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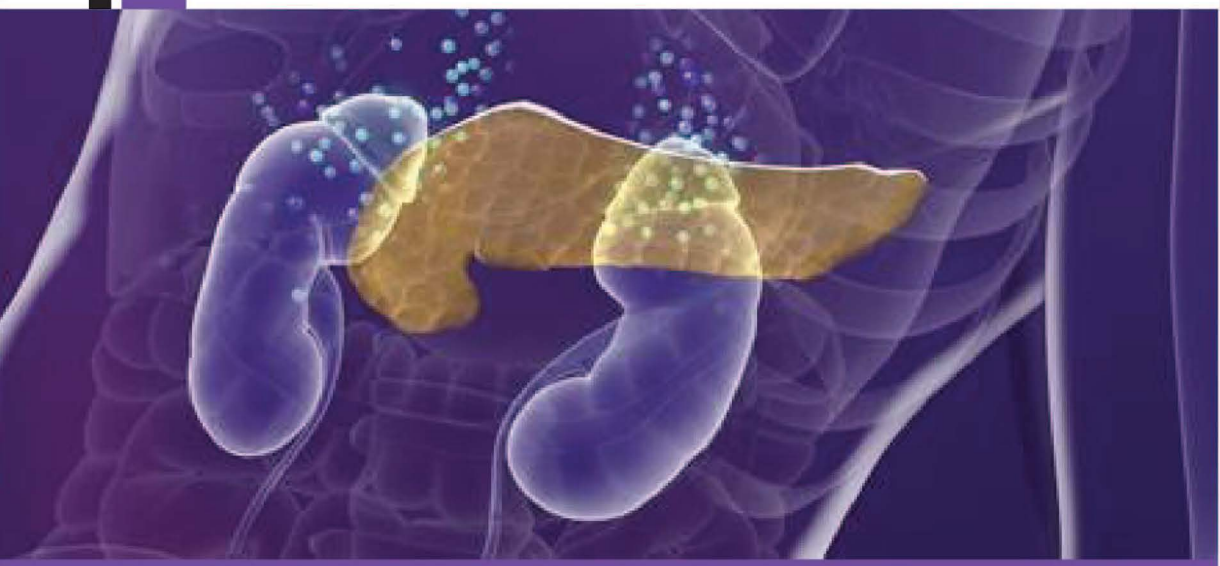
Handbook of Endocrine Protocols



Simon Rajaratnam
Anulekha Mary John

Foreword
Nihal Thomas

2nd Edition

JAYPEE

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CHAPTER 4

Treatment Protocols

HYPONATREMIA[1]

Classification

- Symptomatic or asymptomatic
- Acute (<48 hr) or chronic (>48 hr)
- Mild (130–134 mmol/L); moderate (125–129 mmol/L); severe < 125 mmol/L.

	Serum sodium (mmol/L)	*Plasma osmolality (mOsmol/kg)*	*Cause*
Hypotonic	<135	Low (<280)	SIADH, heart failure, cirrhosis
Isotonic	<135	Normal (280–295)	Hyperglycemia, psuedohyponatremia
Hypertonic	<135	High (>295)	Severe hyperglycemia with dehydration

Calculation

Total body water	
Children	0.6 x weight
Women	0.5 x weight
Men	0.6 x weight
Elderly women	0.45 x weight
Elderly men	0.5 x weight

Normal sodium = 140 mmol/L
Sodium deficit = (Desired sodium – Patient's sodium)
When half correction is planned = (Desired sodium – Patient's sodium)/2
Total body deficit of sodium (TBD) = Sodium deficit × (Weight in kgs × 0.6)
Most physicians replace the Sodium deficit at the rate of 0.5 mEq/hr.
Rate of replacement (hr) = Sodium deficit /0.5

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SODIUM CONTENT OF INTRAVENOUS FLUIDS		
Fluid	*Sodium content (mEq/L)*	*Sodium concentration (mEq/mL)*
Ringer lactate	130	0.13
0.9% NaCl	154	0.154
3% NaCl	513	0.513

Fluid replacement per hour
= Total body deficit/sodium concentration per mL/ Rate of replacement
(Or)
= Sodium requirement (mmol) × 1000/infusate sodium (mmol/L) × time (hr).

Treatment

- The increase in serum sodium should not exceed 8 mmol/L in 24 hours, as rapid correction can lead to central pontine myelinolysis.
- *Patients with euvolemic, asymptomatic hyponatremia*: Restrict free water intake to 1 L per day.
- Patients with acute severe hyponatremia are given a bolus of 100 mL hypertonic saline over 10–15 minutes; this is followed by a slow infusion at the rate of 15–30 mL/hr.
- Patients with chronic severe hyponatremia are given a bolus of 50 mL hypertonic saline; this is followed by a slow infusion at the rate of 15–30 mL/hr. Some authors add desmopressin 1–2 μg SC/ IV 8 hourly for 28–48 hours.

HYPERNATREMIA[2]

Classification

- Acute (<48 hr)
- Chronic (>48 hr).

Calculation

Desired sodium = 140 mmol/L
Insensible water loss = 500–1500 mL/day
The maximum rate at which serum sodium should be lowered is 10–12 mmol/L per day.

Adrogue formula
Change in serum sodium = (Infusate sodium + Infusate potassium) – Serum sodium / (Total body water + 1)

Total water deficit (L) = Total body water × (1– Desired sodium/ serum sodium)

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Desired water replacement on the first day
= Total water deficit × 10/(Serum sodium–Desired sodium)
Hourly infusion rate = Desired water replacement on the first day/24
All calculations should also account for the insensible water loss.

Treatment

- Acute hypernatremia— 5% dextrose at the rate of 3–6 mL/kg/hr
- Chronic hypernatremia—5% dextrose at the rate of 1.35 mL/kg/hr
- Once the serum sodium level reaches 145 mmol/L the infusion rate is reduced to 1 mL/kg/hr until the serum sodium level normalizes.
- Patients with central diabetes insipidus will require desmopressin.

HYPOKALEMIA[3]

Classification

- Mild (3–3.4 mmol/L)
- Moderate (2.5–2.9 mmol/L)
- Severe <2.5 mmol/L (or) with symptoms.

Treatment

- *Mild to moderate hypokalemia*:
  - 10–20 mmol of potassium chloride given 2–4 times a day.
- Severe hypokalemia warrants intravenous replacement, 40 mmol potassium chloride in 1L of 0.9% NaCl given twice or thrice daily.
  - Standard infusion rate 10 mmol/hr.
  - Maximum infusion rate 20 mmol/hr.
- *If the patient has hypomagnesemia in addition*: First give a bolus of 4 mL (8 mmol) of 50% $MgSO_4$ diluted in 10 mL 0.9% NaCl over 20 minutes and then start the potassium infusion. Continue magnesium infusion as per protocol.

HYPERKALEMIA[4]

Classification

- Mild (5.5–6 mmol/L)
- Moderate (6.1–7 mmol/L)
- Severe (>7 mmol/L)
- Asymptomatic/Symptomatic
- Acute/Chronic.

Treatment

- 10 mL of 10% calcium gluconate infused over 5 minutes, if necessary repeat at 5 and 10 minutes until ECG improves.

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- 5–10 units soluble insulin with 50 mL of 50% dextrose (25 g glucose) over 5–10 minutes.
- Salbutamol 10–20 mg in 4 mL of 0.9% NaCl given as nebulization over 10 minutes.
- Calcium resonium or kayexalate (sodium polystyrene sulfonate) 15 g TID (with lactulose).
- If sodium bicarbonate is required, 50–100 mL of 8.4% sodium bicarbonate is given over 1 hour.

HYPOCALCEMIA[5]

Classification

- Mild 7.6–8.5 mg/dL (or) asymptomatic
- Severe <7.6 mg/dL (or) symptomatic.

Note:

- 10 mL of calcium gluconate (10%) contains 90 mg of elemental calcium.
- Tablets like Sandocal with 1250 mg of calcium carbonate contain 500 mg of elemental calcium.

Mild Hypocalcemia

- Tablet Sandocal—2 tablets BD.
- Following thyroidectomy if the serum calcium remains <8.4 mg/dL (<2.1 mmol/L)
  - Increase Sandocal to 2 tablets TID
  - If the patient remains hypocalcemic beyond 48 hours, commence 1,25 Vitamin D3 0.5–1 μg/day.
- If there is associated hypomagnesemia treat with 6 g $MgSO_4$ in 500 mL normal saline over 24 hours.

Severe Hypocalcemia

- 10–20 mL of calcium gluconate in 50–100 mL of 5% Dextrose over 10 minutes. This can be repeated until the patient is asymptomatic. Subsequently commence the patient on calcium infusion—dilute 100 mL of calcium gluconate (5 vials) in 500 mL of 0.9% NaCl and infuse at a rate of 50–100 mL/hr.
- Start 1,25 Vitamin D3 0.5–1 μg/day.
- Correct associated hypomagnesemia.

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HYPERCALCEMIA[6]

Classification

- Mild <12 mg/dL
- Moderate 12–14 mg/dL
- Severe >14 mg/dL
- Asymptomatic/symptomatic.

Treatment

- Isotonic saline infused at a rate of 200–300 mL/hr in order to maintain urine output around 100–150 mL/hr.
- Salmon calcitonin 4 IU/kg repeated every 6–12 hours.
- Zoledronic Acid 4 mg IV over 15 minutes (or) pamidronic acid 60–90 mg over 2 hours.
- Patients with underlying sarcoidosis and lymphoma require prednisone 20–40 mg per day.

HYPOMAGNESEMIA[7]

Definition

Magnesium < 1.7 mg/dL.

Grading

Grade	1	2	3	4	5
Serum magnesium (mg/dL)	1.7–1.2	1.2–1	1–0.7	<0.7	Death

Treatment

- *Grade 1*: No treatment required
- *Grade 2*: 5 g $MgSO_4$ (20 mmol) in 500 mL normal saline over 6–8 hours. Oral magnesium supplements (Maalox) can be tried.
- *Grade 3 and 4*: 5 g $MgSO_4$ in 1 L normal saline over 8–10 hours. Repeat over the next 3–5 days until serum magnesium levels normalize (Reduce dose to 2.5 g $MgSO_4$ (10 mmol) for patients with renal impairment).

If hypocalcemic, correct magnesium until calcium comes within the normal range.

If hypokalemia, replace 40 mmol KCl and 1.25 g $MgSO_4$ (5 mmol) in 500 mL normal saline over 6 hours and repeat up to 24 hours until serum potassium levels improve.

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ADRENAL INSUFFICIENCY[8]

Hydrocortisone replacement during stress and illness should not exceed 200 mg/day.

Surgical stress	*Glucocorticoid dose*
Minor	Hydrocortisone 25 mg IV at the start of the procedure, following the procedure continue the usual replacement dose
Moderate	Hydrocortisone 25 mg Q8H IV for 24 hr, subsequently taper the dose over the next 48 hr
Severe	Hydrocortisone 50 mg Q8H IV for 24 hours, subsequently taper the dose over the next 48–72 hr

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Handbook of
Endocrine Protocols

This book is intended as a quick-reference book for endocrinologists, endocrine trainees and physicians dealing with common endocrine problems. It will be useful both in the wards and the busy out-patient clinics. The information contained in this booklet should be supplemented with clinical judgment and in-depth reading from a bigger textbook.

Simon Rajaratnam MBBS MD DNB (Endo) MNAMS FRACP (Endo) PhD FRCP (Edin) is an alumnus of the Christian Medical College, Vellore, Tamil Nadu, India. He is currently the Head, Department of Endocrinology, Diabetes and Metabolism, Christian Medical College, Vellore. He has trained at the Queen Elizabeth and the Royal Adelaide Hospital, South Australia. He has worked as Senior Consultant at the National Diabetes and Endocrine Centre, Muscat, Oman. He loves doing both clinical work and research. His areas of interest include neuroendocrinology and the molecular pathology of endocrine tumors. He was awarded the PN Shah Oration (2013) by the Endocrine Society of India in recognition of his work on Pheochromocytomas and Paragangliomas.

Anulekha Mary John MBBS MD Fellowship (Endo) is Endocrinologist and Associate Professor in Believers Church Medical College Hospital, Thiruvalla, Kerala, India. She has completed her MBBS, MD (General Medicine), and post-doctoral Fellowship (Endocrinology) from the prestigious Christian Medical College, Vellore, Tamil Nadu, India.

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