperative cardiac function should be monitored in an intensive care setting for careful titration of volume replacement. Invasive monitoring and daily CXRs assist in evaluating volume status.

Renal disease

Fluids and electrolytes. Patients with chronic renal insufficiency require replacement of operative fluid losses in the same manner as normal patients; however, care should be taken to avoid excessive fluid replacement. Maintenance fluids should not contain potassium. Frequent measurement of serum electrolytes is required and early dialysis may be necessary because of hyperkalemia or intravascular volume overload.

Drug therapy in renal insufficiency. Many drugs and their metabolites are cleared by the kidneys.

Diabetes

Postoperative management of diabetic surgical patients centers on maintenance of euglycemia and management of chronic complications. All diabetic patients should have blood glucose checked on arrival to the postanesthesia recovery room.

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