

CONTENTS

1. Normal Water Balance	1
• Water homeostasis	1
• Distribution of total body water	1
• Regulation of total body water	2
2. Distribution of Body Fluid	38
• Units of measurement	38
• Osmoles	38
• Basic concepts of osmotic activity	38
• Difference between osmolality and tonicity	40
• Clinical significance of tonicity	40
• Osmotic pressure	41
• Colloid osmotic pressure	41
• Effective osmotic pressure	41
• Osmosis	41
• Compartmental distribution of total body water	43
• Intracellular fluid	45
• Extracellular fluid	45
• Clinical importance of negative pressure in the interstitial space	49
• Summary of total body water	51
• Summary of water control in the body	52
3. Pharmacology of Crystalloids	53
• Crystalloids	53
• Mechanism of actions of crystalloids	55
• Types of solutions	55
• 5% Dextrose	55
• Normal saline (isotonic saline) or 0.9% NaCl	59
• Dextrose saline (5% Dextrose and 0.9% NaCl)	61
• Ringer's lactate	61
• Isolyte P	63
• Electrolyte contents of commonly used crystalloid intravenous fluids	65
4. Pharmacology of Colloids	66
• General characteristics of colloids	66
• Types of colloidal plasma substitutes	69
• Functions of colloid plasma substitutes	70

- Indications of colloids 70
- Human albumin 71
- Functions of albumin in health 73
- Metabolism 73
- Albumin in critical illnesses 74
- Indications for the infusion of albumin 74
- Dextran 79
- Types of dextran 79
- Clinical effects and advantages 80
- Dextran 40 84
- Dextran 70 85
- Gelatin solutions 86
- Haemaccel 93
- Gelofusine 95

5. Pharmacology of Hydroxyethyl Starch

99

- General pharmacological properties of HES 99
- Degree of volume expansion 104
- Nomenclature of HES 104
- Summary of general pharmacological properties of HES 105
- Metabolism of HES 106
- Disadvantages 106
- Special precautions 112
- Clinical uses of hydroxyethyl starch 112
- Advantages of HES 113
- Evaluation of HES 113
- First-generation HES: Hetastarch (HES 450/0.7) 113
- Second-generation HES: Pentastarch
HAES-Steril (200/0.5): 3%, 6%, 10% 114
- Third-generation HES: Tetrastarch 117
- Pharmacodynamics 117
- Pharmacokinetics 118
- Indications and clinical use 119
- Contraindications 119
- Warning and precautions 120
- Adverse reactions 120
- Tetrastarch in special patient groups 121
- Effects on microcirculation and oxygenation by tetrastarch 121
- Effects on systemic inflammation and endothelial activation by tetrastarch 122
- Characteristics of some available colloids 126
- Tetrastarch v/s pentastarch: summary 126

6. Current Consensus on Crystalloids and Colloids in the Perioperative Period	128
• Choice of fluids crystalloid or colloid	128
• Colloid solutions	128
• Crystalloid solutions	129
• Clinical significance of reflection coefficient	130
• Points to remember	130
• Accepted statements of colloid/crystalloid	130
• Current controversies of fluid and volume management	131
7. Fluid Replacement Therapy	137
• Types of fluid used for volume replacement	137
• Osmosis	138
• Practical fluid balance	138
• Mechanism of action of fluids	141
• Points to remember	142
• Surgery and Stress Response	142
• Types of Surgery	142
• Resuscitation of body spaces with various solutions	143
• Perioperative issues affecting fluid management	144
• General principles of fluid replacement	145
• Perioperative fluid therapy	147
• Key points	147
• Assessment of daily fluid requirement	147
• Maintenance fluids	148
• Goals of intraoperative fluid administration	149
• Replacement fluids	149
• Hole in the bucket analogy	155
8. Perioperative Fluid Therapy in Infants and Children	157
• Fluid therapy in infants and children	157
• Important differences between infant, children and adult	157
• Important points for calculating the fluid requirement	161
• Assessment and correction of any fluid deficit	162
• Maintenance fluids	162
• Neonatal maintenance fluid requirement	162
• Infants and older children maintenance fluid requirement	163
• Important facts about administering dextrose solutions	163
• Avoid dextrose 4% or 5%	164

- Fluid and dextrose management during surgery 164
- Important points to remember regarding calculation of fluids in infant and children 165
- Management of perioperative fluid therapy 166
- Important points to remember in perioperative fluid management 166
- Importance of composition of intravenous fluids 166
- Goals of perioperative fluid administration 168
- Preoperative management 168
- How to evaluate preoperative deficit? 169
- Important key points 179

9. Fluids Therapy in Trauma Resuscitation 181

- The golden hour 181
- Goals of fluid administration 182
- Types of fluids for volume replacement 182
- Choice of fluids in various conditions 182
- Oxygen transport in the high-risk or critically ill surgical patient 187
- Route and rate of fluid administration in various conditions 187
- End point of fluid therapy and monitoring 188
- Measure of preload-central venous pressure 188
- Complications of transfusion 189

10. Fluid Therapy in Fever 190

- Definition of fever 190
- Important facts about fever 190
- Temperature control by the hypothalamus 191
- Resetting the hypothalamic temperature-regulating center in febrile diseases 191
- Mechanism of action of pyrogens in causing fever—role of interleukin-I 191
- Effects of changing the set-point of hypothalamic temperature controller 192
- Crisis or flush 193
- Fever caused by brain lesions 193
- Postoperative fever 194
- Clinical significance of fever 194
- Assessment 197
- Management 197
- Assessment for fever when infection is suspected 197
- Management for fever when infection is suspected 197

- Points to remember before administering anesthesia 198
- Mechanism of action of antipyretics 198
- Goals for anaesthetising patients having fever 199

11. Fluids in Intestinal Obstruction 202

- Problems faced by anesthesiologist with intestinal obstruction 202
- Systemic derangements with intestinal obstruction 202
- Approach towards a patient with intestinal obstruction 207
- Preoperative preparation 209
- Assessment of adequacy of fluid replacement 212
- Important points to remember 212
- Clinical response of the patient after infusion of fluids 212
- Benefits of volume loading 212

12. Fluid Management in Neurosurgical Patients 213

- Principles of water movement across blood-brain barrier (BBB) 213
- Basics of fluid movement in the CNS 215
- Basic concepts of perioperative management of fluids 221
- Intraoperative fluid management of neurosurgical patients 222
- Use of hyperosmolar fluid for cerebral dehydration 225
- Fluid management in neurosurgical patients under special circumstances patient for craniotomy 229
- Fluids during aneurysmal surgery 229
- Fluids in patients with diabetes insipidus with traumatic brain injury 230
- Fluids in postoperative and neurointensive care units 231
- Newer developments 232

13. Fluid Therapy in Traumatic Brain Injury 234

- The "Lund concept" for TBI 234
- Fluid resuscitation in traumatic brain injured patients 236
- Basic concepts in fluid management in traumatic brain injury patients 237

- Focus on preventing further injury in traumatic brain injury patients 237
- Summary of choice of fluids 245

14. Fluid Therapy in Pre-eclampsia and Eclampsia 246

- Incidence of pre-eclampsia 246
- Definition of pre-eclampsia 246
- Definition of proteinuria 246
- Classification of pregnancy induced hypertension 247
- Pathophysiology 248
- Effects on various systems 249
- Clinical importance of oxygen delivery 253
- Choice of analgesia/anesthesia in pre-eclamptic patients 253
- Fluid therapy in pre-eclampsia 253
- Basic concepts of prehydration 254
- Safety precautions while prehydrating patient 254
- Prehydration before regional anesthesia 255
- Precautions before initiation of regional analgesia 255
- Fluid management in pregnant patients in specific conditions 256
- Important points to remember for selecting fluids in PET patients 258
- Goals of fluid management in pregnant patients with pre-eclampsia 259
- Current consensus in fluid therapy in PET 260
- Assessment of renal function and fluid balance 261
- Management of acute pulmonary edema (APO) 261
- Care of pre-eclamptic patients after parturition 262

15. Fluid Management in the Ventilated Patient 263

- Physiological considerations 263
- Homeostatic responses to maintain plasma volume 264
- The influence of positive pressure ventilation on fluid balance 266
- Summary of IPPV and PEEP on water balance 268
- The Starling equation 268
- Factors which help to prevent alveolar edema 270
- Goals of fluid management in the ventilated patient 271
- Maintenance fluids 271
- Clinical applications of central venous pressure (CVP) or pulmonary artery occlusion pressure (PaOP) 273
- Replacement fluids 274

• Resuscitative fluids	274	
• Choice of resuscitation fluids	274	
• Monitoring fluid therapy	278	
• Minimally invasive methods	279	
• Invasive measures	281	
16. Calculation of Fluids		283
• Drop rate calculation of fluid	283	
• Infusion of drug protocol	284	
<i>Index</i>		<i>287</i>