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Post Operative Management in Orthopedics



Editor
Abdul Ghani

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SECTION

3

Fluid and Electrolyte Management

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CHAPTER

3.1 Postoperative Fluid and Managing Fluid Overload

Arti Mahajan, Renu Wakhloo, Barkat Anwar Shah

Postoperative fluid management is critical to the recovery of orthopedic and trauma patients. These patients are prone to fluid shifts, blood loss, inflammatory responses, and restricted oral intake. The main objective is to maintain *euvolemia*, ensure *adequate tissue perfusion*, and prevent complications such as *hypovolemia* (e.g., renal dysfunction) or *fluid overload* (e.g., pulmonary edema).

Fluid therapy is a cornerstone of perioperative care in trauma and orthopedic surgery, aimed at restoring intravascular volume, maintaining tissue perfusion, and supporting recovery. Trauma patients often present with varying degrees of hypovolemia due to blood loss, third-space fluid shifts, and systemic inflammatory responses. Similarly, major orthopedic procedures such as hip fracture repair or joint replacement are associated with significant blood and fluid shifts that necessitate careful postoperative fluid management.

The primary goals of fluid therapy are to ensure hemodynamic stability, optimize oxygen delivery, and prevent both hypovolemia and fluid overload. Crystalloids are typically the first-line choice in the immediate postoperative period, while colloids and blood products may be considered in cases of ongoing blood loss or severe anemia. Special attention must be given to elderly orthopedic patients and those with comorbidities such as cardiac or renal dysfunction, where excessive fluid administration can precipitate pulmonary edema or cardiac decompensation.

Enhanced recovery protocols emphasize individualized, goal-directed fluid therapy guided by clinical parameters, urine output, and, when available, hemodynamic monitoring. Early mobilization, adequate pain control, and balanced fluid administration together contribute to improved outcomes, reduced complications, and shorter hospital stays.

GOALS OF POSTOPERATIVE FLUID THERAPY

- Maintain intravascular volume and organ perfusion
- Avoid under- or over-resuscitation
- Replace ongoing or insensible losses
- Support hemodynamic recovery and tissue oxygenation

TYPES OF INTRAVENOUS FLUIDS

Type	*Examples*	*Indications*
Isotonic crystalloids	RL, NS, Plasma-Lyte	First-line for volume replacement and maintenance
Colloids (cautious use)	Albumin, Gelatin, Hetastarch	Short-term volume expansion in hypoalbuminemia or shock
Dextrose solutions	D5W, D10W	Prevent catabolism or treat hypoglycemia
Blood products	PRBCs, FFP	For blood loss >20% or Hb <7 g/dL in stable adults; consider higher threshold (~8 g/dL) in elderly or patients with cardiac disease

(FFP: fresh frozen plasma; PRBC: packed red blood cells; RL: Ringer's lactate; NS: normal saline)

Ringer's Lactate is preferred over normal saline due to reduced risk of hyperchloremic acidosis.

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FLUID REQUIREMENTS: VOLUME AND TIMING

General Principles of Postoperative Fluid Therapy

- *Maintenance fluids*:
  - Traditionally: *25–30 mL/kg/day of water* and *~1 mmol/kg/day of sodium, potassium, and chloride*.
  - This roughly equals: *Approximately 2–2.5 L/day of crystalloid* in an average adult.
- *Replacement of ongoing losses*:
  - Additional fluids should be given for measured or estimated losses (e.g., drains, nasogastric suction, diarrhea, bleeding, third-space losses).
  - The type of fluid (crystalloid, colloid, or blood) depends on the composition of the loss.
- *Trauma and orthopedic considerations*:
  - *Trauma patients*: May need higher volumes initially for resuscitation, but once stabilized, fluid therapy should be restrictive to avoid overload.
  - *Orthopedic patients (e.g., hip fractures, arthroplasty)*: Often elderly, with cardiac/renal comorbidities, so fluids should be administered cautiously (closer to the lower end of maintenance).
- *Avoiding overload*:
  - Postoperative "third spacing" (fluid shifts into tissues) is less than previously thought; excessive fluid can worsen edema, impair wound healing, and increase pulmonary complications.
  - Modern practice favors *goal-directed therapy*, guided by urine output (>0.5 mL/kg/h), hemodynamics, and laboratory values.

Rule of Thumb for a Stable Adult Postoperative Patient (after Resuscitation is Complete)

- *Approximately 1.5–2.5 L/day crystalloid*, adjusted for oral intake and ongoing losses.
- Restrict to *approximately 1–1.5 L/day* in elderly or those with cardiac/renal disease.
- Add electrolytes (potassium) once urine output is established.

Postoperative Phases

Phase	*Strategy*
Immediate (POD 0–1)	Isotonic crystalloids (1–1.5 mL/kg/h) to replace deficit/loss
Stabilization (POD 2–3)	Shift to maintenance fluids if oral intake is adequate
Recovery (POD 3+)	Encourage oral fluids; reduce IV rate progressively
IV fluids are typically needed for 24–72 hours postoperative.	

SPECIAL SCENARIOS IN ORTHOPEDICS

Clinical setting	*Strategy*
Open fractures/polytrauma	Higher volume; consider DCO principles
Elderly/CHF/CKD	Restrict fluids; use dynamic or CVP-guided monitoring
Spinal surgeries	Avoid overload to reduce spinal cord edema risk
Joint replacements	Moderate volume; prevent neuraxial-induced hypotension
Pediatrics	Strict weight-based dosing; avoid dextrose-free fluids in neonates
(CHF: congestive heart failure; CKD: chronic kidney disease; CVP: central venous pressure)	

RECOGNIZING FLUID OVERLOAD

Clinical signs	*Investigations*
Puffy eyelids, pedal edema	Hemodilution (low Hb/Hct)
Sudden weight gain >2%	Chest X-ray: Pulmonary congestion
Basal crepitations	CVP/IVC ultrasound: Elevated pressure
Hypoxia	ABG: Low PaO_2, alkalosis
Raised JVP, S3 gallop	BNP: Elevated if cardiac strain
(ABG: arterial blood gas; BNP: B-type natriuretic peptide)	

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MANAGEMENT OF FLUID OVERLOAD

Strategy	*Intervention*
Stop or slow IV infusion	Reassess actual needs
Diuretics	IV furosemide 20–40 mg; titrate
Oxygen therapy	Mask or nasal cannula support
Fluid monitoring	Strict I/O charting, daily weight
Investigations	CBC, renal function, CXR, electrolytes
Escalation	ICU referral if unstable or if pulmonary edema develops

PRACTICAL MONITORING CHECKLIST

Parameter	*Frequency*
Vitals (HR, BP, SpO_2)	4–6 hourly
Urine output	Hourly (≥0.5 mL/kg/h)
Daily weight	Once every morning
Serum electrolytes, urea/creatinine	Daily
Fluid input-output	Every 24 hours
Drain/stoma losses	Replace if >100 mL/day

PATIENT-CENTERED FLUID ADJUSTMENT

Patient group	*Recommendations*
Elderly	Slower infusion, monitor for overload
Cardiac/renal disease	Use dynamic tools (CVP, IVC, passive leg raise)
Young/healthy adults	Tolerate slightly liberal fluids
Septic patients	Initial bolus (30 mL/kg), reassess frequently

POSTOPERATIVE FLUID REQUIREMENTS: PRACTICAL GUIDE

General Rule for Adults

Phase	*Volume*	*Duration*
Immediate postoperative (POD 0–1)	1–1.5 mL/kg/h (≈75–125 mL/h) of isotonic fluids	First 24–48 hours
Stabilization phase (POD 2–3)	1–1.2 mL/kg/h or ~2–2.5 L/day	Until oral intake resumes
Recovery phase (POD 3 onward)	Minimal IV fluids; encourage oral fluids	Discontinue IV once oral intake adequate

Maintenance Needs (for Average 60–70 kg Adult)

- *Daily total*: 2,000–2,500 mL/day
  - ~1,000 mL for insensible losses (skin/lungs)
  - ~500–1,500 mL for urine and GI losses
- Use *Ringer's Lactate or Plasma-Lyte* unless contraindicated

Duration of IV Fluids

- *Minor surgeries*: 12–24 hours (or until oral intake is re-established)
- *Major surgeries or polytrauma*: 48–72 hours
- *Stop IV fluids when*:
  - Oral intake >1–1.5 L/day is tolerated
  - Vitals and urine output are stable
  - No ongoing losses (e.g., drains <100 mL/day)

Key Considerations

Patient type	*Adjustments*
Elderly or cardiac/renal disease	Slower rate (~1–1.2 L/day), monitor for overload
Septic/trauma patients	Initial bolus 20–30 mL/kg, reassess frequently
Children	Strict weight-based fluid prescription
Diabetic patients	Avoid glucose-containing fluids unless hypoglycemic

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Red Flags for Over- or Underhydration

- *Overload*: Crackles, weight gain, edema, and low SpO_2
- *Dehydration*: Tachycardia, hypotension, and low urine output

Tip

Always reassess fluid needs *daily* based on:

- Clinical status
- Input-output chart
- Daily weight
- Electrolytes and renal function

SUMMARY GUIDELINES

- Treat IV fluids like medications—with indication, dose, and monitoring.
- Reassess fluid status daily.
- Encourage oral intake as early as feasible.
- Watch for and avoid signs of overload, especially in high-risk groups.
- Tailor type and volume of fluid to surgical type, patient comorbidities, and current status.

SUGGESTED READINGS

1. Perel P, Roberts I, Ker K. Colloids versus crystalloids for fluid resuscitation in critically ill patients. Cochrane Database Syst Rev. 2013;2:CD000567.
2. Grocott MPW, Mythen MG, Gan TJ. Perioperative fluid management and clinical outcomes in adults. Anesth Analg. 2005;100(4):1093-106.
3. NICE. Intravenous fluid therapy in adults in hospital. CG174. London: NICE; 2013.
4. American Society for Enhanced Recovery. Consensus Statement on Perioperative Fluid Management. Anesth Analg. 2020;131(4):1092-103.
5. Gropper MA, Eriksson LI, Fleisher LA, Wiener-Kronish LP, Cohen NH, Leslie K. Miller's Anesthesia, 9th edition. Chapter on Fluid, Electrolyte, and Acid–Base Physiology. Philadelphia: Elsevier; 2020.

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SECTION

4

Pain Management in Post-trauma Care

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CHAPTER

4.1 Perioperative Analgesia and Patient-controlled Analgesia

Rajdeep Kaur, Kashish Mahajan, Sachin Kudyar

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Effective perioperative analgesia in musculoskeletal trauma and orthopedics is essential for *reducing suffering, improving mobility, and accelerating recovery*. Pain control must be individualized, multimodal, and responsive to changing physiological needs—especially in the *postoperative phase* where pain intensity often peaks.

GOALS OF PERIOPERATIVE ANALGESIA

- Relieve pain and anxiety
- Prevent physiological complications (e.g., hypertension, tachycardia, and atelectasis)
- Facilitate early mobilization and rehabilitation
- Minimize opioid use and related side effects

PERIOPERATIVE ANALGESIA IN TRAUMA AND ORTHOPEDIC SURGERY

Preoperative (Priming the System)

Patient Education and Expectation Setting

- Explain expected pain trajectory, multimodal plan, and non-drug options.
- Align goals—comfort, early mobilization, and function.
- Emphasize individualized multimodal care within ERAS pathways.

Risk Screening

- *Assess for*: Obstructive sleep apnea (OSA) (STOP-Bang), frailty, prior opioid exposure, renal/hepatic disease, bleeding risk, and cognitive impairment.
- OSA: Prefer regional techniques, avoid background opioid infusions, ensure monitoring and use continuous positive airway pressure (CPAP) if prescribed.

Preemptive/Preventive Analgesia

- *Paracetamol/acetaminophen*: 1 g PO/IV q6h (maximum ≤4 g/day; ≤3 g/day in frail/low weight/liver disease).
- *NSAIDs/COX-2 inhibitors*: Ibuprofen, diclofenac, celecoxib if not contraindicated. Short perioperative courses effective; avoid prolonged/high-dose in high-risk fractures.
- *Dexamethasone*: Single IV dose (8–10 mg) improves pain control and reduces postoperative nausea and vomiting (PONV).
- *Gabapentinoids*: Inconsistent benefit; use cautiously, low dose, short course; avoid in elderly/OSA due to sedation and respiratory depression risk. Dose reduction mandatory in renal impairment and elderly patients.

Intraoperative (Blocking Pain at the Source)

Regional Anesthesia

- *Neuraxial (spinal/epidural)*: Hip fracture, lower-limb trauma, and spine
- *Peripheral nerve blocks (ultrasound-guided)*:
  - Hip fracture/THA: Fascia iliaca or femoral block; consider catheters.
  - *TKA*: Adductor canal block (preserves quadriceps) + periarticular infiltration.
  - *Shoulder*: Interscalene (catheter for major surgery).
- *Compartment syndrome vigilance*: Use dilute local anesthetic, avoid dense/long-acting blocks, institute surveillance for red flags.

Opioid-sparing IV Adjuncts

- *Ketamine*: 0.1–0.3 mg/kg bolus, then 0.05–0.3 mg/kg/h infusion (higher if opioid-tolerant).
- *Dexmedetomidine*: 0.2–0.7 µg/kg/h (usually no bolus); monitor for bradycardia/hypotension
- *IV lidocaine (selected abdominal/spine cases)*: 1–2 mg/kg bolus, then 1–1.5 mg/kg/h. Avoid in conduction disease.

Balanced General Anesthesia

Combine regional + light GA + adjuncts for opioid-sparing effect

Postoperative Analgesia (Multimodal as Default)

Core regimen:

- Paracetamol 1 g q6h (≤4 g/day; ≤3 g/day if risk factors)
- NSAIDs/COX-2 if not contraindicated (ibuprofen, celecoxib, ketorolac)
- *Local/regional continuation*: Wound infiltration or peripheral nerve block (PNB) catheters with dilute local anesthetic.

PRN layers:

- Short-acting oral opioids (tramadol, oxycodone) for breakthrough; avoid long-acting formulations.
- NMDA/α2 adjuncts—ketamine (low-dose), dexmedetomidine in monitored settings.
- Gabapentinoids only if neuropathic pain and low respiratory risk.

Patient-controlled analgesia (PCA): IV PCA with morphine/hydromorphone if needed; basal infusion generally avoided; consider only in opioid-tolerant patients under close monitoring. Transition to oral ASAP.

Postoperative nausea and vomiting prevention: Risk-stratify, use multimodal prophylaxis (dexamethasone + 5-HT3 antagonist ± NK-1 antagonist).

Nonpharmacological adjuncts: Cryotherapy (knee/shoulder), TENS, early physiotherapy, elevation, splintage optimization, CBT/relaxation.

Regional Techniques for Postoperative Pain

- *Hip fracture/THA*: Fascia iliaca or femoral block; catheter for early rehab; neuraxial in select patients
- *TKA*: Adductor canal block + periarticular infiltration ± IPACK; add dexamethasone; catheter facilitates mobilization
- *Shoulder*: Interscalene block (catheter for major/open cases)
- *Spine*: Wound infiltration; IV lidocaine selectively
- *Trauma caveat*: Avoid dense/long-acting blocks if compartment syndrome risk; maintain scheduled neurovascular checks

Special Considerations in Trauma

- *Polytrauma*: Prioritize hemodynamic stability; ketamine useful in hypotension; regional blocks once coagulopathy corrected
- *Fracture healing and NSAIDs*: Short courses likely safe; avoid prolonged/high-dose in high-risk nonunion fractures (e.g., tibial shaft, femoral neck, scaphoid fractures, and established nonunions).
- *Compartment syndrome*: Breakthrough pain despite a block is a red flag—escalate immediately

Practical "Starter" Protocols

Hip fracture (elderly, OSA/CKD common):

- *Preoperative*: Fascia iliaca block, paracetamol; avoid/limit NSAIDs if CKD/anticoagulated
- *Intraoperative*: Spinal if feasible; single-dose IV dexamethasone
- *Postoperative*: Paracetamol, cautious COX-2 if renal/bleeding risk acceptable, low-dose opioids PRN with bowel regimen; fascia iliaca catheter 24–48 h; avoid sedating adjuvants

Primary TKA:

- *Preoperative*: paracetamol + COX-2; dexamethasone IV
- *Intraoperative*: adductor canal block + periarticular infiltration ± IPACK; balanced GA

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- *Postoperative*: Paracetamol + NSAID/COX-2; ACB catheter or single-shot + PAI; low-dose opioids PRN; cryotherapy; early physio.

Shoulder arthroplasty/arthroscopy:

- *Preoperative*: Paracetamol ± COX-2; dexamethasone
- *Intraoperative*: Interscalene block ± catheter
- *Postoperative*: Paracetamol + NSAID; sling support, cryotherapy; short opioid course PRN (avoid basal PCA in OSA)

Safety, Monitoring, and Stewardship

- *Continuous reassessment*: Pain scores, function, sedation, vitals, neurovascular status.
- *Constipation prophylaxis from day 0*: Stimulant ± osmotic laxatives; PAMORAs if refractory
- *Discharge*: Prescribe smallest effective opioid quantity (≤3–5 days); emphasize nonopioid and non-drug strategies; ensure follow-up.

Quick Reference: Drug Pearls (Adults)

Agent	*Typical use and dose*	*Key cautions*
Paracetamol	1 g q6h (≤4 g/day; ≤3 g/day if frail/liver risk)	Liver disease, low body weight
NSAIDs/COX-2	Ibuprofen 400–600 mg q6–8h; celecoxib 200 mg q12h; ketorolac 15–30 mg IV q6h ≤5 days	Renal dysfunction, GI bleed, platelet issues, fracture healing risk (if prolonged/high-dose)
Dexamethasone	8–10 mg IV once intraoperative	Hyperglycemia, rare infection risk (single dose usually safe)
Ketamine (IV)	0.1–0.3 mg/kg bolus → 0.05–0.3 mg/kg/h	Psychomimetic effects; ↑HR/BP (can be useful in trauma)
Dexmedetomidine (IV)	0.2–0.7 µg/kg/h	Bradycardia, hypotension
Lidocaine (IV)*	1–2 mg/kg bolus → 1–1.5 mg/kg/h	Conduction block, seizure risk; avoid in significant heart block
Gabapentin/pregabalin*	Selected neuropathic pain; low dose, short course	Sedation/respiratory depression (especially elderly/OSA/opioids)

*Use only where evidence supports and based on the patient risk profile.

PATIENT-CONTROLLED ANALGESIA

Technique, Drugs, and Dosages

What is PCA?

Patient-controlled analgesia (PCA) is a method that allows patients to self-administer a pre-programmed dose of analgesic medication—usually opioids—via an infusion pump. PCA provides *prompt, individualized pain relief*, improves patient satisfaction, and often results in lower total opioid consumption.

Indications in Orthopedics and Trauma

- Major joint replacements (e.g., TKR, THR)
- Spine surgeries
- Polytrauma with multiple fractures
- Postoperative fracture fixation (e.g., femur, humerus)
- Painful limb salvage procedures
- Post-amputation pain

Patient-controlled Analgesia Delivery Techniques

Intravenous (IV) PCA:

- Most common route
- Easy to set up in PACU or ward
- Used when regional analgesia is contraindicated or unavailable

Epidural PCA:

- Used for major lower limb or abdominal surgeries
- Offers better segmental pain control

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- Delivered through a catheter placed in the epidural space
- Mixture of *opioid + local anesthetic* provides synergistic analgesia

Subcutaneous PCA:
- Used less commonly; reserved for patients with poor IV access
- Slower onset but effective in stable patients

Commonly Used Drugs and Dosing

IV PCA opioids:

Drug	Bolus dose	Lockout interval	Optional basal rate
Morphine	1 mg	6–10 min	0–1 mg/h
Fentanyl	20–40 mcg	5–10 min	10–25 mcg/h
Hydromorphone	0.2–0.4 mg	6–10 min	0.1–0.2 mg/h
Tramadol	10–20 mg	10–15 min	Rarely used as PCA due to ceiling effect
Oxycodone (less common)	1–2 mg	6–10 min	0–1 mg/h

Note: Always adjust doses based on *age, renal/hepatic function, and opioid tolerance.*

Epidural PCA (opioid + local anesthetic combinations):

Drug combination	Infusion rate	Bolus (optional)
Fentanyl 2 µg/mL + Bupivacaine 0.1%	4–8 mL/h	2–4 mL
Morphine 0.05–0.1 mg/mL + Ropivacaine 0.1%	3–6 mL/h	2 mL

- Ideal for lower limb trauma or total joint replacement
- Continuous infusion allows steady analgesia
- Epidural PCA is *contraindicated* in patients with coagulopathy or local infection

Patient-controlled Analgesia Settings and Safety Features

Programming parameters:
- *Loading dose*: Given initially to establish analgesia
- *Demand dose (bolus)*: Self-administered by patient
- *Lockout interval*: Time between bolus doses to prevent overdose
- *Maximum limit per hour*: Prevents overmedication
- *Basal rate (optional)*: Useful in opioid-tolerant or high-pain patients

Safety and monitoring:
- *Continuous SpO_2 monitoring*
- *Respiratory rate, sedation score, pain score*—hourly initially
- Use *capnography* in high-risk or sedated patients
- *Antidotes* like naloxone should be readily available

Advantages of Patient-controlled Analgesia

- Faster, consistent pain relief
- Reduces nursing workload
- Prevents delays in medication administration
- Promotes *autonomy and control*, reducing anxiety
- Often results in *lower total opioid consumption*

Contraindications and Cautions

- Cognitive impairment, inability to understand device
- Age extremes (e.g., very young or frail elderly)
- Respiratory disorders or opioid hypersensitivity
- Situations where delayed detection of complications (e.g., compartment syndrome) may occur

Common Side Effects and Management

Side effect	Management
Nausea/vomiting	Ondansetron or metoclopramide
Sedation	Hold PCA, reduce dose
Respiratory depression	Naloxone IV (0.04–0.4 mg titrated)
Pruritus	Antihistamines or low-dose naloxone
Urinary retention	Bladder scan, catheterization if needed

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SUGGESTED READINGS

1. Chou R, Gordon DB, de Leon-Casasola OA, Rosenberg JM, Bickler S, Brennan T, et al. Management of postoperative pain: a clinical practice guideline. J Pain. 2016;17(2):131-57.
2. Liu SS, Wu CL. The effect of analgesic technique on postoperative patient-reported outcomes. Anesth Analg. 2007;105(3):789-808.
3. Wheeler M, Oderda GM, Ashburn MA, Lipman AG. Adverse events associated with postoperative opioid analgesia. Pain. 2002;103(1):139-47.
4. Ilfeld BM. Continuous peripheral nerve blocks: a review of the published evidence. Anesth Analg. 2011;113(4):904-25.
5. White PF, et al. Patient-controlled analgesia: a review of therapeutic indications and limitations. Drugs. 1992;44(5):780-96.

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He is the author of seven medical books, including highly acclaimed titles on fracture management, musculoskeletal pain management, solved papers orthopedics for PG students, and self-help strategies for life and exam success. His work consistently bridges the gap between textbook knowledge and real-world clinical application.

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