



Kurs 5: CEEA 6: Anestezija i perioperativna medicina

Naziv teme: Anestezija i perioperativna medicina kod starih pacijenata

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“Age may bring wisdom but it also brings a greater chance of health problems, and some health problems might require surgery to make you better. In fact, 1 in 10 people who have surgery are 65 or older.”

*American Society of **Anesthesiologists***

<https://www.asahq.org/whensecondscount/preparing-for-surgery/risks/age/>

“Some common health problems related to aging — increased blood pressure, clogged arteries, and heart and lung disease — may make it more likely that you’ll experience side effects or complications during or after surgery. And, just being older sometimes can cause some distressing side effects.”

*American Society of **Anesthesiologists***

<https://www.asahq.org/whensecondscount/preparing-for-surgery/risks/age/>

Revised ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management. Implications for preoperative clinical evaluation

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REVISED ESC/ESA GUIDELINES ON NON-CARDIAC SURGERY

GUARRACINO

their agreement on the perioperative cardiac management (especially with regard to the preoperative assessment) is likely to improve patient care. The revised Guidelines emphasize the importance of preoperative cardiac risk stratification in reducing postoperative cardiac complications. Preoperative cardiac risk stratification should be tailored to the individual patient.

The ESC/ESA Joint Task Force recommends that preoperative cardiac testing be performed independent of type (open *vs.* less-invasive surgery) and urgency of the operation (emergent *vs.* urgent surgery), and only in patients who likely benefit from it. For example, in patients scheduled for low-risk surgery, and even in those scheduled for high-risk surgery a routine preoperative resting echocardiogram is no longer recommended.

Preoperative risk assessment

The previous as well as the revised Guidelines recommend to use clinical risk indices for preoperative cardiac risk stratification (Class I recommendation, level of evidence B) (for definitions of classes of recommendation and levels of evidence see Table I). The revised Guidelines recommend to use, in addition to the traditional Lee cardiac risk index,³ the American College of

Surgeons National Surgical Quality Improvement Program (NSQIP) Myocardial Infarction Cardiac Arrest (MICA) model built on the 2007 data set of the NSQIP database (Class I recommendation, level of evidence B).⁴ Independent predictors of perioperative myocardial infarction or cardiac arrest were found to be type of surgery, functional status, creatinine concentration, American Society of Anesthesiologists' physical status classification, and age. The prognostic information provided by the two models is complementary. However, the predictive ability of the NSQIP MICA model was superior to that of the Revised Lee Cardiac Risk Index, and the risk can easily be calculated at the bedside (<http://www.surgicalriskcalculator.com/miorcardiacarrest>)⁴ (Table II).

Assessment of preoperative functional capacity on the basis of metabolic equivalent tasks (METs) or exercise testing is still considered mandatory in preoperative cardiac risk stratification before non-cardiac surgery.

What's new in preoperative evaluation

The new Guidelines emphasize the importance of selective, individualized preoperative screening of patients scheduled for non-cardiac surgery. Not every patient with CVD requires

Guarracino F, Baldassarri R, Priebe H. J. Revised ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management. Implications for preoperative clinical evaluation. *Minerva Anesthesiol* 2015 Feb;81(2):226-33.

RCRI

Revised Cardiac Risk Index
1. History of ischemic heart disease
2. History of congestive heart failure
3. History of cerebrovascular disease (stroke or transient ischemic attack)
4. History of diabetes requiring preoperative insulin use
5. Chronic kidney disease (creatinine > 2 mg/dL)
6. Undergoing suprainguinal vascular, intraperitoneal, or intrathoracic surgery
Risk for cardiac death, nonfatal myocardial infarction, and nonfatal cardiac arrest: 0 predictors = 0.4%, 1 predictor = 0.9%, 2 predictors = 6.6%, ≥3 predictors = >11%

NSQIP MICA index

Age Group Under 65 years

Sex
Female

Functional Status i
Independent

Emergency Case i
No

ASA Class i
Healthy patient

Steroid use for chronic condition i
No

Ascites within 30 days prior to surgery i
No

Systemic Sepsis within 48 hours prior to surgery i
None

Ventilator Dependent i
No

Disseminated Cancer i
No

Diabetes i
No

Hypertension requiring medication i
No

Congestive Heart Failure in 30 days prior to surgery
No

Dyspnea i
No

Current Smoker within 1 Year i
No

History of Severe COPD i
No

Dialysis i
No

Acute Renal Failure i
No

BMI Calculation: i
Height: in / cm
Weight: lb / kg

Revised ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management. Implications for preoperative clinical evaluation

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REVISED ESC/ESA GUIDELINES ON NON-CARDIAC SURGERY GUARRACINO

Preoperative ECG

Preoperative resting ECG should be performed only in patients with risk factors (Ta-

quire additional preoperative cardiac assessment (Figure 2). On the other hand, patients with known or high risk of cardiac disease scheduled for high-risk non-cardiac surgery should un-

TABLE III.—Recommendations for preoperative resting ECG.

Patient population	2009 ESC Guidelines	2014 ESC/ESA Guidelines
Patients with risk factor(s) ^a scheduled for intermediate- or high-risk surgery ^b	Recommended (I,B) ^c	Recommended (I,C)
Patients with risk factor(s) scheduled for low-risk surgery	Should be considered (IIa,B)	May be considered (IIIb,C)
Patients without risk factors scheduled for intermediate-risk surgery	May be considered (IIIb,B)	May be considered (IIIb,C)
Patients without risk factors scheduled for low-risk surgery	Not recommended (III,B)	Not recommended (III,B)

^a Risk factors as listed in Table II. ^b Types of surgery as listed in Figure 2. ^c Class of recommendation (Latin number) and level of evidence (second letter) as listed in Table I.

TABLE IV.—Recommendations for preoperative resting echocardiography.

Patient population	2009 ESC Guidelines	2014 ESC/ESA Guidelines
Asymptomatic patients	Not recommended (III,B) ^a	Not recommended (III) ^b
Patients scheduled for high-risk surgery ^c	Should be considered (IIa,C)	May be considered (IIIb,C)
Patients scheduled for intermediate or low-risk surgery	—	Not recommended (III,C)
Patients with severe valvular heart disease	Recommended (I,C)	—
Patients with known or suspected valvular heart disease scheduled for intermediate or high-risk surgery	—	Recommended (I,C)

^a Class of recommendation, level of evidence as listed in Table I. ^b Level of evidence not listed. ^c Types of surgery as listed in Figure 2.

bles II, III) who are to undergo intermediate- or high-risk surgery. It may be considered in patients without risk factors but older than 65 years scheduled for intermediate- or high-risk surgery. Preoperative resting ECG is not recommended in asymptomatic patients without risk

fore intermediate- or high-risk surgery. Imaging stress testing is generally not recommended before low-risk surgery.

Serum biomarkers

Guarracino F, Baldassarri R, Priebe H. J. Revised ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management. Implications for preoperative clinical evaluation. *Minerva Anestesiol* 2015 Feb;81(2):226-33.

- Gerijatrijski bolesnici – osobe starije od 65 godina
- Poboljšanjem životnog standarda i zdravstvene zaštite životni vek ljudi se značajno produžio
- Velika je odgovornost i izazov efikasnog hirurškog lečenja i perioperativnog praćenja ove specifične i sve brojnije populacije bolesnika

Teritorija - NSTJ		Starosne grupe	Period											
			2014			2015			2016					
			Vrsta podatka		Broj stanovnika		Struktura, %		Broj stanovnika		Struktura, %			
Pol		Ukupno	Muško	Žensko	Ukupno	Muško	Žensko	Ukupno	Muško	Žensko	Ukupno	Muško	Žensko	
REPUBLIKA SRBIJA	Ukupno		7131787	3472746	3659041	100.00	100.00	100.00	7095383	3455335	3640048	100.00	100.00	100.00
	0-14 godina		1024425	527145	497280	14.36	15.18	13.59	1022008	526003	496005	14.40	15.22	13.63
	0-19 godina		1399950	720609	679341	19.63	20.75	18.57	1384353	712596	671757	19.51	20.62	18.45
	20-39 godina		1880823	958477	922346	26.37	27.60	25.21	1860228	948762	911466	26.22	27.46	25.04
	40-59 godina		1986860	975905	1010955	27.86	28.10	27.63	1959488	963067	996421	27.62	27.87	27.37
	60 i više godina		1864154	817755	1046399	26.14	23.55	28.60	1891314	830910	1060404	26.66	24.05	29.13
	65 i više godina		1301401	550918	750483	18.25	15.86	20.51	1328841	564047	764794	18.73	16.32	21.01

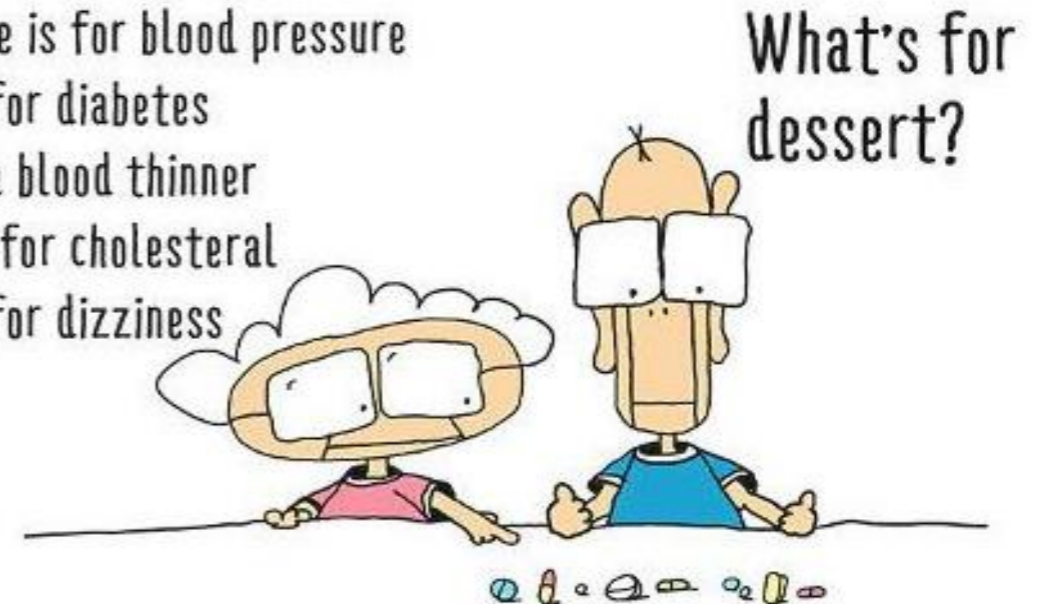
Republički zavod za statistiku, Republika Srbija

<http://www.stat.gov.rs/sr-latn/oblasti/stanovnistvo/procene-stanovnistva/>

- u Evropi do 2040. godine - gerijatrijska populacija do 30% stanovništva
- veliki broj – hirurški bolesnici
- akutno hirurško oboljenje + multiple hronične pridružene bolesti
- godine starosti NISU kontraindikacija za izvodjenje anestezije i operacije
- veći perioperativni morbiditet i mortalitet kod starih nego mladjih hirurških bolesnika

- optimalno perioperativno sagledavanje, praćenje i lečenje
- poznavanje normalnih fizioloških mehanizama starenja i anatomije
- poznavanje farmakologije brojnih lekova

That pill is for your heart
that one is for your eyes
that one is for blood pressure
That's for diabetes
that's a blood thinner
That is for cholesterol
That's for dizziness



- ✓ β -blokatori
- ✓ ACE inhibitori
- ✓ ARB
- ✓ oralni hipoglikemici
- ✓ antitrombocitni
- ✓ antikoagulantni lekovi

- FIZIOLOGIJA STARENJA
- progresivni gubitak funkcionalne rezerve u svim organskim sistemima
- obim i početak promena varira od osobe do osobe
- gotovo uvek prisutan jedan ili više značajnih komorbiditeta

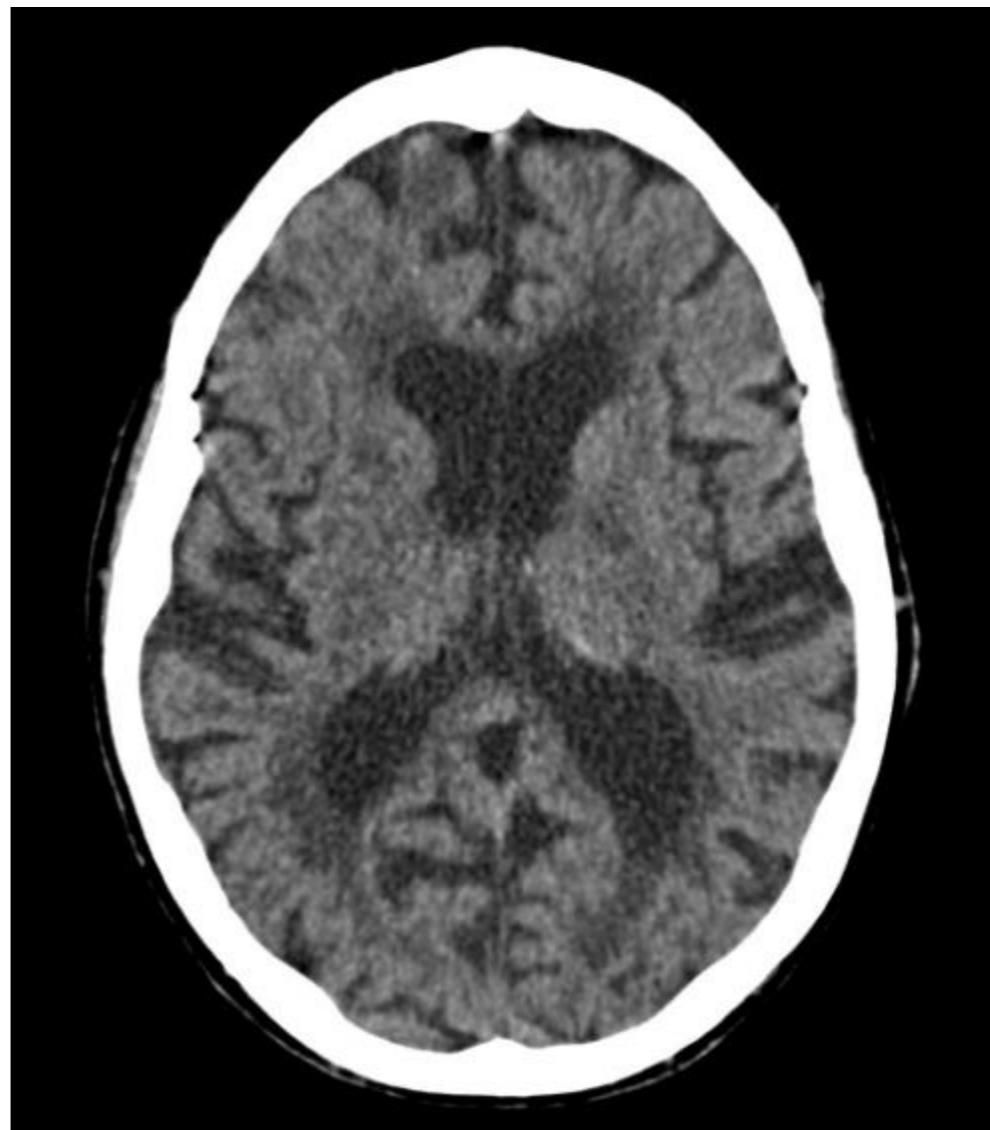
CNS

- cerebralna atrofija – smanjenje moždane mase
- siva masa – istanjenje neurona, gubitak kompleksnih dendritičkih nastavaka i sinapsi
- bela masa – do 15% gubitka
- mali ukupni gubitak neurona – korteks, frontalni režanj
- ↑ astrociti i mikroglialne ćelije
- giralna atrofija i povećanje komora
- cerebralni krvni protok ↓ 10-20% - proporcionalno gubitku neurona

CT mozga mladje osobe



CT mozga stare osobe



<https://radiopaedia.org/cases/elderly-ct-brain>

CNS

- ↓ sinteza neurotransmitera: dopamin, serotonin, GABA
- ↓ broj receptora neurotransmitera
- ↓ funkcija čula vida, sluha, dodira, propriocepcije
- oštećenje kognitivnih funkcija često, korelira sa godinama starosti
- ↓ funkcije pamćenja u 40% gerijatrijske populacije

CNS

- **POCD** (Postoperativna kognitivna disfunkcija)
- ↓ kognitivnih funkcija – mišljenje, pamćenje (kratkoročno), koncentracija, intelekt, pažnja
- u **30%** starijih bolesnika u prvoj nedelji i **10%** u trećem mesecu nakon nekardiohirurške operacije
- novonastala POCD često **nedijagnostikovana** u JIL



“Couldn’t find anything wrong with this one. Maybe he’s just lazy.”

POCD

- “Adverse cerebral effects of anaesthesia on old people” (Bedford, Lancet; 1955.)
- **Faktori rizika:**
godine starosti, ateroskleroza (karotidna, periferne arterije), dijabetes, prethodni neurološki deficit, genetska predispozicija, depresija, cerebralna hipoperfuzija, SIRS perioperativno, bol, hipotermija, metabolički poremećaji
- Mason i sar. – **nema razlike** u incidenci POCD nakon opšte ili regionalnih tehnika anestezije

Mason SE, Noel-Storr A, Ritchie CA. The impact of general and regional anesthesia on the incidence of postoperative cognitive dysfunction and postoperative delirium: a systematic review with meta-analysis. J Alzheimers Dis. 2010;22:67–79.

POCD i anestezijska

- Preoperativna priprema – odrediti postojanje i stepen kognitivnog poremećaja (MMSE – Mini Mental State Examination)
- Premedikacija
benzodiazepini – dezorijentacija, konfuzija
prethodna upotreba benzodiazepina – smanjena incidenca POCD, nagli prekid preoperativno povećava incidencu
- Anestezijska
nijedna tehnika nije superiorna, ali često se predlažu regionalne tehnike anestezije
cilj – kraće trajanje operacije i prevencija respiratornih komplikacija i produžene MV
- Postoperativno lečenje
medikamentozna terapija, rana fizikalna terapija, manji broj bolničkih dana

POSTOPERATIVNI DELIRIJUM

- akutni poremećaj mentalnih funkcija, vizuelne halucinacije, anksioznost, agresivnost, depresija
- čest kod starih bolesnika
- kratko traje
- faktori rizika brojni, često infekcija ili alkoholna apstinencija u postoperativnom periodu
- **LEKOVI**
 - antiholinergici
 - digoksin, tiazidni diuretici, kortikosteroidi (blag antiholinergički efekat)
 - sedativi, opioidi
- elektrolitni disbalans, hipo/hiperglikemija

CNS

U praktičnom radu značajno je:

- Povećana osetljivost CNSa na anestetike (inhalacione, intravenske i lokalne) – redukcija doza
- Epiduralno primenjeni LA ekstenzivnije se šire, ali je trajanje analgezije i motornog bloka kraće
- Nakon spinalne administracije LA, anestezija i motorni blok traju duže

KVS

Fiziološki mehanizmi starenja:

- ↓ **broj miocita** – miokard rigidniji, smanjena komplijansa
- **depoziti amiloida i kalcifikati** – poremećaj rada provodnog sistema srca (aritmije – atrijalna fibrilacija i flater)
- ↓ **broj pretkomorskih PM ćelija**
- **Fibroza zidova krvnih sudova (tunica media)** – smanjena elastičnost
- ↑ **tonus vagusa**, a ↓ **osetljivost adrenergičkih receptora (β)** – SF opada za jedan otkucaj/min sa svakom godinom preko 50.

Anestetici → **značajna hipotenzija** (kompenzatorni mehanizmi oštećeni)

Ateroskleroza (patofiziološki proces)

KVS

- Česti kardiovaskularni komorbiditeti – dijagnostikovani ili **ne**
- **EKG preoperativno** – otkriva prethodno nelečene aritmije/ishemija miokarda ili akutna pogoršanja, koja mogu zahtevati preoperativno terapiju ili intervenciju
- **Ehokardiografija**
 - veća incidenca dijastolne disfunkcije kod starih osoba, teška dijastolna disfunkcija > kongestija
 - promene u valvularnom aparatu srca – kalcifikacija i skleroza

RS

Fiziološke promene

“Emphysema – like changes”

- ↓ elastičnost pluća
- ↓ alveolarna površina
- ↑ rezidualni volumen
- poremećaj V/Q odnosa
- ↓ PaO₂ (4mmHg po dekadi posle 20.godine)
- ↑ rigiditet grudnog koša
- slabljenje respiratorne muskulature
- ↓ sposobnost adekvatnog iskašljavanja
- ↓ centralni ventilatorni odgovor na hiperkapniju i hipoksiju

Komorbiditeti

- HOBP
- Emfizem
- Pneumonija



“Your breathing test results would be normal ... if you were 3'8" and 150 years old.”

RS

- fiziološke promene > povećan disajni rad > smanjena respiratorna rezerva u akutnom oboljenju (infekcija)
- **Prevenција hipoksije:**
produžena preoksigenacija
↑ FiO₂
PEEP
toaleta disajnog puta
- **Aspiraciona pneumonija** – progresivno slabljenje zaštitnih laringealnih refleksa, otežano iskašljavanje

RS

Faktori rizika za nastanak postoperativnih respiratornih komplikacija:

- **>64 godine starosti**
- **HOBP**
- **Sleep apnea**
- **malnutricija**
- **abdominalna/torakalna incizija**

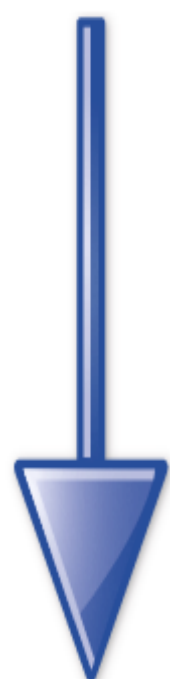


METABOLIZAM I ENDOKRINI SISTEM

- ↓ bazalnog metabolizma
- gubitak telesne težine
- termoregulacioni centar resetovan na nižu telesnu temperaturu (podložniji hipotermiji)

- ↑ insulinska rezistencija – obazriva primena rastvora glukoze
- DM (kod 15% starijih od 70 god.) – dijabetesna neuropatija i disfunkcija ANS

RENALNA FUNKCIJA



Renalni krvni protok
 Renalna masa
 (glomeruli/tubuli)
 GFR
 CrCl
 Odgovor na aldosteron i ADH
 Reapsorpcija glukoze



Urea
 Kreatinin
ABI

- Nefrotoksični lekovi i tehnike (kontrast)!!!
- Sporija eliminacija lekova!

Younger



Older



HEPATIČNA FUNKCIJA

Masa jetre

Hepatični krvni protok

Biotransformacija lekova

Sinteza albumina

Nivo plazma holinesteraze
kod starijih muškaraca



SKELETNO-MIŠIĆNI SISTEM

Redukcija mišićne mase

Artritični zglobovi – poteškoće u
regionalnoj anesteziji!

Degenerativne promene vratnih
pršljenova – limitirana ekstenzija
vrata > potencijalna otežana
intubacija

FARMAKOLOŠKE PROMENE

- Farmakokinetičke i farmakodinamske promene
- \downarrow mišićna masa $>$ \uparrow masno tkivo $>$ \downarrow volumen distribucije za hidrosolubilne (\uparrow plazma conc.), a \uparrow za liposolubilne lekove
- Pad bubrežne i hepatične funkcije $>$ \downarrow klirens lekova $>$ produženo dejstvo
- \downarrow albumina $>$ \uparrow slobodna frakcija (aktivna) kiselih lekova: barbiturati, benzodiazepini, opioidi

FARMAKOLOŠKE PROMENE

- **Smanjenje doza** lekova za uvod i održavanje anestezije (povećana osetljivost na anestetike i smanjen klirens)

Spora administracija lekova na uvodu u anesteziju (produženo vreme cirkulacije ruka/mozak; efekat nastaje posle dužeg vremenskog perioda nego kod mlađih):

TCI pumpe uzimaju u obzir godine starosti



Volatilni anestetici

- ↑ osetljivost
- MAC se smanjuje za 4% za svaku dekadu nakon 40. god.
- Početak dejstva je brži ukoliko je MV srca manji, i sporiji kod poremećaja V/Q odnosa
- Oporavak produžen zbog ↑ Vd (masno tkivo) i smanjene alveolarne razmene gasova

- **Desfluran** – slabo rastvorljiv > brza eliminacija > brz oporavak
- **Sevofluran**

Nevolatilni anestetici

- **Propofol** - brzo se eliminiše, kratkog je dejstva
 - češća apnea i hipotenzija
 - 50% niža plazma conc u anesteziji
- **Opioidi** – doze 50% manje
- **Benzodiazepini (midazolam)** - $\uparrow V_d >$ produženo poluvreme eliminacije za 50% $>$ doze za 50% manje
- **Miorelaksanti** – rokuronium ima produženo vreme eliminacije zbog \downarrow hepatične funkcije; atrakurijum, cisattrakurijum – uglavnom neizmenjen metabolizam

Endotrahealna intubacija

- Obično laka nakon uklanjanja zubnih proteza, ali otežana ventilacija na masku (“four hand ventilation”)
- Povećan rizik za aspiraciju želudačnog sadržaja (↓ tonus ezofagealnog sfinktera)
- ↓ pokretljivost vrata
- osteoporozna pršljenova

Postoperativna terapija bola

- Percepcija bola se ne smanjuje sa godinama, ali interpretacija može biti otežana (afazija, kognitivni poremećaji)
- NSAID – relativno kontraindikovani, povećan rizik od GIT krvarenja, ABI
- acetaminofen + slabi opioidi (tramadol)

TAKE HOME MESSAGES

- ✓ Proces starenja **smanjuje funkcionalne rezerve** bolesnika i smanjuje sposobnost adekvatnog odgovora na hirurški stres.
- ✓ Poznavanje **fizioloških mehanizama starenja i patofiziologije pridruženih bolesti** je od presudnog značaja u perioperativnom lečenju gerijatrijskih pacijenata.
- ✓ Poznavanje **farmakoloških promena** je neophodno prilikom izbora tehnike anestezije i lekova u perioperativnom periodu.

HVALA NA PAŽNJI!

