Table 33-1 Components of Maintenance Water

Urine	60%
Insensible losses (skin and lungs)	35%
Stool	5%

Table 33-2 Adjustments in Maintenance Water

SOURCE	CAUSES OF INCREASED WATER NEEDS	CAUSES OF DECREASED WATER NEEDS
Skin	Radiant warmer Phototherapy Fever Sweat Burns	Mist tent Incubator (premature infants)
Lungs	Tachypnea Tracheostomy	Humidified ventilator Mist tent
Gastrointestinal	Diarrhea Emesis Nasogastric suction	
Renal	Polyuria	Oliguria/anuria
Miscellaneous	Surgical drain Third space losses	Hypothyroidism

A variety of clinical situations modify normal maintenance water balance (Table 33-2). Evaporative skin water losses can be higher in neonates, especially premature infants who are under radiant warmers or undergoing phototherapy. Burns can result in massive losses of water and electrolytes (see Chapter 44). Fever increases insensible losses. Tachypnea or a tracheostomy increases evaporative losses from the lungs.

The gastrointestinal tract is potentially a source of considerable water and electrolyte losses. A child who has large amounts of gastrointestinal losses should have these losses measured and replaced with an appropriate **replacement solution** (Table 33-3).

Urine output is normally the largest cause of *water* loss. Diseases such as renal failure and the syndrome of inappropriate antidiuretic hormone (SIADH) can lead to a decrease in urine volume. Maintenance fluids in a patient with oliguria or anuria produce fluid overload. In contrast, other conditions produce an increase in urine volume; these include the polyuric phase of acute tubular necrosis, diabetes mellitus, and diabetes insipidus. When the urine output is excessive, the patient must receive more than standard maintenance fluids to prevent dehydration.

The approach to decreased or increased urine output is similar (Table 33-4). Insensible losses are replaced by a solution that is administered at a rate one third of the normal maintenance rate. Placing the **anuric** child on "insensibles" theoretically maintains an even fluid balance, with the caveat that one third of maintenance fluid is only an *estimate* of insensible losses. This rate may need to be adjusted based on monitoring of the patient's weight and hydration status. An **oliguric** child needs to receive a urine replacement solution. Most children with **polyuria** (except for children with diabetes mellitus [see Chapter 171]) should be placed on insensible fluids plus urine replacement.

Table 33-3 Adjusting Fluid Therapy for Gastrointestinal Losses

AVERAGE COMPOSITION	APPROACH TO REPLACEMENT
DIARRHEA	REPLACEMENT OF ONGOING STOOL LOSSES
Sodium: 55 mEq/L	Solution: 5% dextrose in ¼ normal saline + 20 mEq/L sodium bicarbonate + 20 mEq/L potassium chloride Replace stool mL/mL every 1–6 hr
Potassium: 25 mEq/L	
Bicarbonate: 15 mEq/L	
GASTRIC FLUID	REPLACEMENT OF ONGOING GASTRIC LOSSES
Sodium: 60 mEq/L	Solution: normal saline + 10 mEq/L potassium chloride Replace output mL/mL every 1–6 hr
Potassium: 10 mEq/L	
Chloride: 90 mEq/L	

Table 33-4 Adjusting Fluid Therapy for Altered Renal Output

OLIGURIA/ANURIA	POLYURIA
Place the patient on insensible fluids (⅓ maintenance)	Place the patient on insensible fluids (⅓ maintenance)
Replace urine output mL/mL with half normal saline	Measure urine electrolytes
	Replace urine output mL/mL with a solution that is based on the measured urine electrolytes

Output from surgical drains and chest tubes, when significant, should be measured and replaced. **Third space losses** manifest with edema and ascites and are due to a shift of fluid from the intravascular space into the interstitial space. Third space losses cannot be quantitated. Nonetheless, these losses can be large and lead to intravascular volume depletion, despite weight gain from edema or ascites. Replacement of third space fluid is empirical but should be anticipated in patients who are at risk, such as children who have burns or abdominal surgery. Third space losses and chest tube output are isotonic and usually require replacement with an **isotonic fluid,** such as normal saline or Ringer's lactate. Adjustments in the amount of replacement fluid for third space losses are based on continuing assessment of the patient's intravascular volume status.

DEHYDRATION

Dehydration, most often due to gastroenteritis, is common in children. The first step in caring for a dehydrated child is to assess the degree of dehydration. The degree of dehydration dictates the urgency of the situation and the volume of fluid needed for rehydration. Table 33-5 summarizes the clinical features that are present with varying degrees of dehydration.

A patient with **mild dehydration** has few clinical signs or symptoms. The history may describe decreased intake but