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Mnemonics for endocrinologists: hyperparathyroidism

Mnemotechnika dla endokrynologów — nadczynność przytarczyc

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Introduction

Mnemonics are learning techniques that make for greater memorability and help improve long term memory. Commonly encountered mnemonics are usually verbal, such as an acronym, a short poem or mathematical relations for numerical data. Mnemonics may also be visual, kinesthetic or auditory. Mnemonics are based on the observation that the human mind much more easily remembers and retrieves surprising and/or amusing information, rather than colourless, monotonous sequences of data.

Mnemonics herein involving the main issues of hyperparathyroidism are addressed especially to students and endocrinologists, but they may help physicians of any specialisation.

Calcium and phosphate norms (important: 10 and 0.6)

Mathematical relations between ciphers that make calcium and phosphate norms are set out in Table I. "10" is the crucial number to memorise normal ranges for blood calcium concentration in mg/dL, mEq/L and mM/L. In mg/dL, the normal calcaemia range is 10 mg/dL ± 10% (9–11 mg/dL). To count the normal range of calcaemia in mEq/L, 10 is divided by 2 and the obtained 5 ± 10% makes the range (4.5–5.5 mEq/L). Furthermore, to count the normal range for blood calcium concentration in mM/L, 5 is divided by 2 (as calcium is bivalent, its mole consists of two equivalents) and the obtained 2.5 ± 10% makes the range (4.5–5.5 mM/L). As 50% of calcium is ionised, the normal range for Ca^{2+} is half of the above value (1.1–1.3 mM/L).

"0.6" is the basic number to code the normal range of phosphate urine and blood concentrations. Commencing with 0.6 and multiplying it twice, 1.2 is obtained. These numbers make the phosphaturia diurnal range (0.6–1.2 g/24 h). Furthermore, multiplying 1.2 twice we obtain 2.4; this settles the lower range for phosphataemia in mg/dL. The upper limit of phosphataemia is established by multiplying 2.4 twice (2.4–4.8 mg/dL).

Causes of hypercalcaemia (acronym: RHINOS)

The first creature in which parathyroids were discovered as four small glands that lie at the back of the thyroid was the rhinoceros. Sir Richard Owen, the curator of the British Natural History Museum, described them in 1852 when he was dissecting a great Indian rhinoceros that had died in the London Zoo. Therefore RHINOS seems a fine acronym for the causes of hypercalcaemia (Table II).

Table I. ***Mathematical relations between ciphers making normal ranges of calcaemia, phosphataemia and phosphaturia***
Tabela I. ***Zależności matematyczne pomiędzy cyframi określającymi zakresy prawidłowej kalcemii, fosfatemii i fosfaturii***

Calcaemia			Phosphaturia	
Mean *	**Range (± 10% of mean)**	**Units**	**Range****	**Units**
10	9–11	mg/dL	0.6–1.2	g/24 h
5	4.5–5.5	mEq/L	**Phosphataemia**	
2.5	2.25–2.75	mM/L	**Range**	**Units**
1.25 (ionized)	1.1–1.3	mM/L	2.4–4.8	mg/dL

*subsequent mean is half of the previous one (starting from "10"); **ranges are obtained by multiplying twice a previous limiting value (starting from "0.6")

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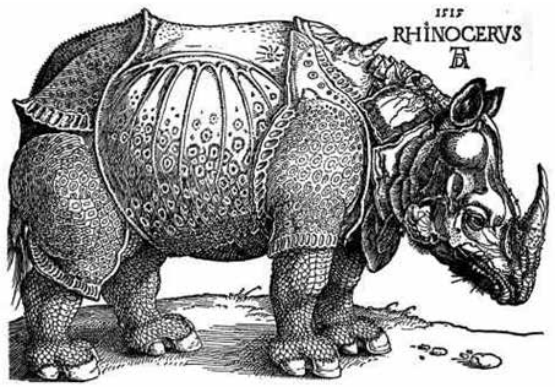

Figure 1. *Albrecht Dürer's rhino (woodcut; 1515; British Museum)*

Rycina 1. *Nosorożec Albrechta Durera (drzeworyt; 1515; British Museum)*

Table II. *Acronym for the causes of hyperparathyroidism*
Tabela II. *Akronim dla przyczyn nadczynności przytarczyc*

R	Renal insufficiency (secondary and tertiary hyperparathyroidism)
H	Hyperparathyroidism (solitary and combined in MEN1 and MEN2a)
I	Immobilisation and iatrogenic (overdosage of calcium, vitamin D, thiazids)
N	*Neoplasms (bone metastasis, primary bone cancer and paraneoplasmatic syndromes)
O	Other endocrinopathies (thyrotoxicosis and Addison's disease)
S	Sarcoidosis

*most frequent

Clinical picture ("Stones, Bones, Groans, Moans" and acronym: PARATHORMONE)

The signs and symptoms of primary hyperparathyroidism are those of hypercalcaemia. They are classically summarised by the mnemonic "stones, bones, abdominal groans and psychiatric moans".

"Stones" refers to kidney stones, nephrocalcinosis, and diabetes insipidus (polyuria and polydipsia). These can ultimately lead to renal failure.

"Bones" refers to bone-related complications. The classic bone disease in hyperparathyroidism is osteitis fibrosa cystica, which results in pain and pathological fractures. Other bone diseases associated with hyperparathyroidism are osteoporosis, osteomalacia, and arthritis.

"Abdominal groans" refers to gastrointestinal symptoms of indigestion, nausea, vomiting and constipation. Hypercalcaemia can lead to peptic ulcers and acute pancreatitis. The peptic ulcers can be an effect of increased gastric acid secretion by hypercalcaemia, but may also be part of a multiple endocrine neoplasia type 1 syndrome of both hyperparathyroid neoplasia and a gastrinoma.

"Mental moans" refers to effects on the central nervous system. Symptoms include psychosis, anxiety, lethargy, memory loss, depression and coma.

The full clinical picture of hyperparathyroidism is encoded in the acronym PARATHORMONE (Table III).

Diagnostics and treatment (half joking/half serious)

To end, a quip by an expert in the field — John Doppman: "The only localisation study needed in a patient with hyperparathyroidism is to locate an experienced parathyroid surgeon."

Table III. *Acronym for the features of hyperparathyroidism/hypercalcaemia*
Tabela III. *Akronim dla objawów nadczynności przytarczyc/hiperkalcemii*

P	Poor bones (rarefications of bone structure with increased risk of fractures)
A	Abdominal pain (related to intestine muscle spasms, constipation, nausea and vomiting or to peptic ulcer, acute and chronic pancreatitis)
R	Renal stones (nephrocalcinosis and renal failure)
A	Altered mental state (from aggression, anxiety to ataxia, apatia and coma)
T	Thirst (related to polyuria)
H	Hypertension (in 50% of patients)
O	Ocular calcifications (and other organ and tissue calcifications)
R	von Recklinghausen's osteitis fibrosa cystica
M	Muscle weakness (tingling of extremities)
O	Other MEN1 and MEN2a components
N	Norms: exceeded for calcium, parathormone and alkali phosphatase and decreased for phosphate
E	Electrocardiogram (shortened QT and bradycardia; increased sensitivity to digitalis and enhanced risk of asystole)

*Friedrich von Recklinghausen reported recurrent fractures of several bones in a patient who experienced only negligible trauma and whose long bones subsequently were described as 'bended' with extensive fibrosis, cysts and brown tumours. Nowadays, "osteitis fibrosa cystica" — mainly in radiograms — is recognised as one of the most severe findings of advanced parathyroid disease