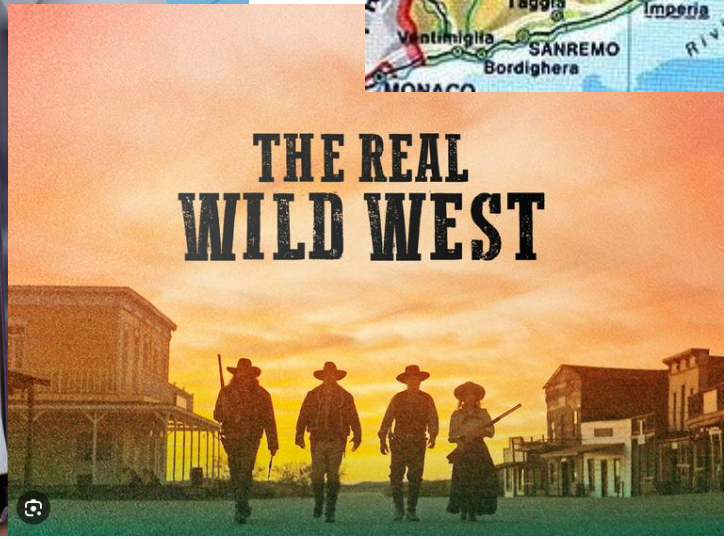
Società Italiana dell'Ipertensione Arteriosa
Lega Italiana contro l'Ipertensione Arteriosa

EVENTO FORMATIVO INTERREGIONALE SIIA
PIEMONTE | LIGURIA | VALLE D'AOSTA
Torino, 29 novembre 2025

Ipertensione Arteriosa e miopatia ipokaliemica

Massimiliano Uccelli
SC Medicina – Sanremo (IM)

No Nephrologist or Endocrinologist were harmed in the making of this case report



- Donna, 38 anni, non precedenti anamnestici di rilievo
- Da 8 mesi lamenta astenia, facile faticabilità, dolori muscolari sotto sforzo (va in palestra)
- Normopeso, non fumatrice, non beve alcolici, lavora come impiegata
- Valori pressori abituali nei limiti di norma

Esegue esami ematici tramite il MMG:

CPK: 2002
GOT 220 U/l GPT 81 U/l
Emocromo : Hb 15,4 wbc 5200 plt 243.000

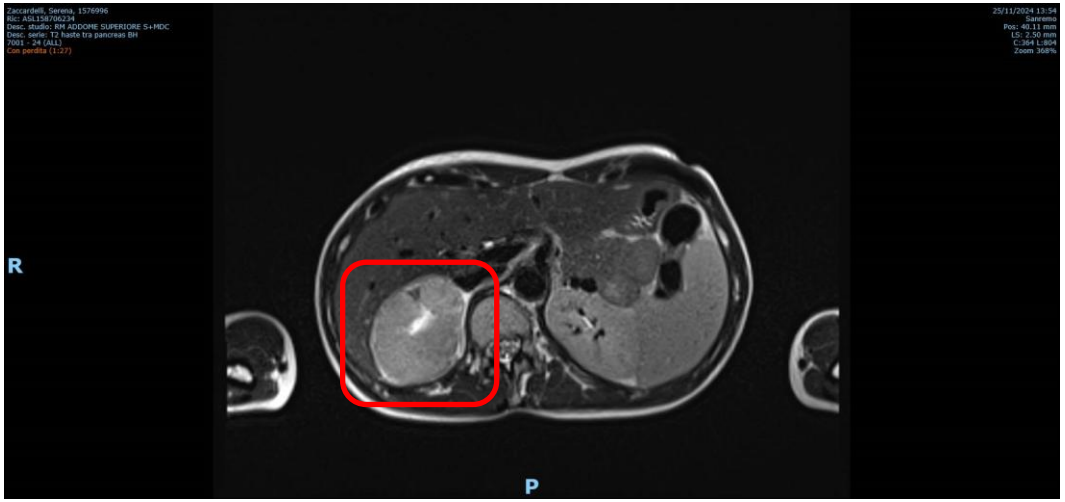
Ecocolordoppler Venoso AA.II. , nella norma

Visita Neurologica: nds eccetto lieve ioporeflessia profonda
Viene inviata ad eseguire ETG addome superiore per studio del fegato

ETG addome: nulla a fegato milza pancreas: voluminosa neoformazione in loggia surrenalica dx di circa 65 x 75 mm

Viene inviata a valutazione internistica e viene ricoverata per accertamenti

Allesame RM odierno si documeta, in sede surrenalica a DESTRA, la presenza di una voluminosa neoformazione solida, dai diametri assiali di circa mm 62x54, a margini lobulati che origina dal surrene di destra e si dispone in sede epatorenale comprimendo il polo superiore del rene di destra, quest'ultimo depiazzato in fossa ilica destra, e contrae stretti rapporti di contiguita' superiormente e antero-lateralmente con il margine mediale del lobo epatico DX.



post-contrastografico ed allo studio in diffusione è da riferire in prima ipotesi a voluminoso feocromocitoma surrenalico destro che necessita di valutazione Specialistica ed eventuali ulteriori approfondimenti diagnostici.

Riassumendo:

1. Ipostenia e dolori muscolari, modesta rabdomiolisi
2. MRI: <u>sospetto morfologico di feocromocitoma</u>

Signs/symptoms	Patient percentage
Classic triad (headache+diaphoresis+tachycardia)	21 (5/24)
Hypertension	33 (8/24)
Labile blood pressure	4 (1/24)
Palpitations	8 (2/24)
Headache	8 (2/24)
Abdominal pain	4 (1/24)
Adrenal hemorrhage	4 (1/24)
Asymptomatic	25 (6/24)

EO: normopeso, PA 160/90 mmHg, lievissima succulenza perimalleolare,
Struttura osteomuscolare e rappresentazione adiposa armonica
Obiettività toracica e addominale inespressiva

Azotemia	13	<	mg/dl
Sodio	146	>	mmoli/l
Potassio	1.4	<	mmoli/l
	Ricontrollato. Valore comunicato telefonicamente al medico curante.		
Glicemia	72		mg/dl
Calcio	7.6	<	mg/dl
Creatinina	0.50		mg/dl
GOT/AST	81	>	U.I./l
GPT/ALT	63	>	U.I./l
Fosfatasi Alcalina	31	<	U.I./l
Gamma G.T.	12		U/L
LDH	353	>	U.I./l

pH	7.54	>
pCO2	50.4	
pO2	62.9	>
cCl-	92	<
cHCO3 - (P,st)	43.4	

0025-7974/82/6103-0141$02.00/0
MEDICINE

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The Spectrum of Rhabdomyolysis

PATRICIA A. GABOW, WILLIAM D. KAEHNY, AND STEPHEN P. KELLEHER

TABLE 5. Reported Causes for Rhabdomyolysis

I. Excessive Muscular Activity
- Contact sports (46, 125)
- Noncontact sports (3, 7, 10, 34, 51, 56, 87, 91, 111, 143)
- Seizures (26, 39, 98, 153, 160, 164)
- Delirium tremens
- Status asthmaticus (25)
- Psychosis (30)

II. Direct Muscle Injury
- Trauma (20, 33, 39, 49, 102, 178)
- Burns (43)

III. Ischemia
- Compression (24, 39, 48, 113, 117, 119, 131, 147)
- Vascular occlusion (53, 64, 112)
- Sickle cell trait (79)
- Air embolism (43)

IV. Immunological Diseases
- Dermatomyositis (65, 71, 93)
- Polymyositis (65, 82, 92, 123, 156)

V. Metabolic Disorders
- Diabetes mellitus
  - hyperosmolar nonketotic coma (51)
  - ketoacidosis (127)
- Hypokalemia
  - diuretics (110)
  - carbenoxolone (9, 35)
  - amphotericin (38)
  - parenteral nutrition (107)
  - licorice (166)
  - primary hyperaldosteronism (37)
  - cortisone therapy (57)
  - renal tubular acidosis (23)
- Hyponatremia (18)
- Hypernatremia (169)
- Hypophosphatemia (107, 174)
- Myxedema (55)

VI. Drugs
- Heroin (32, 39, 50, 73, 78, 128, 135, 137, 147, 148, 150, 167, 177)
- Methadone (45)
- Phencyclidine (2, 11, 28, 116)
- Amphetamines (51, 70)
- L.S.D.
- Glutethimide (58)
- Salicylate overdose (14, 155)
- Succinylcholine (140)
- Clofibrate (157)
- Epsilon aminocaproic acid (15, 17, 136)

VII. Toxins
- Ethanol (4, 39, 42, 78, 84, 94, 121, 122, 129, 139, 146, 150, 158, 176)
- Isopropyl alcohol
- Carbon monoxide (89)
- Mercuric chloride (27)
- Ethylene glycol (114)
- Toluene, paint sniffing (162)
- Quail ingestion, ? hemlock (13)
- Snake bite (61, 130)
- Hornet or wasp sting (154)
- Brown spider bite
- Haff's disease

VIII. Infections
- Bacterial
  - tetanus
  - Legionnaire's disease (124)
  - pyomyositis (6)
  - other (134, 159)
- Viral
  - influenza (31, 60, 72, 105, 106, 133, 152, 181)
  - infectious mononucleosis (67)
  - other (12, 31, 63, 67, 72, 133, 144, 175)

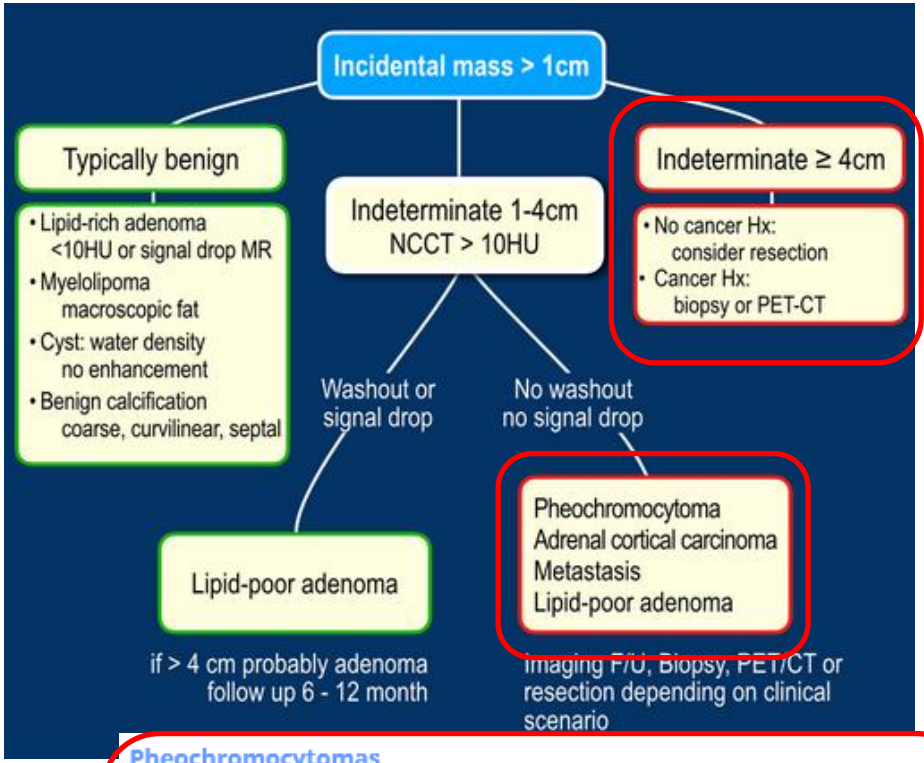
IX. Genetic Disorders
- Abnormal carbohydrate metabolism
  - myophosphorylase deficiency (51, 52, 99, 115, 145)
  - alpha-glucosidase deficiency
  - amylo-1-6-glucosidase deficiency
  - phosphohexomerase deficiency (141)
  - phosphofructokinase deficiency (83)
- Abnormal lipid metabolism
  - carnitine deficiency (172)
  - carnitine palmityl transferase deficiency (8, 62, 118, 132)
- Muscular dystrophies (120)

X. Miscellaneous
- Idiopathic, recurrent (16, 29, 41, 80, 86, 90, 165)
- Temperature extremes
  - hyperthermia (26, 76, 85, 95, 155, 170)
  - hypothermia (126)
- Electric shock, lightning (179)

Hypokalemia
diuretics (110)
carbenoxolone (9, 35)
amphotericin (38)
parenteral nutrition (107)
licorice (166)
primary hyperaldosteronism (37)
cortisone therapy (57)
renal tubular acidosis (23)

Riassumendo:

1. Ipostenia e dolori muscolari, modesta rabdomiolisi,ipertensione
2. MRI: massa surrenalica 7 cm, sospetto morfologico di feocromocitoma
3. Severa ipokaliemia (1,4 mEq/L)



Cosa ci dicono i radiologi..

Pheochromocytomas

Pheochromocytomas are rare tumors that originate in the adrenal medulla.
Usually, tumors are larger than 3 cm when found.
Nonfunctioning tumors are typically larger than functioning tumors.

A typical pheochromocytoma will have an unenhanced density >10 HU, or higher in case of hemorrhage.
They are highly vascular, resulting in strong enhancement, but in contrast to adenomas they usually have delayed washout [4,5].

Adrenal Mass and Hypokalaemia: The Zebra Among Horses

Zsuzsanna Reti [1], Laszlo Szabo [1], Radu M. Neagoe [2], Melinda Kolcsar [3]

Abstract

Pheochromocytoma rarely presents with unexplained hypokalaemia, although there are some case report
in the literature. The mechanism behind this could be the increased cellular potassium uptake promoted b
beta-2-adrenoreceptor hyperactivation and insulin resistance.

HELPDESK ANSWERS

What is the most sensitive and specific imaging technique for identifying pheochromocytomas?

Ariel, Hoffman MD; Jonathan, Letko DO; Marc-Eli, Faldas DO; Jessica, Coulter MD

Author Information

Evidence-Based Practice 27(4):p 26-27, April 2024. | *DOI:* 10.1097/EBP.0000000000002018

Huang *et al. BMC Medical Imaging* (2024) 24:175
https://doi.org/10.1186/s12880-024-01350-0

BMC Medical Imaging

RESEARCH Open Access

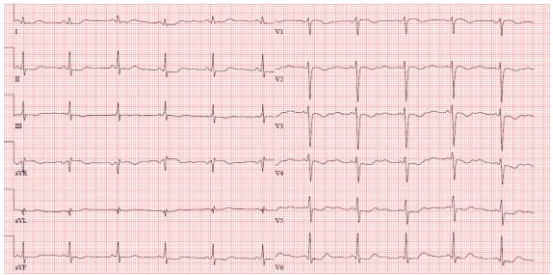
Diagnostic performance of magnetic resonance imaging features to differentiate adrenal pheochromocytoma from adrenal tumors with positive biochemical testing results

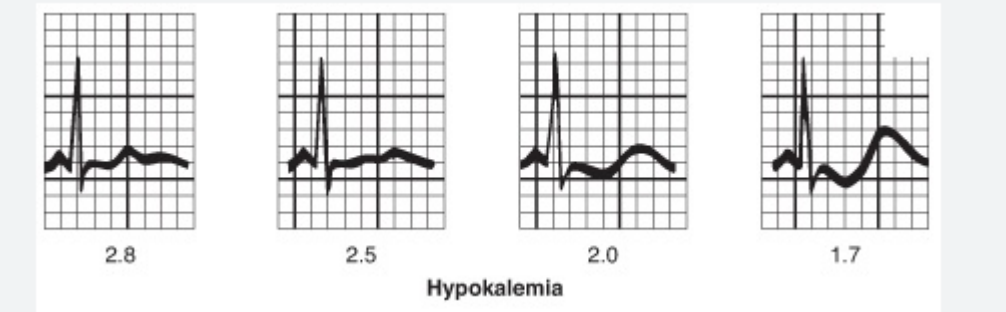
Rukun Huang[1,2†], Tingsheng Lin[1,2†], Mengxia Chen[1,2†], Xiaogong Li[1,2*] and Hongqian Guo[1,2*]

Urine: Cloruri 65 mEq/L
Plasma: K+ 1.4 mEq/L pH 7.54

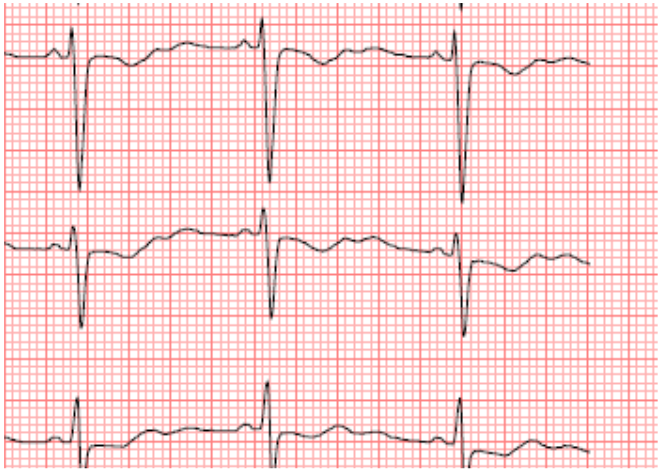
- Comincia correzione urgente e.v. dell'ipokaliemia, sotto monitoraggio ECG
- Correzione di concomitante ipomagnesiemia
- Concomita lieve volume espansione, alcalosi metabolica verosimilmente cloruro-resistente

Frequenza ventricolare	65	BPM
Intervallo PR	110	ms
Durata QRS	102	ms
QT/QTc	456/474	ms
Assi P-R-T	43 67	1




2.8
2.5
2.0
1.7
Hypokalemia


K
Potassium
39.0983
Rb



esami	valore
K+	1,4 mEq/L ↓
pH	7,54
HCO3	43 mmol/L
Cl-	92 mEq/L ↓
Metanefrine 24 h x 3	Nella norma
Cortisolo /ACTH	12.90 mcg/dL/ 38pg/mL → Nugent: 0.8 mcg/dL
DHEA	122
aldosterone	89→ 145 ↑
renina	0.5
testosterone	21 ng/dL

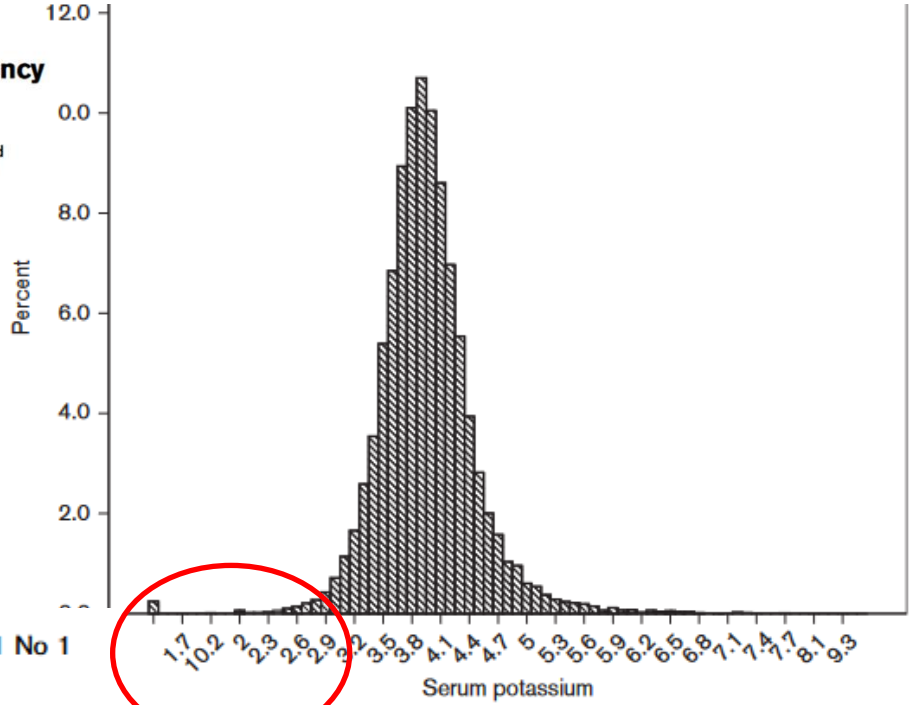
Aggiunge terapia con spironolattone 25 mg x 2→ 100 mg x 2

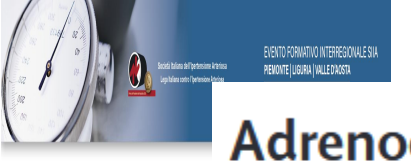
Severe hypokalemia (≤2.5 mEq/L) was observed in 87 patients (0.4%)

Distribution of serum potassium on admission to the emergency department. Serum potassium in mmol/l (N=43 805).

Etiology and symptoms of severe hypokalemia in emergency department patients

Grischa Marti[b], Christoph Schwarz[e], Alexander B. Leichtle[a], Georg-Martin Fiedler[a], Spyridon Arampatzis[c], Aristomenis K. Exadaktylos[d] and Gregor Lindner[b,d]





Adrenocortical carcinoma: a practical guide for clinicians

Martin Fassnacht, Soraya Puglisi, Otilia Kimpel, Massimo Terzolo

Lancet Diabetes Endocrinol
2025; 13: 438–52
Published Online
March 11, 2025
https://doi.org/10.1016/
S2213-8587(24)00378-4

Hormonal investigations

- Glucocorticoid excess
  - 1 mg dexamethasone suppression test or free cortisol in 24 h urine*
  - Basal adrenocorticotropic hormone in plasma†
- Sex steroids and steroid precursors‡
  - Dehydroepiandrosterone sulphate
  - 17-hydroxyprogesterone
  - Androstenedione
  - Testosterone (only in women)
  - 17-β oestradiol (only in women who are postmenopausal and men)
  - 11-deoxycortisol
- Mineralocorticoid excess
  - Potassium
  - Aldosterone to renin ratio (only in patients with arterial hypertension or hypokalaemia, or both)
- Exclusion of a phaeochromocytoma
  - Fractionated metanephrines in 24 h urine or free plasma metanephrines

Imaging

- CT or MRI of abdomen and pelvis
- Chest CT
- [^{18}F]fluorodeoxyglucose PET or CT scans§
- Bone or brain imaging (when skeletal or cerebral metastases are suspected)

Panel 1: **Diagnostic investigations in patients with suspected or proven adrenocortical carcinoma (adapted from Fassnacht et al[16])**

Metanefrine nella norma …

Essendoci allarmati *ab initio* abbiamo comunque fatto

^{18}F-DOPA TC PET, «ovviamente» negativa

^{18}FDG TC PET, con intensa attivita' metabolica localizzata

ADRENOCORTICAL CARCINOMA (ACC)

0.7–2 per million / year. Median age: 40–60 years

Signs & Symptoms

Autonomous adrenal hormone ⇧
Mixed steroid excess is frequent

Hypercortisolism
(see Cushing's syndrome)

Androgen ⇧ (virilization) in ♀

Rare

Mineralocorticoid ⇧
(see primary hyperaldosteronism)

Oestrogen ⇧ (feminization) in ♂

Abdominal mass effect (30%)

Abdominal discomfort (nausea, vomiting, abdominal fullness)

Back pain

Classical malignancy-associated symptoms (rare)

Weight loss

Night sweat

Fatigue

Fever

10–15% incidentally discovered

Aldosterone hypersecretion is the least common (0-7%) among the functional adrenocortical carcinoma (ACC).

Functional Breakdown of Adrenal Cortical Carcinomas

Nonfunctional	21%-50%
Functional	50%-79%
Cushing syndrome	33%-53%
Cushing syndrome + virilization	20%-24%
Virilization alone	10%-20%
Feminization	6%-10%
Hyperaldosteronism	2.5%-5%

Am J Med. 1955 Dec;19(6):966-75. doi: 10.1016/0002-9343(55)90163-7.

Adrenal cortical carcinoma producing solely mineralocorticoid effect

L V FOYE Jr, T V FEICHTMEIR

1955

PMID: 13275491 DOI: 10.1016/0002-9343(55)90163-7

Endocrine-Related Cancer (2005) **12** 149–159

Aldosterone-producing adrenocortical carcinoma: an unusual cause of Conn's syndrome with an ominous clinical course

Teresa M Seccia[1], Ambrogio Fassina[2], Gastone G Nussdorfer[3], Achille C Pessina[4] and Gian Paolo Rossi[4]

Adrenal cortical carcinoma: an unusual cause of hyperaldosteronism

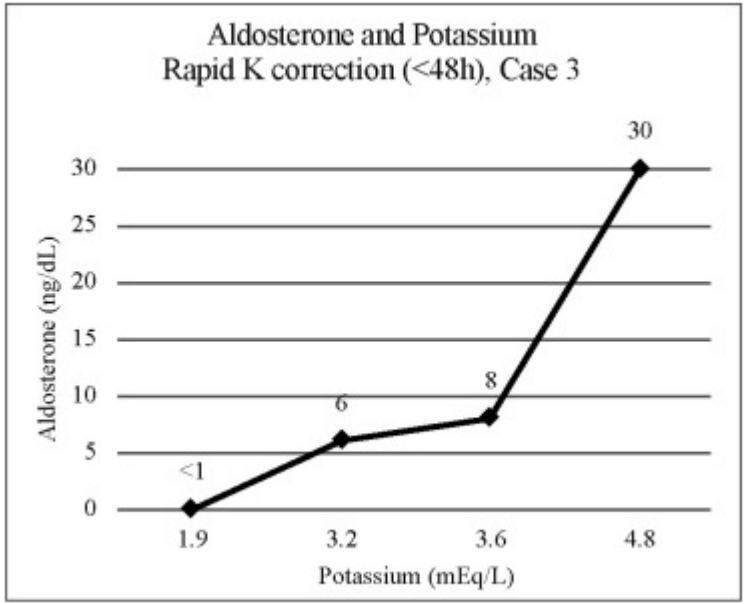
ADAM H. TELNER, MD, FRCP[C]

CAN MED ASSOC J, VOL. 129, OCTOBER 1, 1983

Case Reports

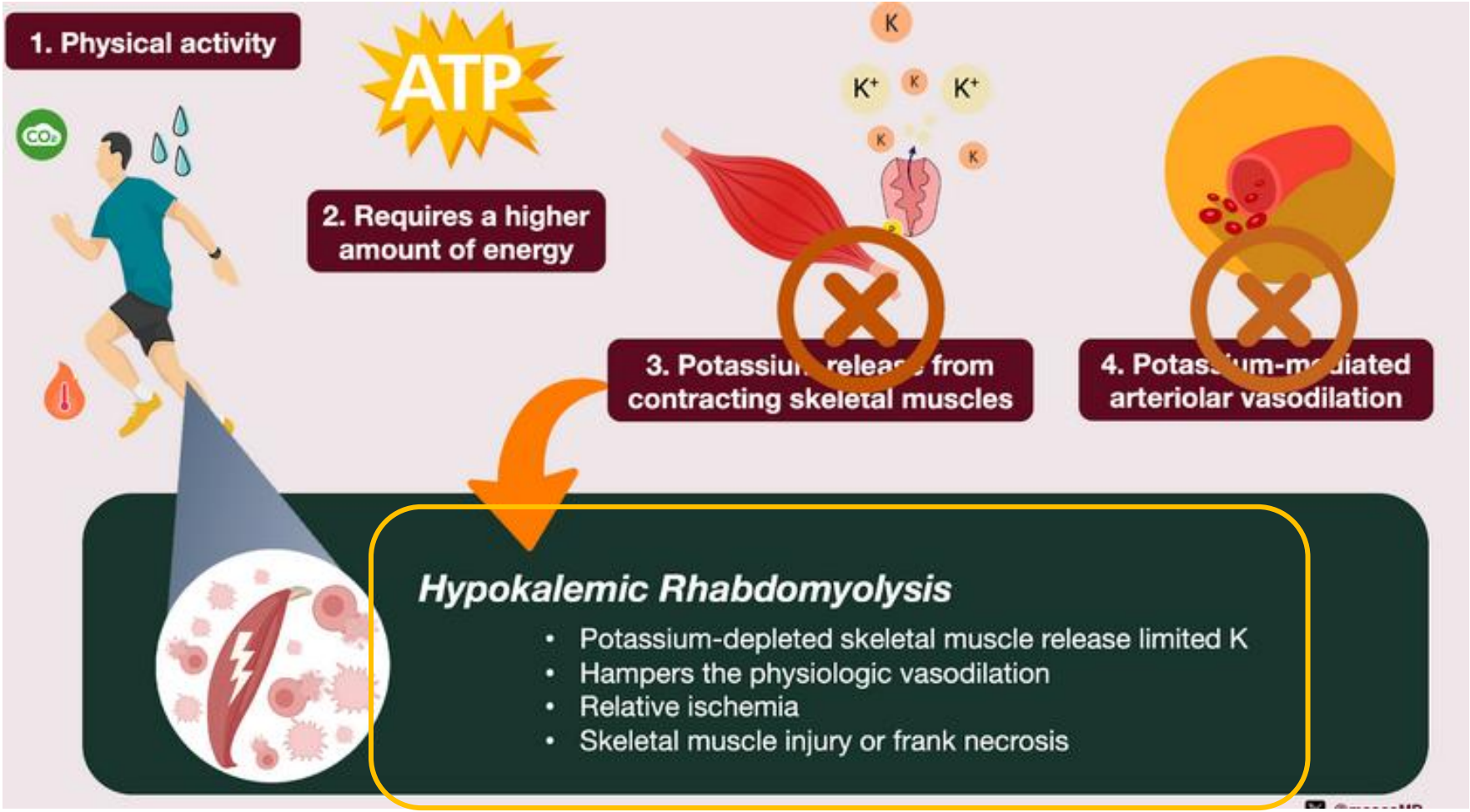
Hypokalemia may Mask Primary Aldosteronism: A Case Series

Michael Morkos MD, MS, Yu-Chien Cheng MD, Leon Fogelfeld MD



Classificazione	Livello di Potassio
Ipopotassiemia **Lieve**	3 – 3.5 mEq/L
Ipopotassiemia **Moderata**	< 3 mEq/L
Ipopotassiemia **Severa**	<2.5 mEq/L / Sintomi

Riduzione di 1 mEq/l di potassio	Deficit di potassio di 100 – 200 mEq
pH Aumenta di 0.1	Potassio scende di 0.6 mEq/l
60 mEq di potassio	incremento di 1 mEq/l


1. Physical activity
ATP
2. Requires a higher amount of energy
K
K+
K+
3. Potassium release from contracting skeletal muscles
4. Potassium-mediated arteriolar vasodilation
Hypokalemic Rhabdomyolysis
• Potassium-depleted skeletal muscle release limited K
• Hampers the physiologic vasodilation
• Relative ischemia
• Skeletal muscle injury or frank necrosis

INTERNAL MEDICINE

□ CASE REPORT □

Primary Aldosteronism Associated with Severe Rhabdomyolysis Due to Profound Hypokalemia

Atsushi Goto[1], Yoshihiko Takahashi[1], Miyako Kishimoto[1], Shigeru Minowada[2], Hitoshi Aibe[3], Kanehiro Hasuo[3], Hiroshi Kajio[1] and Mitsuhiko Noda[1]

orts of Primary Aldosteronism Associated with Hypokalemia-in-

			toms	Serum CPK (IU/L)	Serum K (mEq/L)	Author	Year	Report type
			ıess	3456	1.6	Saito S	2007	Abstract
2	73	M	Weakness, Myalgia	6821	1.7	Tomaru A	2007	Abstract
3	31	M	Weakness	1148	2.1	Nakagawa H	2006	Abstract
4	41	F	Weakness, Myalgia	6600	1.4	Uetake Y	2005	Abstract
5	58	F	Myalgia	16190	1.6	Makita T	2004	Abstract (17)
6	55	M	Weakness	881	1.8	Atsumi T	1979	Article (18)
The present case	55	M	Weakness, Myalgia	15760	1.4	Goto A	2008	-

Information was obtained from abstracts or articles in Japanese. Only first authors are listed, and an abstract for No.5 and an article for No. 6 are cited in the references. Abstracts for No.1-4 can be found in the website of the Japanese Society of Internal Medicine (https://www.naika.or.jp), which requires ID and password to login. Abbreviation: CPK, creatinine phosphokinase.

Primary hyperaldosteronism leading to hypokalemia is a rare but important cause of rhabdomyolysis a

Primary aldosteronism associated with severe hypokalemic rhabdomyolysis

Wan-Ting Tsai,[1,6] Yen-Lin Chen,[7] Wei-Shiung Yang,[1,2] Hong-Da Lin,[3,7]
Chih-Cheng Chien,[4] Ching-Ling Lin[5]

Dear Sir,

Reports associating hypokalemic rhabdomyolysis with primary aldosteronism are rare.[1,2] Hypokalemia does not develop in every patient with primary aldosteronism, and hypokalemic rhabdomyolysis is even rarer in patients with primary aldosteronism.[3] We

ORIGINAL RESEARCH

Health Science Reports Open Access WILEY

Severe hypokalemia in the emergency department: A retrospective, single-center study

Ryuichirou Makinouchi[1] | Shinji Machida[1] | Katsuomi Matsui[1] | Yugo Shibagaki[2] | Naohiko Imai[1]

TABLE 3 Etiology of severe hypokalemia.

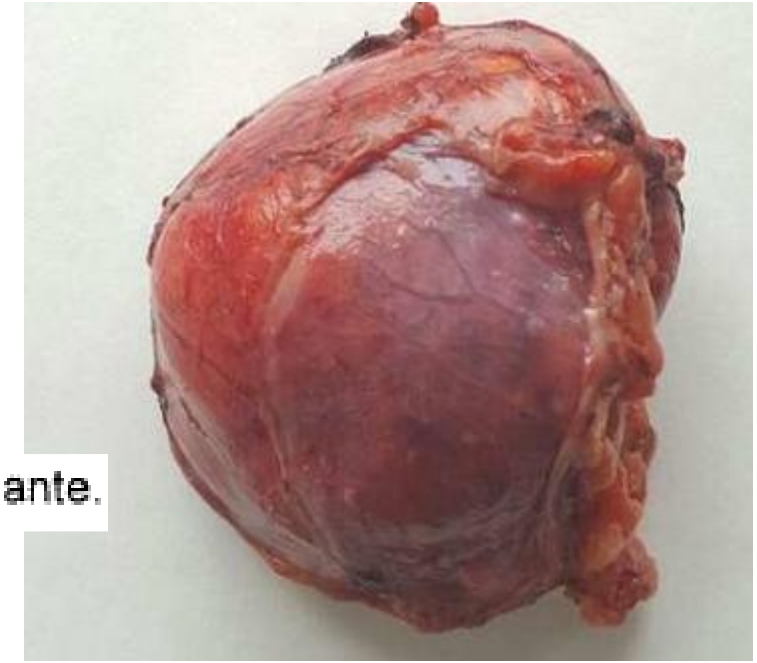
	N = 54
Malnutrition[#]	16 (30%)
Use of Japanese herbal medicine[a]	14 (26%)
Diuretics[b]	13 (24%)
Diarrhea	7 (13%)
Hypothermia	3 (6%)
Insulin	3 (6%)
Vomiting	2 (4%)
Others	10 (19%)

TABLE 2 Symptoms of severe hypokalemia.

	N = 15
Weakness[#]	12 (80%)
Severe rhabdomyolysis	4 (27%)
Constipation	2 (13%)
Muscle cramps	1 (7%)

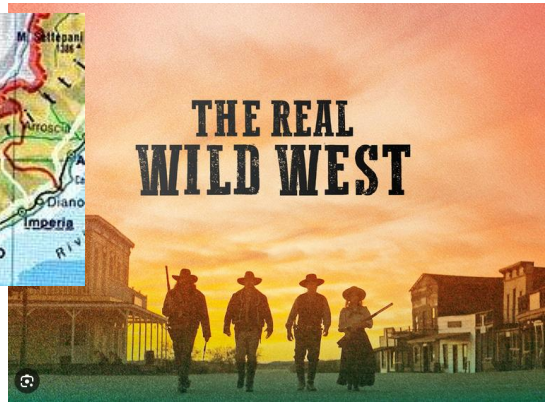
Note: Some patients had more than one symptom.
[#]$p = 0.001$.

- 24/01/2025 Intervento chirurgico di surrenectomia destra laparotomica.
EI: Carcinoma cortico-surrenalico. Dimensioni 8.8x8.6x7.2 cm. Nuclei marcatamente atipici, figure apoptotiche con focale necrosi tumorale. Capsula focalmente infiltrata senza estensione all'adipe circostante. Si evidenziano emboli vascolari. Mitosi >40/50 HPF, alcune mitosi atipiche. Ki67 mediamente 15% con aree hotspot a circa 35-40%. ER 0%, PgR 30%. Margini indenni (R0), invasione linfo-vascolare presente, invasione sinusoidale presente. pT4 N0 (0/4).



17/03/2025 Indicazione ad avvio di Mitotane adiuvante.

+ cortone acetato



Gestione internistica

sintomi

CPK/GOT
Visita Neurologica

ETG

K+,
imaging

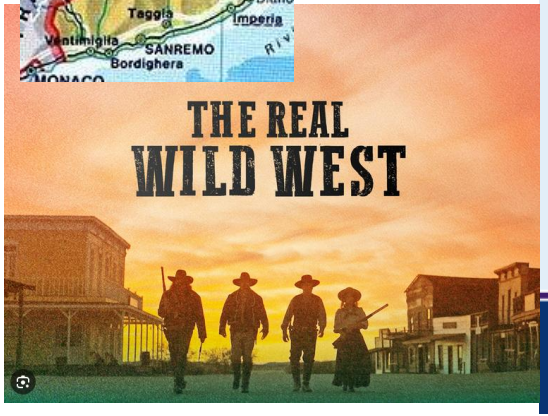
Marzo 24

9 mesi

Ottobre 24

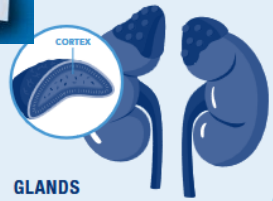
Novembre 24

Dicembre 24



ENDOCRINE SOCIETY PATIENT RESOURCE

AVIGATING N ADRENOCORTICAL ARCINOMA DIAGNOSIS



GLANDS

Adrenal glands produce hormones. The inner adrenal medulla make catecholamines (noradrenaline and adrenaline) and the outer adrenal cortex make steroid hormones that regulate salt (MINERALocorticoids or aldosterone) sugar (GLUCOcorticoid or cortisol) and sex hormones (androgen or DHEAS). Adrenocortical Carcinoma (ACC) is a term specifically referring to a cancer of the adrenal cortex.

HORMONES

Approximately 50% of ACCs produce excessive symptomatic steroid hormones, or more than normal. In these cases, signs or symptoms of hormone excess will be present.

May also experience worsening high blood pressure, diabetes, weight gain, menstrual irregularities, hirsutism, or erectile dysfunction.

ACC is also associated with an inherited cancer syndrome requiring genetic testing and counseling.

DIAGNOSIS

Adrenocortical carcinoma (ACC) is rare. It is a malignant tumor, meaning it has the potential to spread (metastasize) to other organs in the body.

In more than 50% of cases, ACC is diagnosed by chance during imaging studies for other reasons.

Alternatively, the diagnosis is made during evaluation for potential hormone excess.

SYMPTOMS

The symptoms of ACC may vary depending on the extent of the disease (size and metastasis) and hormone excess.

- Asymptomatic: without symptoms
- Rarely abdominal discomfort associated with tumor "burden weight"
- Hormone excess: high blood pressure, diabetes, weight gain, menstrual irregularities, hirsutism, and/or libidinal/erectile dysfunction

Visit endocrine.org for more information.

Editors: Irina Bancos, MD; Fady Hannah-Shmouni, MD, FRCPC; Gary Hammer, MD, PhD

DIAGNOSIS

Adrenocortical carcinoma (ACC) is rare. It is a malignant tumor, meaning it has the potential to spread (metastasize) to other organs in the body.

In more than 50% of cases, ACC is diagnosed by chance during imaging studies for other reasons.

Alternatively, the diagnosis is made during evaluation for potential hormone excess.

SYMPTOMS

The symptoms of ACC may vary depending on the extent of the disease (size and metastasis) and hormone excess.

- Asymptomatic: without symptoms
- Rarely abdominal discomfort associated with tumor "burden weight"
- Hormone excess: high blood pressure, diabetes, weight gain, menstrual irregularities, hirsutism, and/or libidinal/erectile dysfunction

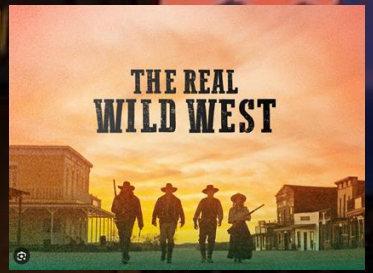
Interesse del caso:

1- ACC malattia rara, ad esordio clinico spesso subdolo per paucisintomaticità
2- nel nostro caso:
sintomi presenti ma interpretati tardivamente
diagnosi tardiva come statisticamente frequente in letteratura
3- dato di ipokaliemia particolarmente severa, persistente verosimilmente da lungo tempo, non diagnosticata e non trattata
4- rarità dell'iperaldosteronismo isolato nel contesto di un ACC

IL CONTRARIO DI SERENDIPITY È ZEMBLANITY

In tempi più recenti, il romanziere scozzese William Boyd ha coniato il termine **zemblanity** a significare l'opposto di **serendipity**: "fare scoperte infelici, sfortunate e prevedibili che si verificano secondo un disegno". Deriva da Novaja Zemlja, un luogo freddo e spoglio, il più lontano che si possa immaginare,

Zemblanity: the inexorability of unfortunate discoveries



Sanremo, Ospedale, 2025