Geleceğe Köprü...

Sürrenal Yetmezlik

Dr. Mustafa Burak SAYHAN

Trakya Üniversitesi Tıp Fakültesi

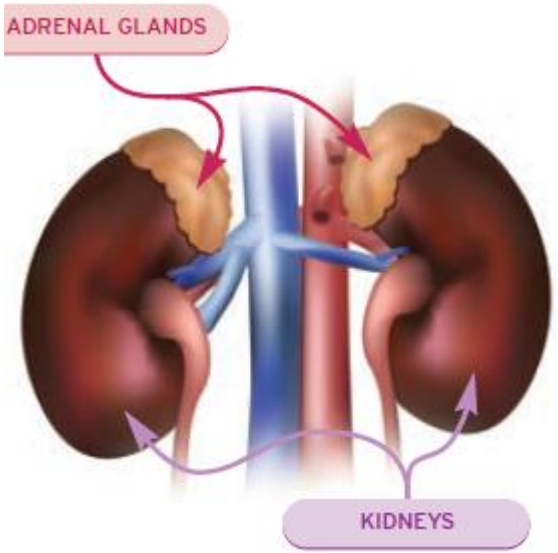
Acil Tıp Anabilimdalı

Sürrenal Yetmezlik

- **Adrenokortikal Yetmezlik**

&

- **Adrenal Yetmezlik (AY)**



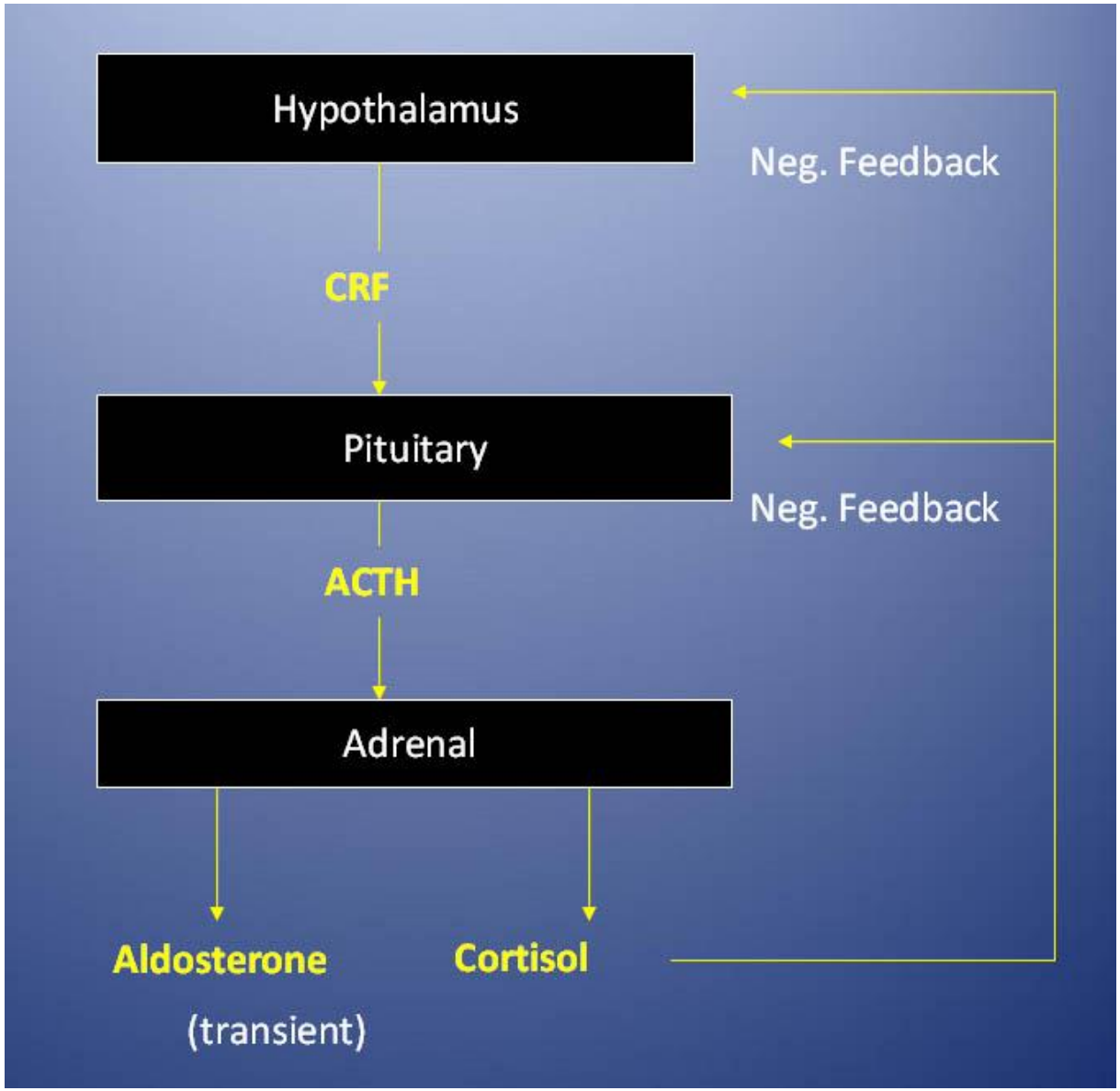
Adrenal Yetmezlik

Hipotalamus, Hipofiz ,Adrenal korteks

- Doğumsal
- Edinsel patolojilere bağlı olarak ortaya çıkar.

Yaşamı tehdit eden krizlerle seyreder.

HPA aks


Hypothalamus
Neg. Feedback
CRF
Pituitary
Neg. Feedback
ACTH
Adrenal
Aldosterone
(transient)
Cortisol

Anatomi

- Adrenal bezin bölümleri:
  - Korteks;
    - Z. glomerüloza:
      - Mineralokortikoid
    - Z. fasikülata:
      - Glukokortikoid
    - Z. retikülaris:
      - Androjenik steroidler salgılanır
  - Medulla;
    - Epinefrin ve norepinefrin salgılar (adrenal venlere)
    - Sinir sistemiyle kontrol edilir

Kaç çeşit adrenal yetmezlik vardır?

1. **Primer adrenal yetmezlik** (Addison hastalığı)

2. **Sekonder adrenal yetmezlik**

3. **Akut adrenal kriz**

Primer Adrenal Yetmezlik

Adrenal korteksten

- **Glukokortikoid**
- **Mineralokortikoid**

sentezlenme ve salgılanma kusurudur.

Primer Adrenal Yetmezlik Nedenleri

Ani başlayan

- Adrenal nekroz
- Adrenal kanama
- Meningokoksik veya diğer sepsislerde
- Koagülasyon bozukluklarında
- Antikoagulan alınımı
- Antifosfolipid sendromundaki trombozis

REVIEW ARTICLE

Adrenal Cortical Insufficiency—a Life Threatening Illness With Multiple Etiologies

Marcus Quinkler, Felix Beuschlein, Stefanie Hahner, Gesine Meyer, Christof Schöfl, Günter K. Stalla

Primer Adrenal Yetmezlik Nedenleri

Kronik

- Otoimmün hasar (%70-80)
- Tüberküloz (%20)
- Adrenal metastazlar
- AIDS'de CMV infeksiyonu

Primer Adrenal Yetmezlik Nedenleri

Primary adrenal cortical insufficiency (AI)	
Isolated autoimmune adrenalitis	Autoimmune adrenalitis = most common cause of primary AI in Western countries (>80%), of which 30-40% as isolated disease, 21-Hydroxylase antibody often positive
Polyglandular autoimmune syndrome Type 1	Hypoparathyroidism, chronic mucocutaneous candidiasis, other autoimmune diseases, lymphomas (rare), mutation in the AIRE gene, autosomal recessive
Polyglandular autoimmune syndrome Type 2	Hypo/hyperthyroid, premature ovarian failure,vitiligo, type 1 diabetes mellitus, pernicious anemia, association with HLA-DR3 (approximately 60% of patients with autoimmune adrenalitis)
Infections	Tuberculosis (most common cause in developing countries), CMV, HIV, Mycosis (e.g. histoplasmosis)
Bilateral adrenal hemorrhage	Meningococcal sepsis, primary antiphospholipid syndrome, septic shock
Extensive adrenal metastases	e.g. renal, lung, breast, gastric, or colon carcinomas, lymphoma
Bilateral adrenalectomy	–
Drugs	e.g. mitotane, etomidate, ketoconazole, fluconazole can cause AI. Rifampicin, phenytoin, barbiturate, carbamazepine accelerate cortisol metabolism
Adrenogenital syndrome (AGS)	congenital enzyme defect of steroid biosynthesis (21a-hydroxylase [95%], 11 b-hydroxylase, and others), autosomal recessive, salt deficiency (75%), virilization in girls
Adrenoleukodystrophy	neurological disturbances (frequent), hypogonadism, X-linked recessive trait, mutation in the X-ALD gene, accumulation of long chain fatty acids (>C24)
Familial glucocorticoid resistance	–
Familial glucocorticoid deficiency	genetic ACTH insensitivity, type 1-3 FGD
Congenital adrenal hypoplasia	Hypogonadotropic hypogonadism, X-linked mutation in the DAX-1 gene

Sekonder Adrenal Yetmezlik

Adrenal korteksi uyaracak kadar ACTH üretilememesi durumunda görülür.

- **Hipotalamik** (Tersiyer -CRH ↓)
- **Hipofizer** (Sekonder-ACTH ↓)

-Adrenal korteks fonksiyonları (Glukokortikoid) azalmıştır.

-Adrenal androjen eksikliği ile birliktedir.

-**Mineralokortikoid fonksiyonları korunmuştur. (RAAS)**

Sekonder Adrenal Yetmezlik

- Ekzojen steroid (Glukokortikoid) tedavisinin kesilmesi (en sık)
- Hipopituitarizmde yapan diğer durumlar

Glukokortikoid Kullanımına Bağlı Adrenal Yetmezlik

- Glukokortikoid kullanımı HPA aksı baskılar.
- Ancak baskılamanın derecesini önceden kestirmek mümkün değildir
- Baskılamanın derecesi glukokortikoidin potensi, kullanım süresi ve ilaç dozu ile ilişkilidir.

Glukokortikoid Kullanımına Bağlı Adrenal Yetmezlik

Sistemik glukokortikoid kullanımı **beş günden daha kısa** süreli ise çoğunlukla HPA aksını baskılamaz.

Glukokortikoid kullanımını takiben HPA aksının baskılanmasının sona erip ermediği kortizol seviyesi ölçümü ile anlaşılabilir.

Endocrinology, Diabetes & Metabolism CASE REPORTS

C M Hay and D I Spratt | Adrenal insufficiency during fluticasone therapy

ID: 13-0080; January 2014
DOI: 10.1530/EDM-13-0080

Adrenal insufficiency in a woman secondary to standard-dose inhaled fluticasone propionate therapy

Casey M Hay[1] and Daniel I Spratt[2]

[1]Department of Obstetrics and Gynecology [2]Division of Reproductive Endocrinology and Infertility, Maine Medical Center, 22 Bramhall Street, Portland, Maine 04102, USA

Correspondence should be addressed to D I Spratt
Email
spratd@mmc.org

Olgu sunumu / Case report

International Journal of Clinical Research 2013;1(2):74-75

Topikal Steroid Kullanımına Bağlı İyatrojenik Adrenokortikal Yetmezlik

Topical Steroid Induced Latrogenic Adrenocortical Insufficiency

Mustafa Tekin[1], Naci Topaloğlu[1], Şule Yıldırım[1], Köksal Fatih Binnetoğlu[1], Nazan Kaymaz[1], Hakan Aylanç[1], Fatih Battal[1], Zuhal Aşık[1]

[1] Çanakkale 18 Mart Üniversitesi Tıp Fakültesi, Çocuk Sağlığı ve Hastalıkları AD, Çanakkale

Key points:

† Standard-dose inhaled **fluticasone** can cause adrenal insufficiency.

† Adrenal insufficiency should be considered in patients taking inhaled fluticasone.

Endocrinology, Diabetes & Metabolism CASE REPORTS

C Policola and others | Opiate-induced adrenal insufficiency

ID: 13-0071; January 2014
DOI: 10.1530/EDM-13-0071

Adrenal insufficiency in acute oral opiate therapy

Caterina Policola, Victoria Stokes[1], Niki Karavitaki[1] and Ashley Grossman[1]

Department of Endocrinology and Metabolic Diseases, Università Cattolica del Sacro Cuore, Rome, Italy

[1]Oxford Centre for Diabetes, Endocrinology and Metabolism, Oxford University Hospitals NHS Trust, Old Road, Oxford OX3 7LE, UK

Correspondence should be addressed to V Stokes
Email
vickystokes22@hotmail.com

Key points:

† Therapy with opiates is the standard therapy for severe acute and chronic pain.

† Such drugs cause profound changes in endocrine function. Short-term therapy with morphine could be the cause of biochemical adrenocortical insufficiency.

† Morphine and related drugs also suppress the pituitary–gonadal axis.

Sekonder Adrenal Yetmezlik Nedenleri

Ani başlayan (Hipopituitarizm)

- Sheehan sendromu
- Hipofizer apopleksi
- Kafa travması
- Hipofiz sapı lezyonları
- Cushing sendromunda

- Hipofiz veya adrenal cerrahi sonucu

Sekonder Adrenal Yetmezlik Nedenleri

Kronik (Hipopituitarizm)

- Hipofiz tümörü veya metastazlar
- Kraniyal cerrahi, radyoterapi
- Kraniofarinjioma
- Sarkoidozis
- Amiloidozis
- Histiyositozis
- Empty cella sendromu
- Hipotalamik tümörler
- Lenfositik hipofizitis

Sekonder Adrenal Yetmezlik Nedenleri

Secondary adrenal cortical insufficiency	
Tumors of the pituitary and hypothalamus regions	e.g., pituitary adenoma, Rathke's cyst, craniopharyngioma, meningioma, metastases
Pituitary / hypothalamic surgery	–
Radiation to the pituitary and hypothalamus regions	–
Pituitary infarction / Sheehan syndrome	–
Autoimmune hypophysitis	lymphocytic, IgG4 associated, drug associated (e.g. ipilimumab, tremelimumab), xanthomatous
Granulomatous disease	Sarcoidosis, histiocytosis X, Wegener's granulomatosis
Infections	Abcess, tuberculous meningitis
Traumatic brain injury	–
Genetic causes	e.g. mutations in PROP-1, LHX-4, HESX1, TPIT, POMC genes
Isolated ACTH deficiency	Autoimmune, mutations in PC-1, POMC, or TPIT genes
Tertiary adrenal cortical Insufficiency	
Chronic glucocorticoid therapy	–
Endogenous Cushing's disease	–
Isolated CRH deficiency	–

İmidazol grubu ilaçlar adrenokortikal fonksiyonu baskılayabilir

Ketoconazole blocks adrenal steroid synthesis.

Pont A, Williams PL, Loose DS, Feldman D, Reitz RE, Bochra C, Stevens DA.

Abstract

Ketoconazole, a broad-spectrum, antifungal drug that is administered orally, has been shown to inhibit sterol synthesis in fungi. When gynecomastia developed in some patients taking this drug, we investigated the effects of ketoconazole on steroid synthesis in humans and in isolated adrenal cells from rats. In healthy humans, the cortisol response to adrenocorticotropic hormone was significantly blunted 4 hours after a 400-mg or 600-mg dose. The inhibition persisted for up to 8 hours and was absent by 16 hours. This finding indicated that adrenal androgen response was reduced. Easily achieved therapeutic concentrations of ketoconazole virtually eliminated corticosterone production by isolated adrenal cells from rats. Although ketoconazole at currently used doses has never been documented to cause clinical hypoadrenalism, caution is urged in high- or multiple-dose trials. The drug may prove useful as an agent to block steroid synthesis.

PMID: 6287893 [PubMed - indexed for MEDLINE]

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Related citations in PubMed

Ketoconazole inhibits cortisol secretion of an adrenal adenoma in vivo [Klin Wochenschr. 1983]

Ketoconazole blocks testosterone synthesis. [Arch Intern Med. 1982]

Steroid synthesis inhibition by ketoconazole: sites of action. [Clin Invest Med. 1988]

Review Ketoconazole

See 1 citation found using an alternative search:

JAMA. 1985 Apr 26;253(16):2413-4.

Reversible adrenal insufficiency induced by ketoconazole.

Tucker WS Jr, Snell BB, Island DP, Gregg CR.

PMID: 3981770 [PubMed - indexed for MEDLINE]

Publication Types, MeSH Terms, Substances

Full text links

FULL TEXT JAMA

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CASE REPORT Open Access

Peri-portal lymphedema in association with an acute adrenal insufficiency: case report

Elamin Ibrahim Elamin Abdelgadir[1*], Alaaeldin MK Bashier[1], Inas A Al Hameedi[2], Azza Abdulaziz[1], Sona Abuelkheir[1] and Fatheya Alawadi[1]

Akut Adrenal Kriz

Akut Adrenal Kriz

- Kronik yetmezlik → Akut alevlenme
- Kronik yetmezlik → Tedaviye uyumsuzluk **(akut/kronik)**
- Kronik yetmezlik → Akut stres durumu (↑ kortizol gereksinimi)

  - Enfeksiyon

  - Cerrahi

  -Operasyon

- Adrenal kanama
- Adrenal nekroz
- Hipofiz apopleksisi

Common triggering factors for adrenal crisis and frequency by percent*

- Gastrointestinal infection (22–33%)
- Other febrile infections (17–24%)
- Surgery (7–16%)
- Intense physical activity (7–8%)
- Psychological stress (4–6%)

Hahner S, Loeffler M, Bleicken B, et al.: Epidemiology of adrenal crisis in chronic adrenal insufficiency — the need for new prevention strategies. Eur J Endocrinol 2010; 162: 597–602.

Hangi durumda adrenal krizden şüphelenilir?

Akut Adrenal Kriz

Adrenal krizin klinik prezentasyonu farklılıklar gösterebilir.

Klasik tedavilere yanıt vermeyen

- Hipotansiyon (SKB 70 mmHg, DKB ölçülemeyecek kadar düşüktür)
- Dehidratasyon
- Elektrolit denge bozukluğu
- Açıklanamayan ateş
- Hipoglisemi
- Şok

Migeon CJ, Lanes RL. Adrenal Cortex: Hypo- and hyperfunction. Ed Lifthitz F, Pediatric Endocrinology 4th
003 Marcel Dekker NewYork 147-192

Orjinal Makale / *Original Articles*

Türkiye Çocuk Hast. Derg. / *Turkish J. Pediatr. Dis.* 2010; 4(2): 100-103

Geliş Tarihi / *Received*: 09.02.2009 • Kabul Tarihi / *Accepted*: 22.05.2009

HİPOGLİSEMİNİN NADİR BİR NEDENİ: GEÇİCİ ADRENAL YETMEZLİK

A RARE REASON OF HYPOGLYCEMIA: TRANSIENT ADRENAL INSUFFICIENCY

M. Emre TAŞCILAR[1], Bülent HACIHAMDİOĞLU[1], Ayhan ABACI[2], Ediz YEŞİLKAYA[1], Ümit SARICI[3]

- **Hipotansif** her hastanın adrenal kriz olma olasılığı akla getirilmelidir.

- Tedavisini düzenli kullanmasına rağmen adrenal yetmezlikli bir hastada adrenal kriz görülebilir mi?

Gebelik

- Hiperemezis gravidarum
- Enfeksiyon
- Doğum eylemi

hayatı tehdit edebilecek olaylardır.

Ege Tıp Dergisi/ *Ege Journal of Medicine* 50 (4) : 277-279; 2011

Addison hastalığı ve gebelik

Addison disease and pregnancy

Bayrak Z[1] Turan V[1] Demirtaş G[1] Erdoğan M[2] Aşkar N[1]

[1]Ege Üniversitesi Tıp Fakültesi, Kadın Hastalıkları ve Doğum Anabilim Dalı, İzmir, Türkiye
[2]Ege Üniversitesi Tıp Fakültesi, Endokrinoloji Bilim Dalı, İzmir, Türkiye

Yanık

Burns. 1993 Feb;19(1):63-6.

Acute adrenal insufficiency in the burn intensive care unit.

Sheridan RL[1], Ryan CM, Tompkins RG.

Author information

Abstract

Acute adrenal insufficiency may underlie a confusing, stormy, intensive care unit course after a burn. The aetiology is most likely to be adrenal haemorrhage despite the absence of a coagulopathy. This report describes two patients who were diagnosed antemortem and successfully treated with replacement therapy. The aetiology, presentation, diagnosis and treatment of acute adrenal insufficiency in the intensive care unit is reviewed.

PMID: 8435119 [PubMed - indexed for MEDLINE]

Cerrahi stres

J Trauma. 1997 Jan;42(1):27-31.

Adrenal insufficiency in the surgical intensive care unit patient.

Barquist E[1], Kirton O.

Author information

Abstract

BACKGROUND: Adrenocortical dysfunction is unusual in the unselected critically ill patient. Case reports document a state of corticosteroid responsive vasopressor dependence, resembling the systemic inflammatory response syndrome. The exact incidence of this disorder is unknown.

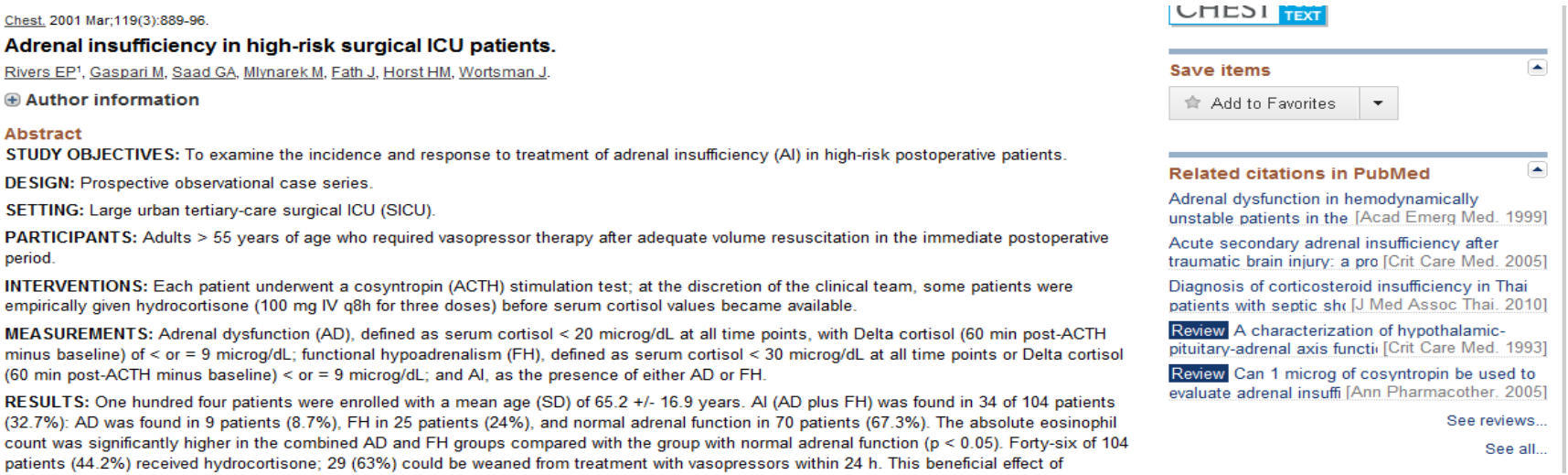
METHODS: We prospectively studied the incidence of adrenal insufficiency during a 9-month period in a surgical intensive care unit (ICU) population. Trauma, general surgery, urology, and gynecologic-oncology patients were included. Patients who met criteria were given a cosyntropin stimulation test.

RESULTS: Overall, the incidence of adrenal insufficiency was 0.66%. In the subgroup of patients with greater than 14 days stay in the ICU, 6% were found to have adrenal insufficiency. In patients aged more than 55 years and with ICU stays of 14 days or greater, 11% were adrenally insufficient.

CONCLUSIONS: Screening of critically ill patients for adrenal insufficiency, particularly those with prolonged ICU stay and age greater than 55 years, is warranted.

Cerrahi stres

- Rivers ve arkadaşları sepsis ve hipotansiyonu olan yaşlı postoperatif hastalarda geçici bir adrenal yetmezliğin olduğunu göstermişlerdir



Chest. 2001 Mar;119(3):889-96.

Adrenal insufficiency in high-risk surgical ICU patients.

Rivers EP[1], Gaspari M, Saad GA, Mlynarek M, Fath J, Horst HM, Wortsman J.

Author information

Abstract

STUDY OBJECTIVES: To examine the incidence and response to treatment of adrenal insufficiency (AI) in high-risk postoperative patients.

DESIGN: Prospective observational case series.

SETTING: Large urban tertiary-care surgical ICU (SICU).

PARTICIPANTS: Adults > 55 years of age who required vasopressor therapy after adequate volume resuscitation in the immediate postoperative period.

INTERVENTIONS: Each patient underwent a cosyntropin (ACTH) stimulation test; at the discretion of the clinical team, some patients were empirically given hydrocortisone (100 mg IV q8h for three doses) before serum cortisol values became available.

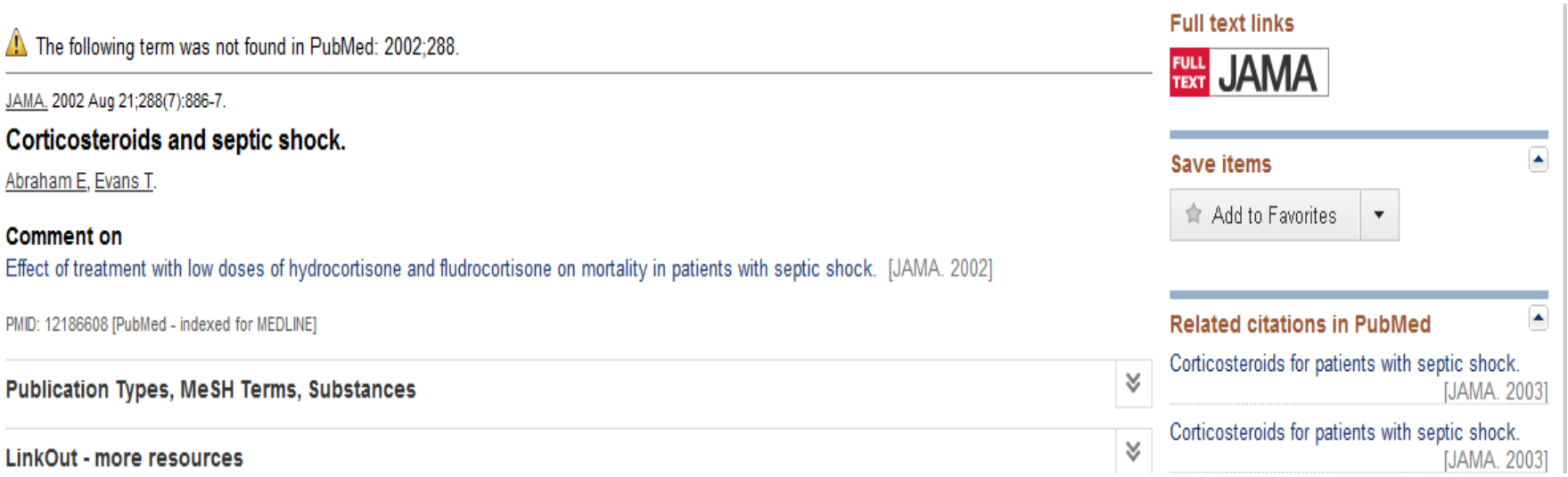
MEASUREMENTS: Adrenal dysfunction (AD), defined as serum cortisol < 20 microg/dL at all time points, with Delta cortisol (60 min post-ACTH minus baseline) of < or = 9 microg/dL; functional hypoadrenalism (FH), defined as serum cortisol < 30 microg/dL at all time points or Delta cortisol (60 min post-ACTH minus baseline) < or = 9 microg/dL; and AI, as the presence of either AD or FH.

RESULTS: One hundred four patients were enrolled with a mean age (SD) of 65.2 +/- 16.9 years. AI (AD plus FH) was found in 34 of 104 patients (32.7%): AD was found in 9 patients (8.7%), FH in 25 patients (24%), and normal adrenal function in 70 patients (67.3%). The absolute eosinophil count was significantly higher in the combined AD and FH groups compared with the group with normal adrenal function ($p < 0.05$). Forty-six of 104 patients (44.2%) received hydrocortisone; 29 (63%) could be weaned from treatment with vasopressors within 24 h. This beneficial effect of

Sepsis

- Abraham ve Evans, septik şok nedeniyle yoğun bakım hastalarında adrenal rezervin yetersiz olduğunu savunmuşlardır.

- Yoğun bakımda klasik tedavilere yanıt vermeyen sepsis hastalarında baskılanmış adrenokortikal fonksiyon olduğundan kuşku edilmelidir.



⚠ The following term was not found in PubMed: 2002;288.

JAMA. 2002 Aug 21;288(7):886-7.

Corticosteroids and septic shock.

Abraham E, Evans T.

Comment on

Effect of treatment with low doses of hydrocortisone and fludrocortisone on mortality in patients with septic shock. [JAMA. 2002]

PMID: 12186608 [PubMed - indexed for MEDLINE]

Publication Types, MeSH Terms, Substances

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Related citations in PubMed

Corticosteroids for patients with septic shock. [JAMA. 2003]

Corticosteroids for patients with septic shock. [JAMA. 2003]

?

- Adrenal yetmezlikli bir hasta, adrenal kriz ortaya çıkana kadar tanı almamış olabilir mi?

- Adrenal kriz, öncül belirtisi olmadan aniden gelişebilir mi?

Klinik-Değerlendirme

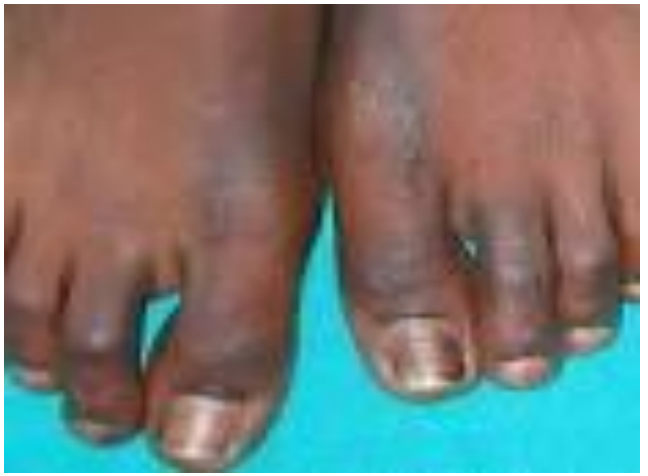
- Birkaç gün önceden **krizin habercisi** olarak
  - Bulantı, şiddetli adinami, karın ağrısı olabilir.
- Huzursuz-irritabldır, kollaps-koma gelişir.
- Dehidratasyon bulguları vardır.
- Genellikle hipotermi vardır, deri soğuktur.
- Hemen daima **karın ağrısı, kusma, diare** vardır
- **Kriz sırasında**
  - Azotemi, hipernatremi, hiperpotasemi bulunur.
  - Hemeokonsantrasyondan ötürü **anemi maskelenir.**

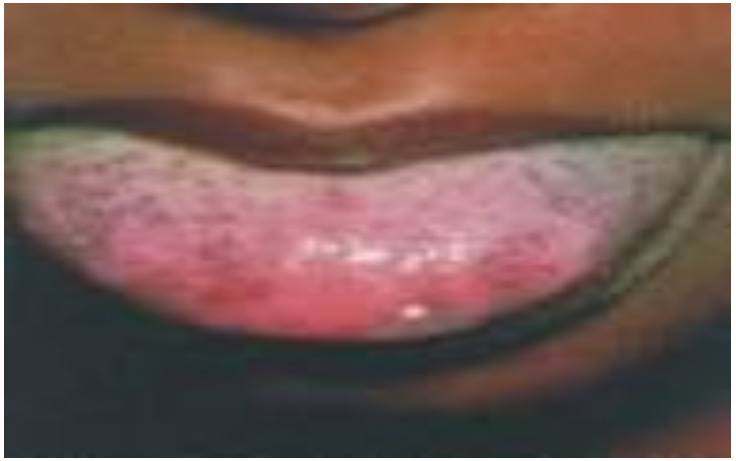
Klinik-Değerlendirme

Symptoms and laboratory changes in adrenal cortical insufficiency (AI)

Hormone	Symptoms
ACTH (POMC) stimulation (primary AI)	Hyperpigmentation
ACTH (POMC) suppression (secondary/tertiary AI)	Pale complexion
Glucocorticoid deficiency	Fatigue and decreased performance
	Appetite / Weight loss
	Nausea, vomiting, and abdominal pain
	Myalgias and joint pain
	Orthostatic hypotension
	Anemia, lymphocytosis, eosinophilia
	Hypoglycemia / hypoglycemic tendency
	Hyponatremia (no inhibition of ADH secretion)
	Hypercalcemia
	Slight TSH increase
Mineralocorticoid deficiency (primary AI)	Hypotonia, hypovolemia, creatinine increase, orthostatic dysregulation
	Hyponatremia
	Hyperkalemia
	Salt hunger
Androgen deficiency	Loss of axillary and pubic hair (females)
	Dry skin (females)
	Depression, loss of libido (females)

hiperpigmentasyon





Primer ve sekonder adrenal yetmezlik kliniği aynı mıdır?

hipopigmentasyon

- Sekonder AY genellikle
  - Hiper yerine hipopigmentasyon görülür.

Klinik-Değerlendirme

- Acil servislerde birçok tedavi edici müdahale aynı anda yapılır.
- Bu tedavilerin bir kısmı klasik adrenal yetmezlik tablosu gösterecek olan hastanın kliniğini karmaşık hale getirir.
- Örneğin;

  -hiponatremi,

  -hipoglisemi

  -hiperkalemi intravenöz (IV) volüm resüsitasyonları ile değiştirilebilir.

Kortikotropin stimülasyon testi

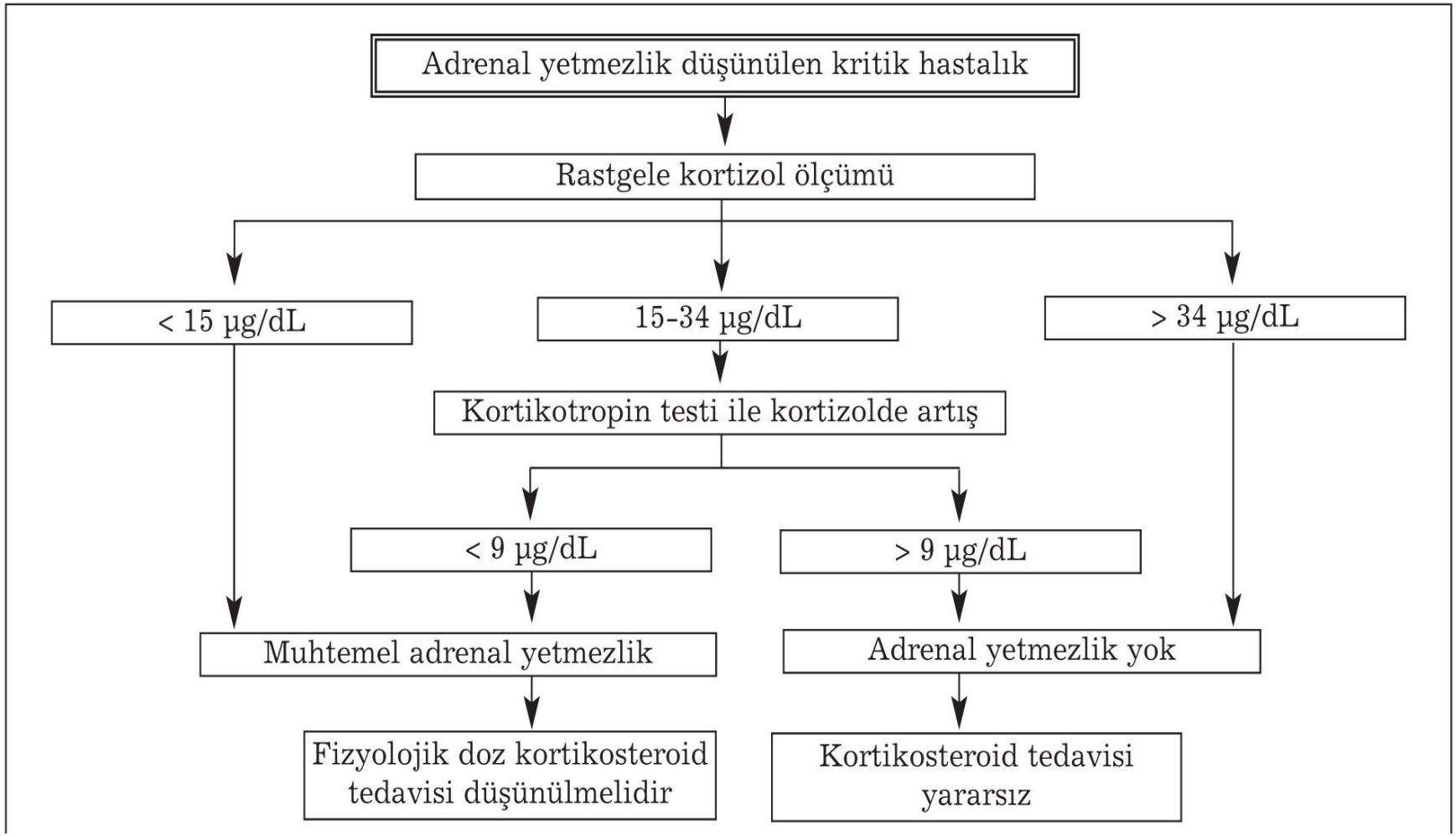
Sentetik bir peptid olan kortikotropinin (Synacten®) 250 µg (IM) / IV

Kortikotropinin verilmesinden

- Hemen önce
- 30 ve 60. dakikalar

kan alınarak plazma kortizol seviyesi çalışılır.

Akut hastalıkta adrenal yetersizliğin belirlenebilmesi için birçok eşik seviye tanımlanmış olmasına rağmen hiçbiri tam olarak tatmin edici değildir.



Akut hastalıkta adrenal yetersizliğin belirlenebilmesi için birçok eşik seviye tanımlanmış olmasına rağmen hiçbiri tam olarak tatmin edici değildir

Akut Adrenal Kriz

Strategies to prevent adrenal crisis*

- Emergency identification card
- Continuing education of patient and family
  - Dose adjustment in stressful situations / discussion of typical stress situations (fever, trauma, surgery)
  - Vomiting and diarrhea as urgent indications for parenteral glucocorticoid administration
  - Symptoms of acute adrenal insufficiency
- Prescribing a hydrocortisone "emergency kit" (e.g., 100 mg hydrocortisone 21-hemisuccinate as ampoules and glucocorticoid suppositories, e.g., 100 mg prednisolone suppositories)
- Instruction in self-injecting hydrocortisone

EDITORIALS

How to avoid precipitating an acute adrenal crisis

Most importantly, heed patients' requests for hydrocortisone

John A H Wass *professor of endocrinology*[1], Wiebke Arlt *professor of medicine*[2]

[1]Department of Endocrinology, Oxford Centre for Diabetes, Endocrinology, and Metabolism, Churchill Hospital, Oxford OX3 7LJ, UK; [2]Centre for Endocrinology, Diabetes and Metabolism (CEDAM), School of Clinical and Experimental Medicine, University of Birmingham, Birmingham, UK

Tedavinin Esasları

Serum örneği alınarak tedavi başlanmalı

- – Kortizol
- – ACTH
- – Aldosteron
- – Na, K
- – Hemogram

Tedavinin Esasları

- Tedavinin en önemli kısmı yüksek doz parenteral glukokortikoid ve volüm resüsitasyonudur.
- Sıvı serum fizyolojik olarak verilir, ancak hipoglisemi varlığında glikoz eklenmelidir.
- En sık hidrokortizon kullanılmakla birlikte ülkemizde bulunmadığı için deksametazon 8-16 mg verilebilir.

Tedavinin Esasları

- Prednizolon ve kortizol özellikle hipotansif hastalarda kullanılmamalıdır, çünkü her ikisi de aktif forma dönüşerek etki eder ve bu zaman alıcıdır.

- Mineralokortikoid çoğunlukla gereksizdir, ancak bol miktarda serum fizyolojiğe gereksinim olduğu bilinmelidir.

Tedavi

- ABCDs which may include:
  - Oxygen.
  - IV normal saline fluid boluses (500-1000 mL for adult, 10-20 mL/kg for a child).
  - IV dextrose (25-50 mL 50% dextrose for an adult, 2-5 mL/kg 10% dextrose for a child) as required.

Tedavi

- If hypotension persists, give additional corticosteroids and consider vasopressors, eg dopamine.
    - Investigate adrenal haemorrhage, especially if the patient is receiving anticoagulants.
    - Reversal of coagulopathy should be attempted with fresh frozen plasma.

- Treat the underlying precipitating disorder, eg infection, with antibiotics.
- When testing for adrenal insufficiency and treating at the same time, replace hydrocortisone with dexamethasone added to the infusion together with corticotropin.
- Collect blood and urine for analysis of cortisol and urinary-17-hydroxycorticosteroid (OHCS) levels.

Steroid	Features/challenges	Half-life (h)	Recommended total daily dose[a] (mg)	Recommended dose frequency	Monitoring
Glucocorticoid					
Hydrocortisone (=cortisol)	Physiological GC; 96% orally available; short half-life with steep peaks and troughs	1–2	20–25 for primary AI 15–20 for secondary AI	Two or three doses with 1/2–2/3 of dose in the morning and subsequent doses later in the early afternoon/evening	No reliable and convenient marker to assess GC levels. Monitoring is based on clinical assessments indicating over- or under-treatment which are non-specific to AI
	Modified-release formulation (Plenadren)			Once in the morning	
Cortisone acetate	Lower serum cortisol peak; requires conversion to HC, which results in slow rise to peak and slower decline. May be affected by impairment of the enzyme 11β-hydroxysteroid dehydrogenase type 1 for conversion to HC		25–37.5	Once daily	
Prednisolone	Intermediate duration; more anti-inflammatory than mineralocorticoid	12–36	3–5[b]	Once in the morning	Prednisolone cross reacts in many cortisol assays
Dexamethasone	Mainly anti-inflammatory with no mineralocorticoid activity. Increased risk of excess exposure because of long half-life Not used on a regular basis in AI therapy	36–72	Not recommended	Not recommended	Does not significantly cross-react in most assays
Mineralocorticoids					
9-α-Fludrocortisone	Selective binding to mineralocorticoid receptor		0.1 mg		
			Dose adjustments needed in hot climate, strong perspiration, pregnancy or in patients with concomitant hypertension	Once daily in the morning; or 1/2–0–1/2	Blood pressure, serum sodium and potassium, salt-craving, plasma renin activity/ concentration with target at normal to upper normal reference range
Androgen					
DHEA	Not regarded as standard replacement regimen in AI		25–50	Once daily in the morning	Measure trough serum DHEAS concentrations, androstenedione, testosterone and sex hormone-binding globulin levels
	No pharmaceutical-licensed preparation available. Actual DHEA in over-the-counter preparations claiming 25 mg may vary from 0–140 mg				

KEY MESSAGES

- Adrenocortical insufficiency is a rare but life-threatening disease with various causes.
- Hydrocortisone is the first choice for glucocorticoid replacement, in which a rigid treatment schedule should be rejected for a flexible day-to-day modification (e.g., ±5 mg hydrocortisone).
- Complications occur because of replacement doses set too low (adrenal crises) or too high (metabolic syndrome, osteoporosis). Monitoring of therapy is performed primarily according to clinical criteria.
- Infectious diseases are the main risk for the development of adrenal crisis, and they must be treated early and vigorously. In cases of diarrhea and vomiting, immediate parenteral administration of 100 mg hydrocortisone is necessary.
- Continuing instruction of patients and relatives is essential. Patients should be supplied with an emergency identification card and an emergency kit.