کارگاه آرامبخشی در بخش مراقبت های ویژه

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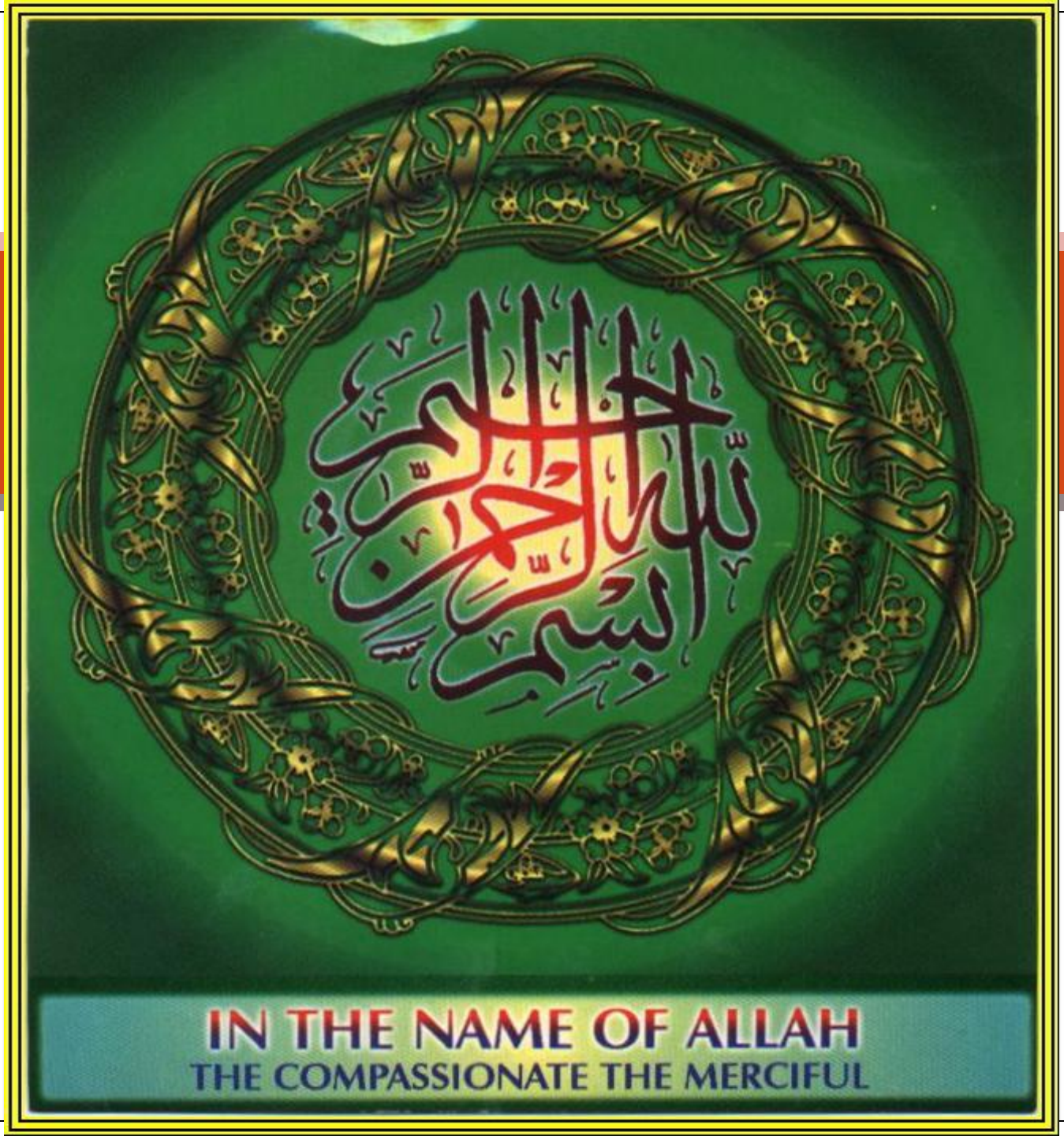
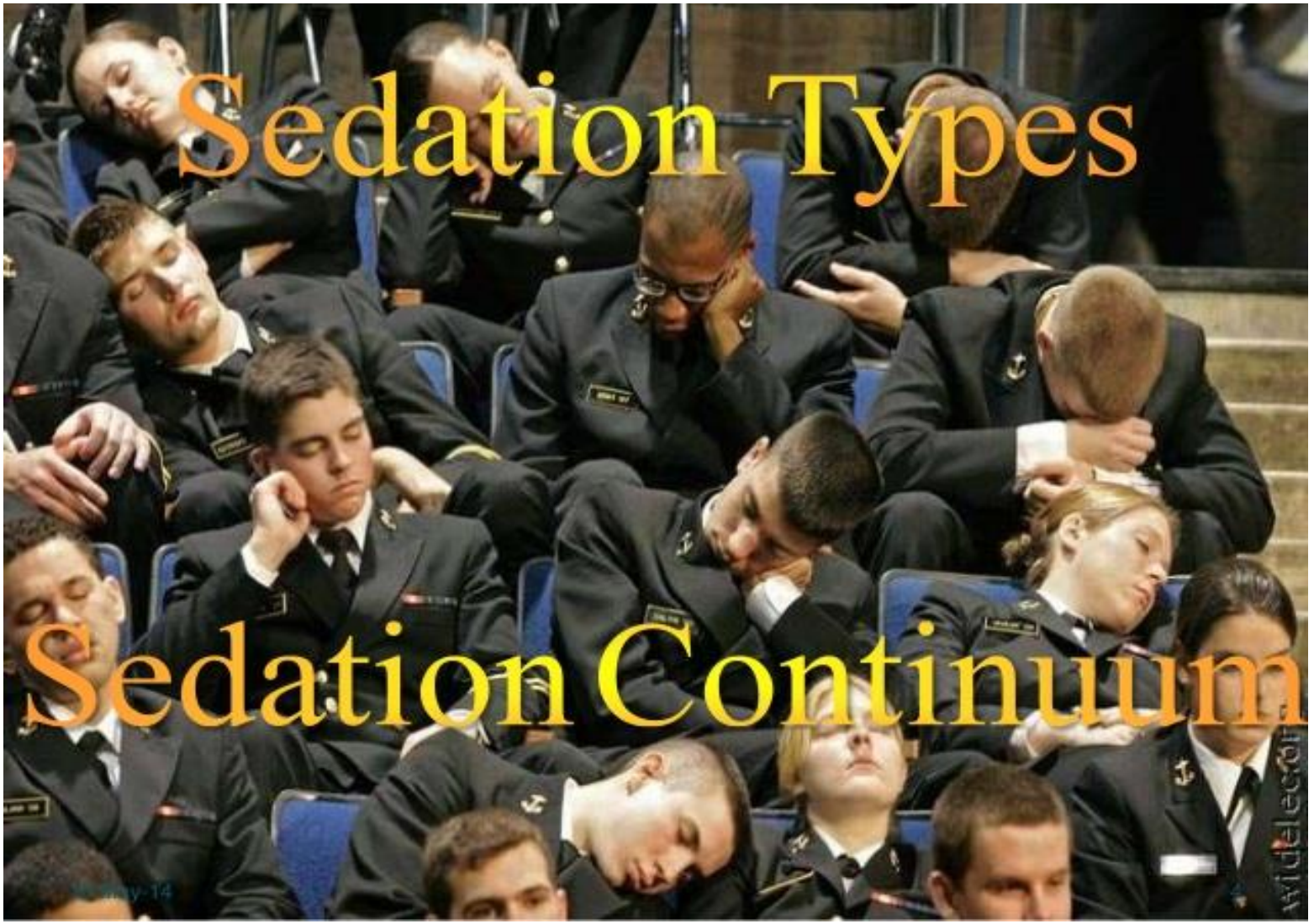
استاد بیهوشی و فوق تخصص مراقبت های ویژه

فلوشیپ احیاء قلبی-ریوی و مراقبت بحرانی بیماران ترومایی

فلوشیپ بالینی پزشکی مبتنی بر شواهد دانشگاه علوم پزشکی تبریز


بسم الله الرحمن الرحيم
IN THE NAME OF ALLAH
THE COMPASSIONATE THE MERCIFUL

- *Sedation* comes from the Latin word *sedare*.
- *Sedare* = to calm or to allay fear
- *Conscious sedation (آرام‌بخشي بدون بيهوشي)*: A minimally depressed level of consciousness induced by the administration of pharmacologic agents in which a patient retains the ability to independently and continuously maintain an open airway and a regular breathing pattern, and to respond appropriately and rationally to physical stimulation and verbal commands


Sedation Types
Sedation Continuum

سطح آرام‌بخشي

- راهكارهاي عملي براي آرام‌بخشي و بي‌دردي ممكن است در نقاط مختلف دنيا متفاوت باشد. جامعه متخصصان بيهوشي آمريكا چنين راهكارهايي را براي پزشكان غيرمتخصص بيهوشي ارايه نموده است. اين جامعه، آرام‌بخشي را يک طيف پيوسته بيان مي‌كند ولي سه سطح براي آن در نظر مي‌گيرد (جدول ۱).

- آرام‌بخشي اندک به صورت وضعيت كاهش اضطراب توسط دارو به گونه‌اي است كه بيمار به صورت طبيعي به دستورات كلامي پاسخ مي‌دهد.

- آرام‌بخشي يا بي‌دردي متوسط يا آرام‌بخشي بدون بيهوشي به صورت كاهش سطح هوشياري توسط دارو به گونه‌اي است كه بيمار با تحريک صوتي يا لمسي سبک بيدار شده، به دستورات كلامي به صورت هدفمند پاسخ مي‌دهد. به هيچ مداخله‌اي جهت باز نگه داشتن راه هوايي طي آرام‌بخشي بدون بيهوشي نياز نيست.

- آرام‌بخشي يا بي‌دردي عميق به صورت كاهش سطح هوشياري توسط دارو به گونه‌اي است كه نمي‌توان به راحتي بيمار را بيدار نمود ولي بيمار پس از تحريک مكرر يا دردناک، پاسخ‌هاي هدفمند ارايه مي‌دهد. كاركرد تهويه‌اي ممكن است در طي آرام‌بخشي يا بي‌دردي عميق مختل شود. مداخله‌هاي تهاجمي يا دردناک به اين سطح از آرام‌بخشي نياز دارند.

Inadequate Sedation

- All ICU patients suffer from severe sleep deprivation.
- REM sleep is 6% (Normal 25 %).
- Stress → neuroendocrine response
  (↑ ACTH, GH, Aldosterone, Adrenaline, …..)
- Release of cytokines → inflammatory response.

Inadequate Sedation (Cont)

- Stimulation of the autonomic nervous system and release of humoral factors → increased heart rate, blood pressure, and myocardial oxygen consumption → myocardial ischemia or infarction

- Altered humoral response can lead to hypercoagulability as a result of increased level of factor VIII, fibrinogen, platelet activity, and inhibition of fibrinolysis

Inadequate Sedation (Cont)

- Stress hormones also produce insulin resistance, increased metabolic rate, and protein catabolism
- Immunosuppression with reduction in number and function of lymphocytes and granulocytes
- Psychological disturbances – memories of vivid nightmares, hallucinations, and paranoid delusions

Why sedation is necessary?

- To improve patient comfort.
- Reduce stress.
- Facilitate interventions.
- Allow effective ventilation.
- Encourage sleep.
- ?? Prevent post-ICU psychosis. Unpleasant recall
- Medical device removal
- Additional cost
- Self-extubation, body injury
- Dysynchrony with mechanical ventilation

Properties of Ideal Sedative

- Easily titratable
- Rapid onset of action
- Short-acting
- No adverse effects
- No active or toxic metabolites
- No drug interaction
- Lack of accumulation with prolonged use
- Cost effective

Remember!

Most Common Reasons for Fighting the Ventilator

- Hypoventilation (hypercarbia)
- Acidemia
- Inadequate oxygenation
- CNS dysfunction
- Pain & anxiety

Manual ventilation for a short time often "***settles the patient down***"

Clinical indications for sedation in the ED

- Orthopedic reduction.
- Cardioversion.
- Wound debridement.
- Pediatric laceration repair.
- Lumbar puncture.
- Abscess incision and drainage.
- Chest tube insertion.
- Burn care.
- CT scans and other diagnostic procedures in children.
- Peritoneal lavage.
- Removal of vaginal or rectal foreign body.

Non-pharmacological interventions

- **Good nursing.**

- **Psychological:**

  - Explanation. - Reassurance.

(گر طبیبانه بیایي به سر بالینم، به دو عالم ندهم لذت بیماري را)

- **Physical:**

  - Touching & message. - Environment
  - Prevent constipation - Physiotherapy.
  - Tracheostomy.

Sedation-Analgesia Medications

- **IV Anaesthetics:**

  - Prpofol
  - Ketamine
  - Thiopentone.
  - Etomidate.

- **Benzodiazepines:**

  - Midazolam.
  - Lorazepam

Sedation-Analgesia Medications

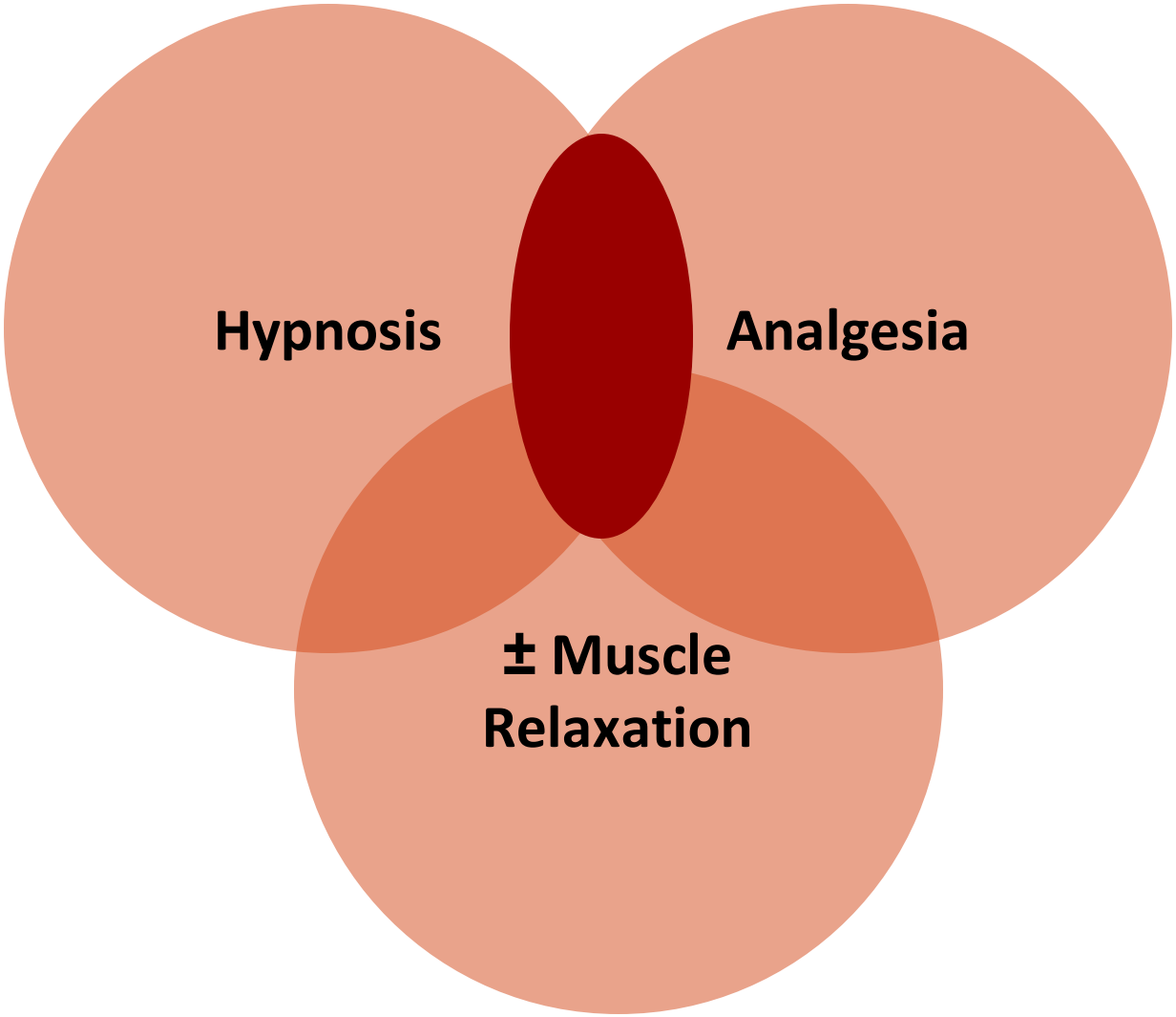
- **Opiodis:**

  - Morphine

  - Fentanyl.

  - Remifentanil

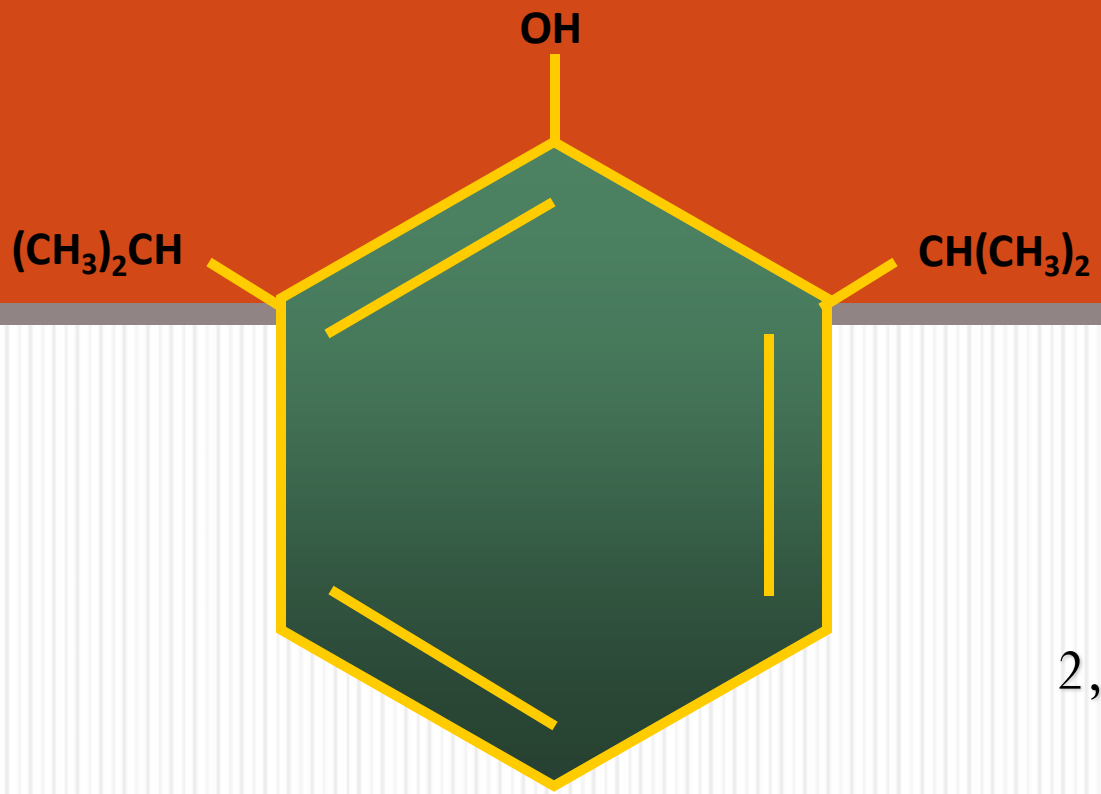
- **α-$_2$ receptors agonists:**
  - Clonidine.
  - Dexmedetomidine .

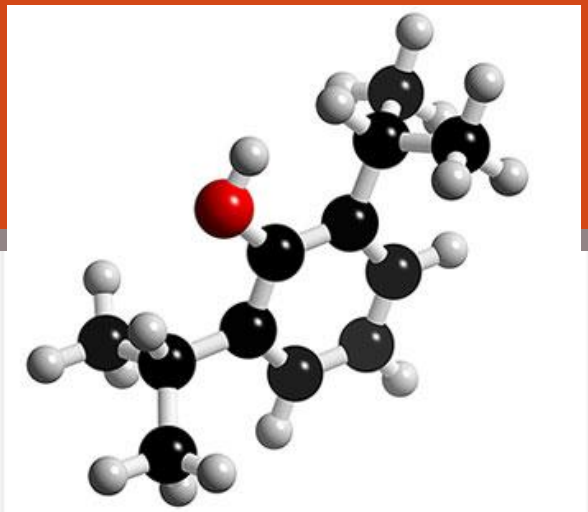

Hypnosis
Analgesia
± Muscle
Relaxation

Intravenous Nonopioid Anesthetics

- Propofol
- Barbiturates
- Phencyclidines (Ketamine)
- Benzodiazepines
- Etomidate

IV Anaesthetics; Propofol





2,6 di-isopropyl phenol

Short-term sedation (< 48 h)

Propofol- History

- Early 1979s
- Key & Rolly 1977

Propofol- Physicochemical characteristics

- Propofol is one of a group of alkylphenols.
- Oils at room temperature and insoluble in aqueous solution, but they are highly lipid soluble.
- Formulation:
  - 1% (weight/volume) propofol
  - 10% soybean oil
  - 2.25% glycerol
  - 1.2% purified egg phosphatide
- All formulations available commercially are stable at room temperature
- Dilute: with 5% dextrose

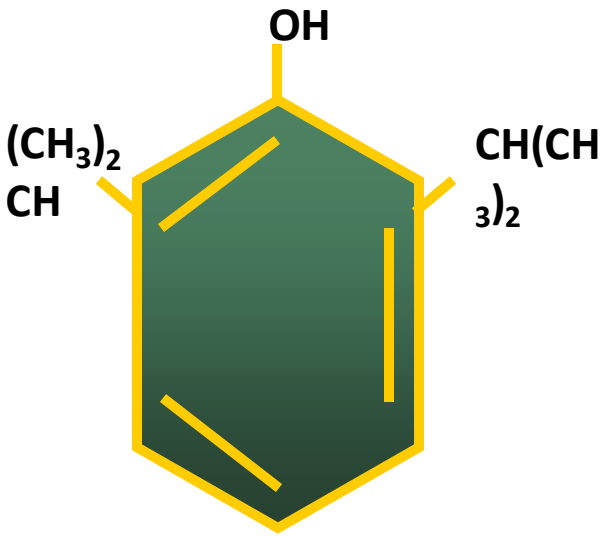
Propofol- Physicochemical characteristics

پروپوفول یک داروی فنولی و هیدروفوب است که عمده اثر خود را بر روی کانال کلر رسپتور GABAA می گذارد. هیدروفوب بودن این دارو باعث شده تا برای آماده کردن آن ، از زرده تخم مرغ و پروتئین سویا به عنوان امولسیون کننده استفاده کنند که اگر فردی به لستین موجود در زرده یا فراورده های پروتئین بکار رفته حساس باشد، واکنش آلرژیک می تواند اتفاق بیفتد.

فوس پروپوفل، از مشتقات پروپوفل است و هیدروفیل است که این امر باعث کاهش خطر آلرژي می شود. این دارو در بدن به پروپوفل متابولیزه می شود و لذا کندتر از پروپوفل اثر می کند

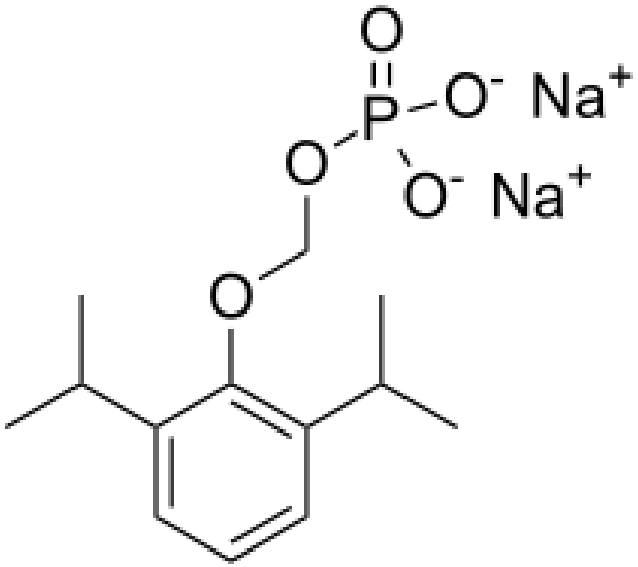
this water-soluble chemical compound include less pain at the site of intravenous administration, less potential for hyperlipidemia with long-term administration, and less chance for bacteremia

propofol



2,6-diisopropylphenol

Fospropofol



disodium [2,6-di(propan-2-yl)phenoxy]methyl phosphate

Propofol- **Pharmacokinetics**

- After a single bolus injection, whole blood propofol levels decrease rapidly as a result of both redistribution and elimination (2 to 8 minutes)
- The time to peak effect: 90 - 100 sec
- The **context-sensitive half time** of propofol for infusions lasting up to 8hr <40 mins

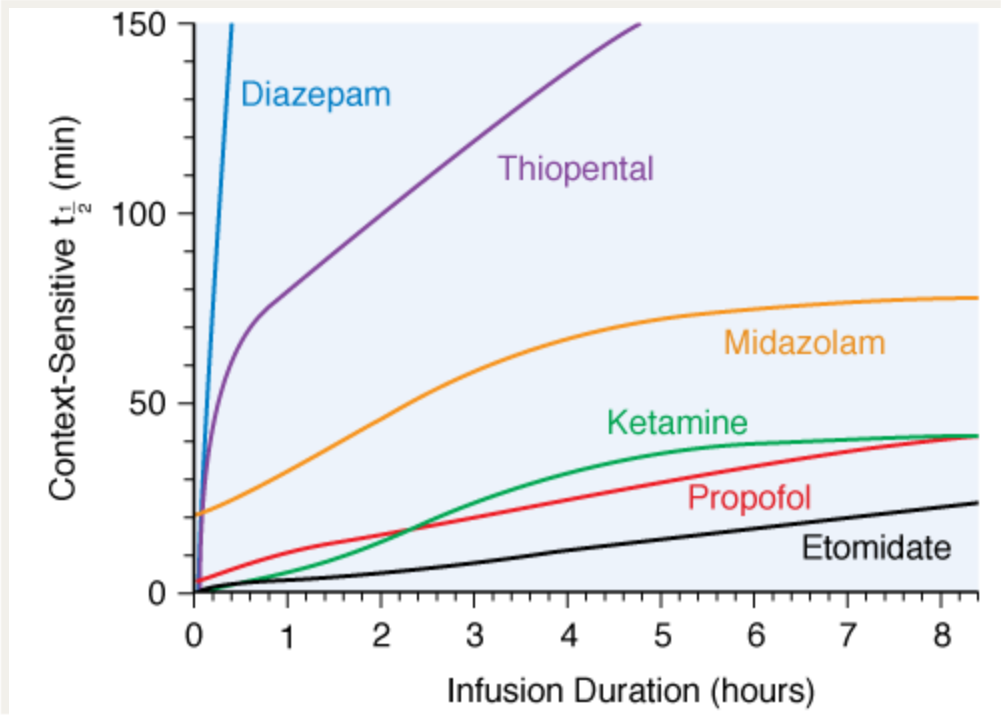
.

Context-Sensitive Half-Time

- معادل فارسی ندارد!، عبارتست از تاثیر تداوم مدت مصرف دارو، بر زمان ریکاوري، پس از قطع دارو. هر چه زمان ریکاوري از یک دارو به زمان استفاده از آن بستگی کم تري داشته باشد، بهتر است.

به نمودار زیر توجه کنید:

زمان لازم برای کاهش ۵۰ درصد غلظت پلاسمائی دارو پس از قطع انفوزیون =Context –sensitive half-time



در نمودار فوق، سه داروي اتومیدیت، کتامین و پروپوفل از همه بهتر هستند، ولی عوارض جانبی کتامین و اتومیدیت باعث میشود تا پروپوفول، بهترین داروی بیهوشی وریدی باشد.

Propofol- **Pharmacokinetics**

- Clearance extremely high: 1.5 to 2.2 L/min.
- Factors that alter Pharmacokinetics**:**
  - gender
  - weight
  - preexisting disease
  - Age
  - concomitant medication
- Propofol kinetics is unaltered by renal disease

Propofol- Pharmacology

- Effects on CNS:
  - Hypnotic
    - mediated by potentiating the $GABA_A$ receptor
  - Unlike barbiturates, propofol is not antianalgesic.
  - Two interesting side effects of propofol:
    - Antiemetic effect
    - the sense of well-being
  - ↓ ICP,
    - In patients with normal lCP: 30% ↓ ICP, 10% ↓ CCP
    - In patients with elevated ICP: 30-50% ↓ ICP, significant ↓ CCP
  - ↓ CMRO2 : 36%
  - ↓ IOP: 30-40%

Propofol- Pharmacology (cont.)

- Effects on cardiovascular system:
  - ↓BP: MBP 10-40% ↓
  - ↓cardiac output/cardiac index: 10-30% ↓
  - ↓stroke volume index: 10-25% ↓
  - HR ←→
- Other effects
  - Does not potentiate the neuromuscular blockade
  - Choice in MH
  - Antiemetic (sandwich technique)
  - Relieve pruritus
  - ↓PMN chemotactic
- Vehicle (soybean emulsion):
  - Hypertriglyceridemia
  - Venoirritation
  - Infection

Propofol- Uses

Uses and Doses of Propofol	
Induction of General Anesthesia	1-2.5 mg/kg IV: Dose reduced with increasing age
Maintenance of General Anesthesia	50-150 μg/kg/min IV combined with N2O or an opiate
Sedation	**25-75 μg/kg/min IV**
Antiemetic	10-20 mg IV; can repeat q 5-10min or start infusion of 10 μg/kg/min

IV Anaesthetics; Propofol

- **Propofol infusion syndrome:**

  - Rare but fatal.

  - 1st described in children.

  - Infusion ≥ 5 mg/kg/hr or ≥ 48 hours.

Propofol Infusion Syndrome

- Clinical features:

  - Cardiomyopathy with acute cardiac failure.
  - Myopathy.
  - Metabolic acidosis, ↑↑K^+
  - Hepatomegaly.

- Inhibition of FFA entry into mitochondria → failure of its metabolism.

Barbiturates- History

- Von Bayer : Barbituric acid1864
- Landy & Waters: 1934

Barbiturates- Physicochemical characteristics

- Thiobarbiturates are stable for 1 week if refrigerated after reconstitution methohexital remains available for use for up to 6 weeks after reconstitution.

- A decrease in alkalinity of the solution can result in precipitation of barbiturates as free acids, which is why they cannot be reconstituted with lactated Ringer's solution or mixed with other acidic solutions.

- Examplesof drugs that are not to be coadministered or mixed in solution with barbiturates are pancuronium, vecuronium, atracurium, alfentanil, sufentanil, and midazolam.

Barbiturates- Metabolism

- The barbiturates (with the exception of phenobarbital) are hepatically metabolized.
  - (1) *oxidation of the aryl, alkyl, or phenyl moiety at C5*
  - (2) N-dealkylation
  - (3) desulfuration of the thiobarbiturates at C2
  - (4) destruction of the barbituric acid ring.

- The induction of hepatic enzymes by barbiturates is responsible for the recommendation that they not be administered to patients with acute intermittent porphyria.

(However, without porphobilinogen deaminase, a necessary cytoplasmic enzyme, heme synthesis cannot finish, and the metabolite porphobilinogen accumulates in the cytoplasm.

A high-carbohydrate (10% glucose) infusion is recommended, which may aid in recovery.

Urine from a person experiencing an acute attack may be red or "port wine" in color because of the presence of porphyrins.)

Barbiturates- Pharmacology (cont.)

- **Effects on CNS:**
  - Hyperalagesia
  - ↓ICP, CBF, $CMRO_2$ & IOP
  - Reverse Steel

Barbiturates- Dosing

Recommended doses of barbiturates for induction and maintenance of anesthesia			
Drug	**Induction Dose (mg/kg)**	**Onst (sec)**	**IV Maintenance infusion**
Thiopental	3-4	10-30	**infusion 3-5 mg/kg/hr (doses may be as high as 15mg/kg/hr.)**

Barbiturates- Contraindictions

- Patients with respiratory obstruction
- Severe cardiovascular instability or shock
- Status asthmaticus
- Porphyria
- Without proper equipment for administration and airway equipment

Ketamine- History

- Maddox — Phencyclidine
- Greifen stein — 1958
- Steven — Ketamine 1962
- Corssen and Domino(in human) — 1965

Ketamine- Pharmacology

Effects on CNS:

- **Unconsciousness**
- **Analgesia**
- **Dissociative anesthesia**
- **↑ Skeletal muscle tone**
- **↑CBF, ↑ ICP, ↑ $CMRO_2$**
- **Emergence reactions: incidence 10-30%**
  - vivid dreaming, extracorporeal experiences (sense of floating out of one's body), and illusions (misinterpretation of a real, external sensory experience).

Ketamine- Pharmacology (cont.)

Effects on CNS:

- **Emergence reactions: incidence 10-30%**
  - Vivid dreaming
  - Extracorporeal experiences (sense of floating out of one's body)
  - Illusions (misinterpretation of a real, external sensory experience)
- **Factors that affect the incidence**
  - Age
  - Dose
  - Gender
  - Psychological susceptibility
  - Concurrent drugs.
- **Benzodiazepines seem to be the most effective group drugs to attenuate or treat ketamine emergence reactions.**

Ketamine- Pharmacology (cont.)

- **Effects on respiratory system:**
  - **Minimal**
  - **Bronchial smooth muscle relaxation**
  - **Increased salivation**
  - **Silent aspiration**

- **Effects on cardiovascular system**
  - **↑ BP,**
  - **↑ HR,**
  - **↑ C.O**
  - **The hemodynamic changes are not related to the dose ketamine.**
  - **A second dose of ketamine produces hemodynamic effects less than or even opposite those of the first dose.**
  - **Ketamine in vitro probably has negative inotropic effects.**

Ketamine- Pharmacology (cont.)

Effects on CNS:

- **Unconsciousness**
- **Analgesia**
- **Dissociative anesthesia**
- **↑ Skeletal muscle tone**
- **↑CBF, ↑ ICP, ↑ $CMRO_2$**
- **Emergence reactions: incidence 10-30%**
  - vivid dreaming, extracorporeal experiences (sense of floating out of one's body), and illusions (misinterpretation of a real, external sensory experience).

Ketamine- Uses

1. ASA IV & cardiac disease
2. Reactive airway
3. Trauma
4. Septic shock
5. Tamponade, restrictive pericarditis
6. CHD (R-L-Shunt)
7. Thoracic surgery
8. Wishes to avoid narcotics
9. Pediatric (outpatients)
10. Dressing changes

Ketamine- Doses

Table 10–11 Uses and doses of ketamine

Induction of General Anesthesia*

0.5-2 mg/kg IV

4-6 mg/kg IM

Maintenance of General Anesthesia

0.5-1 mg/kg IV prn with 50% N_2O in O_2

15-45 µg/kg/min IV with 50%-70% N_2O in O_2

30-90 µg/kg/min IV without N_2O

Sedation and Analgesia

0.2-0.8 mg/kg IV over 2-3 min

2-4 mg/kg IM

Preemptive/Preventive Analgesia

0.15-0.25 mg/kg IV

Ketamine- Contraindications

1. ↑ ICP
2. Intracranial mass
3. Open eye injury
4. Sole anesthetic in IHD
5. Vascular aneurysms
6. Psychiatric disease
7. Subarachnoid administration

Benzodiazepines- History

- Chlordiazepoxide (Librium) 1955 (Sternbach)
- Diazepam (Valium) 1959 (Sternbach)
- Oxazepam (Serax) 1961 (Bell)
- Lorazepam (Ativan) 1971
- Midazolam (Versed) 1976 (Walser)

Benzodiazepines- Pharmacokinetics

- **Midazolam: short**
- **Lorazepam: intermediate**
- **Diazepam: long lasting**

Benzodiazepines- Uses

Table 10–9 Uses and doses of intravenous benzodiazepines

	Midazolam	Diazepam	Lorazepam
Induction	0.05-0.15 mg/kg	0.3-0.5 mg/kg	0.1 mg/kg
Maintenance	0.05 mg/kg prn 1.0 µg/kg/min	0.1 mg/kg prn	0.02 mg/kg prn
Sedation*	0.5-1.0 mg repeated 0.07 mg/kg IM	2 mg repeated	0.25 mg repeated

Benzodiazepine

- Recommended to provide anxiolysis, sedation, and amnesia
- Midazolam if less than 24
- Lorazepam for longer-term use
- Propofol in subanesthetic doses for < 48h

Midazolam

- Properties

1. Rapid onset, short-acting
2. water-soluable benzodiazepine
3. Hypnosis, amnesia and anxiolysis

- Drug Interaction of Midazolam

1. Inhibit midazolam metabolism:

Erythromycin, clarithromycin, Itraconazole, fluconazole, ketoconazole, Cimetidine, diltiazem, propofol

2. Promote midazolam metabolism:

Phenytoin, carbamazepine Rifampicin

Lorazepam

- Properties

1. Lower lipid-solubility than midazolam
2. hypnosis, amnesia and anxiolysis
3. Less hypotesnion
4. Lower cost

Diazepam

- Highly lipid-soluble benzodiazepine
- Prolong time to recovery of consciousness
- Less use in ICU

1. Pain and thrombophlebitis
2. Long half-life (20-40 hours)
3. Excessive sedation

Etomidate

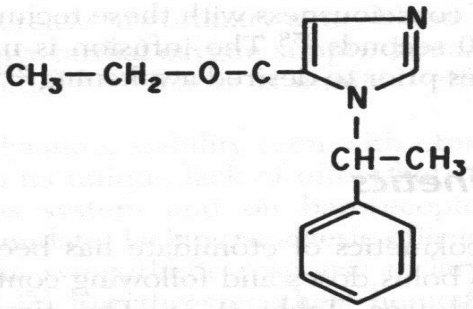


Figure 9–14. The structure of etomidate, an imidazole derivative.

1. History
    1. 1972
2. Physicochemical
3. Metabolism, induction, maintenance of anesthesia
4. Pharmacokinetics
5. Pharmacology
    1. effects on CNS:
        - Hypnosis
        - ↓ CBF, ↓$CMRO_2$, CPP ←→↑
        - ↓ ICP
        - ↓ IOP
        - ↑ EEG activity
    2. effects on respiratory system: Minimal
        - Hiccups or coughing
    3. effects on cardiovascular system: Minimal
    4. Endocrine effects

Etomidate cont.

5. Other effects:
   - Nausea vomitting
   - Pain on injection
   - Myoclonic movement
   - Hiccups
   - Superficial thrombophlebitis
   - Hemolysis

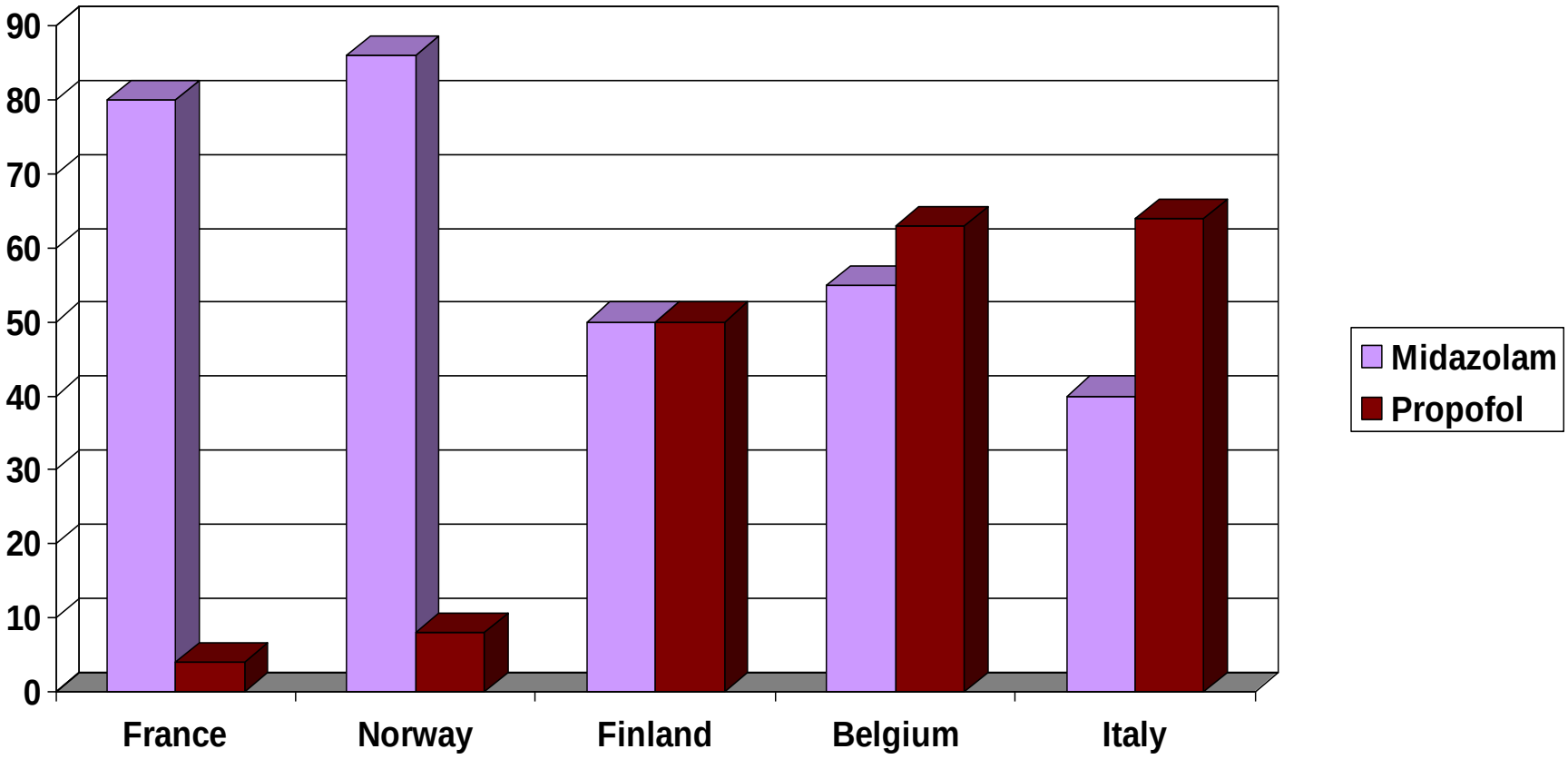
6. **Uses: in patients with:**
   - Cardiovascular disease
   - Reactive airway
   - Intracranial hypertension
   - Sick patients
   - Cardiothoracic procedures
   - Trauma patients
   - Cardioversion
   - ECT
   - Prolonged sedation in ICU contradicated

Table 9–8. Uses and Doses of Etomidate

Induction of general anesthesia	0.2–0.6 mg/kg IV
Maintenance of general anesthesia	10 µg/kg/min IV with N_2O and an opiate
Sedation and analgesia	5–8 µg/kg/min IV only for short periods of sedation because of inhibition of corticosteroid synthesis

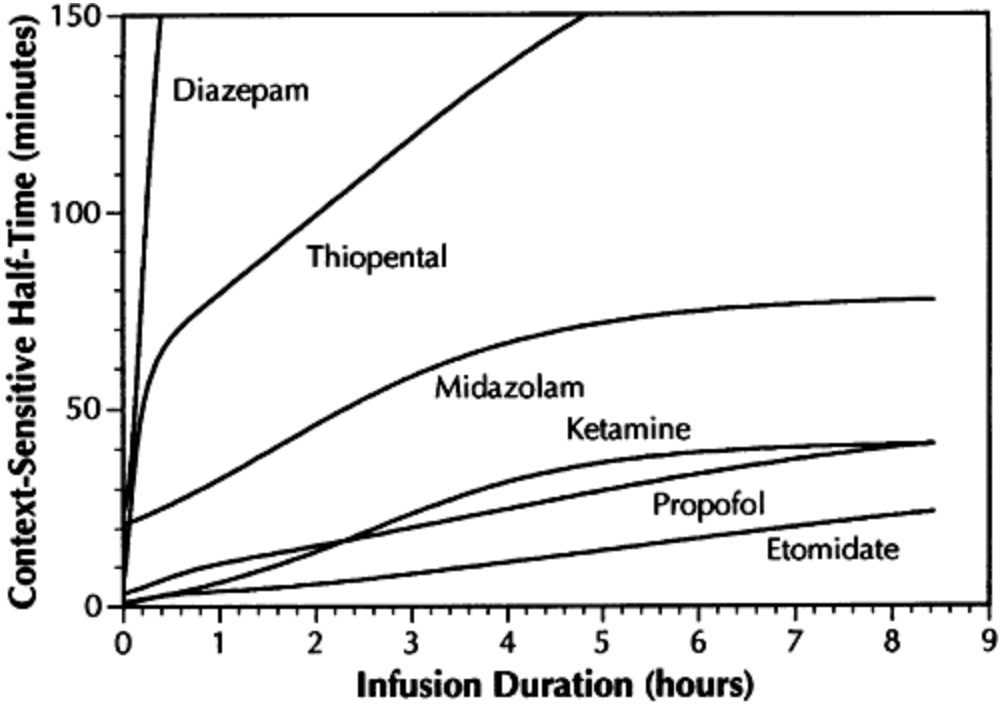
Opioid

Which Medication?

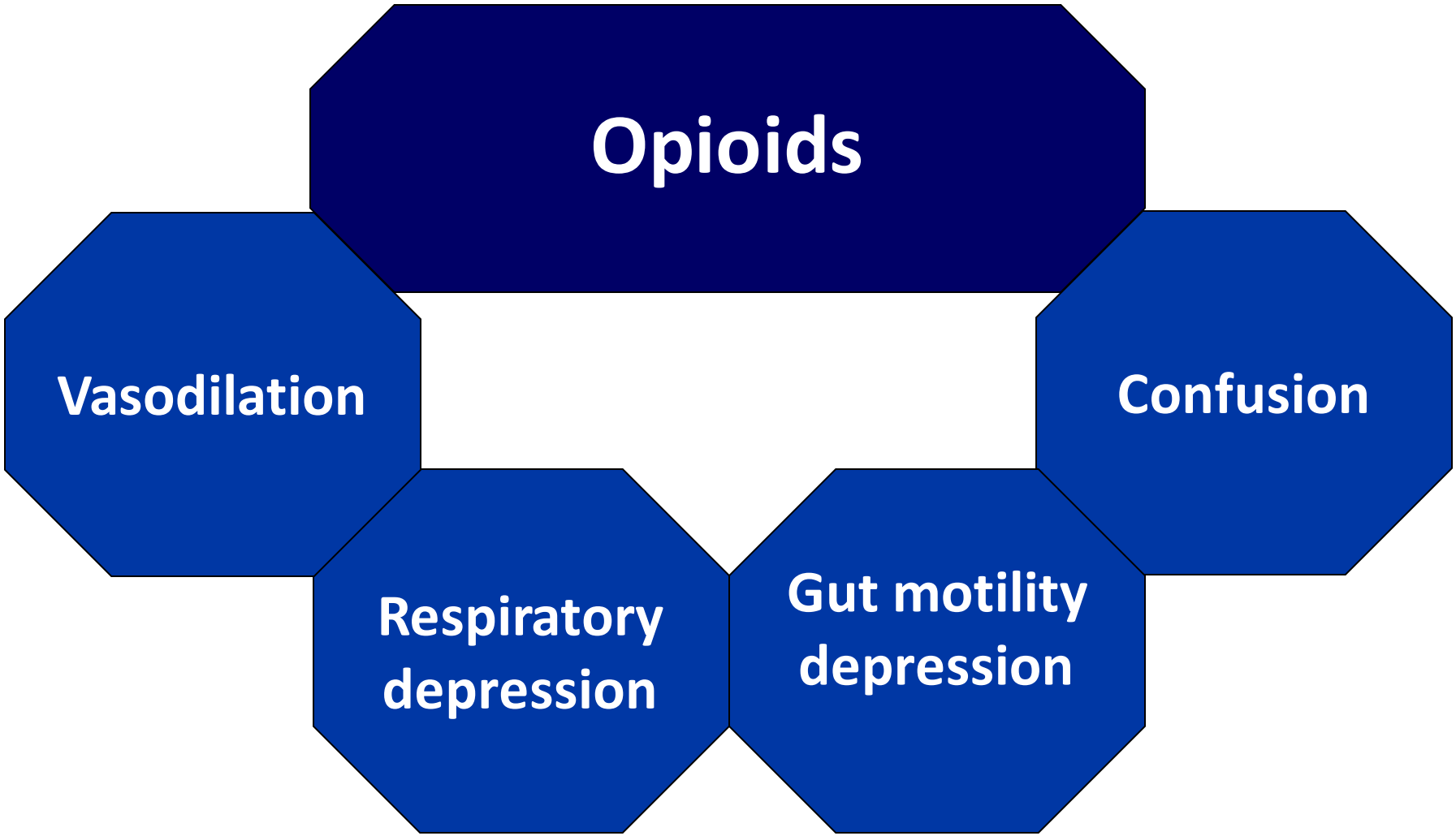


Soliman et al, Brit J Anaesth 2001;87:186-92

Context –sensitive half-time= زمان لازم برای کاهش ۵۰ درصد غلظت پلاسمائی دارو پس از قطع انفوزیون



Unwanted side-effects of opioids

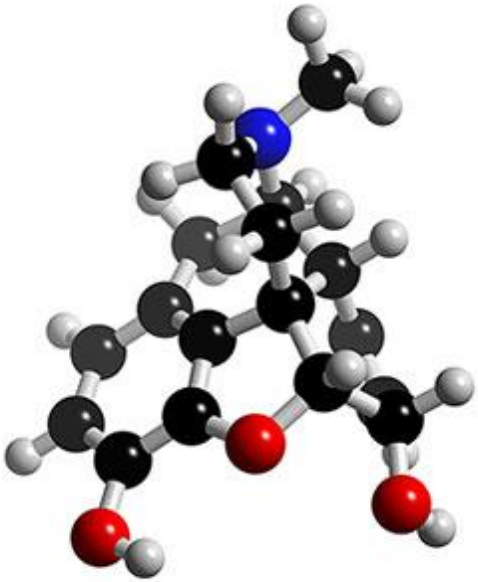


Morphine Sulfate

1. Society of Critical Care Medicine(SCCM) recommend that MS should be the basic analgesic agent because:

1. Effective analgesic
2. Reasonable sedative
3. Good euphoric
4. Familiar to nursing staff
5. Inexpensive

Opioids; Morphine



- Isolated in 1803 by the German pharmacist Friedrich Adam.
- Named it 'morphium' after Morpheus, **the Greek god of dreams**.

Morphine Sulfate

- **Starting dose**: 0.1 mg/kg IV/IM/SC
- **Maintenance dose**: 5-20 mg/70 kg IV/IM/SC q4h

Caution:

- If CV instability then fentanyl is recommended

Opioids - Morphine

- Morphine-6-glucuronide (active).

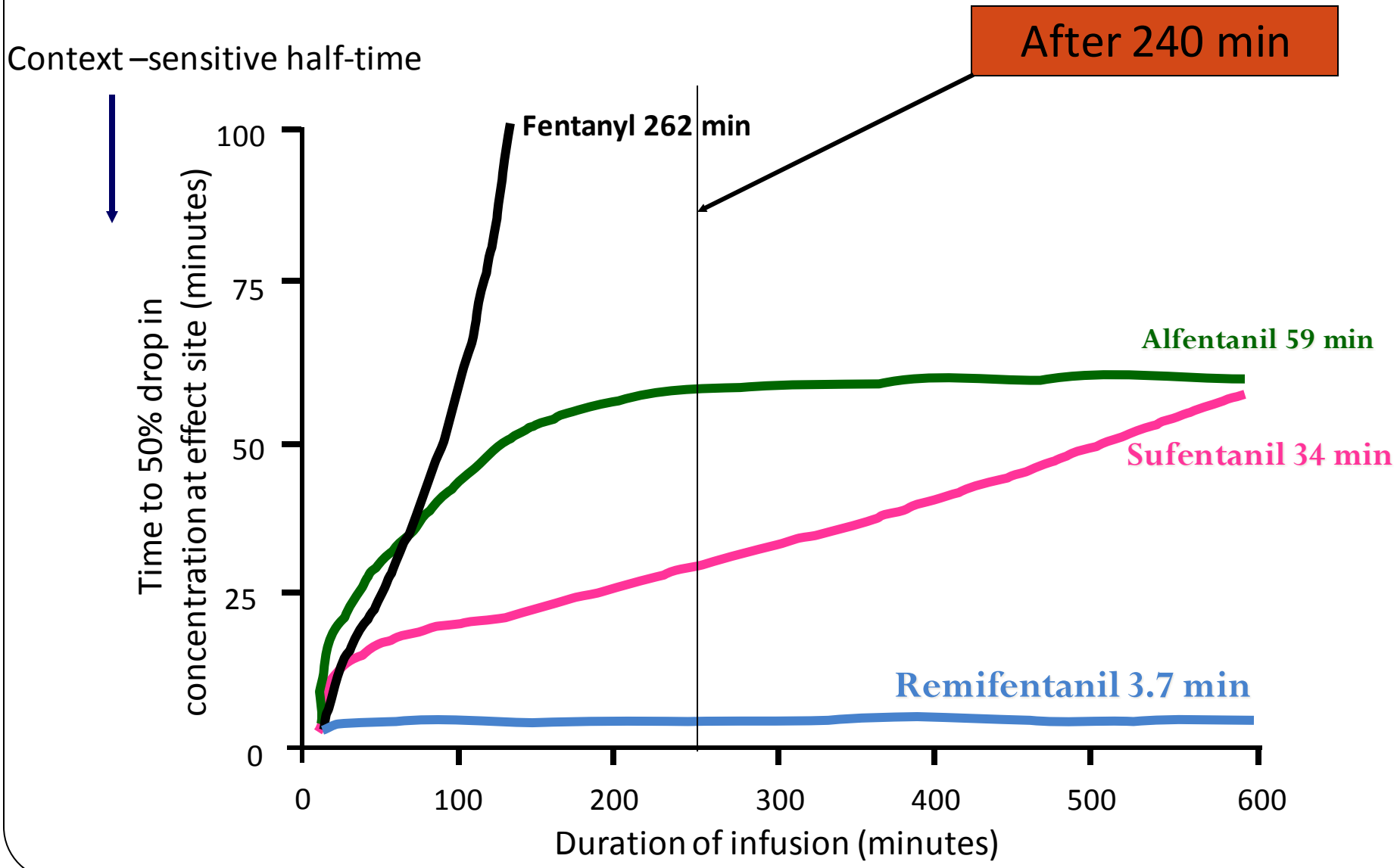
Remifentanil

- Piperidine derivative.
- Selective mu-receptor agonist.
- Potency similar to fentanyl.
- Terminal half-life < 10 min.
- Rapid blood-brain equilibrium.
- Metabolised by non-specific esterases.

امتیاز: عدم دفع کلیوی و کبدی دارد و شروع اثر سریع نیز دلرد

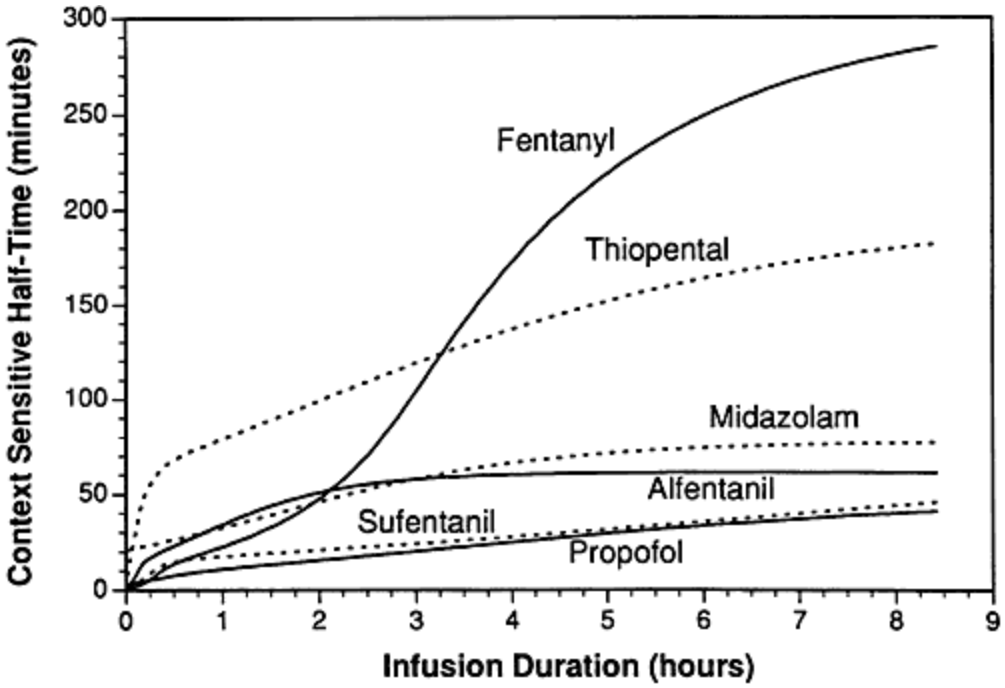
Plasma concentration after long term infusion

(Context –sensitive half-time= زمان لازم برای کاهش ۵۰ درصد غلظت پلاسمائی دارو پس از قطع انفوزیون)



نام دارو	میزان انفوزیون نگهداری
آلفنتانیل	۲ – ۰,۵ میکروگرم بر کیلوگرم در دقیقه
سوفنتانیل	۱,۵ – ۰,۵ میکروگرم بر کیلوگرم در ساعت
فنتانیل	۱۰ – ۲ میکروگرم بر کیلوگرم در ساعت
رمیفنتانیل	۱ – ۰,۱ میکروگرم بر کیلوگرم در دقیقه

(زمان لازم برای کاهش ۵۰ درصد غلظت پلاسمائی دارو پس از قطع انفوزیون =Context –sensitive half-time)



Is any place for neuro-muscular Blockers in ICU?

Muscle relaxant

As a last resort for:

1. Fighting the ventilator
2. Ablating the work of breathing
3. Protecting the patient from harm.
4. Sedation, analgesia, & amnesia must be provided for paralyzed ICU patients.
5. Pancuronium the agent of choice
6. Atracurium for CV unstable patients (cisatr)

NEUROMUSCULAR BLOCKING AGENTS

- Difficult to asses adequacy of sedation
- Polyneuropathy of the critically ill
- Use if unable to ventilate patient after patient adequately sedated
- Have no sedative or analgesic properties

Nondepolarizing Agents

- Pancuronium
  - Drug of choice for normal hepatic and renal function
- Atracurium or Cisatracurium
  - Use in patients with hepatic and/or renal insufficiency
- Vecuronium
  - Drug of choice for cardiovascular instability

Tools to Monitor Sedation

- Ramsay sedation scale
- Sedation-Agitation scale
- BIS monitor

Ramsay Sedation Score

Level 1	Awake, anxious, agitated, restlessness
Level 2	Awake, cooperative, tranquil.
Level 3	Respond to commands.
Level 4	Asleep, brisk response to stimuli.
Level 5	Asleep, sluggish response to stimuli.
Level 6	Asleep, no response

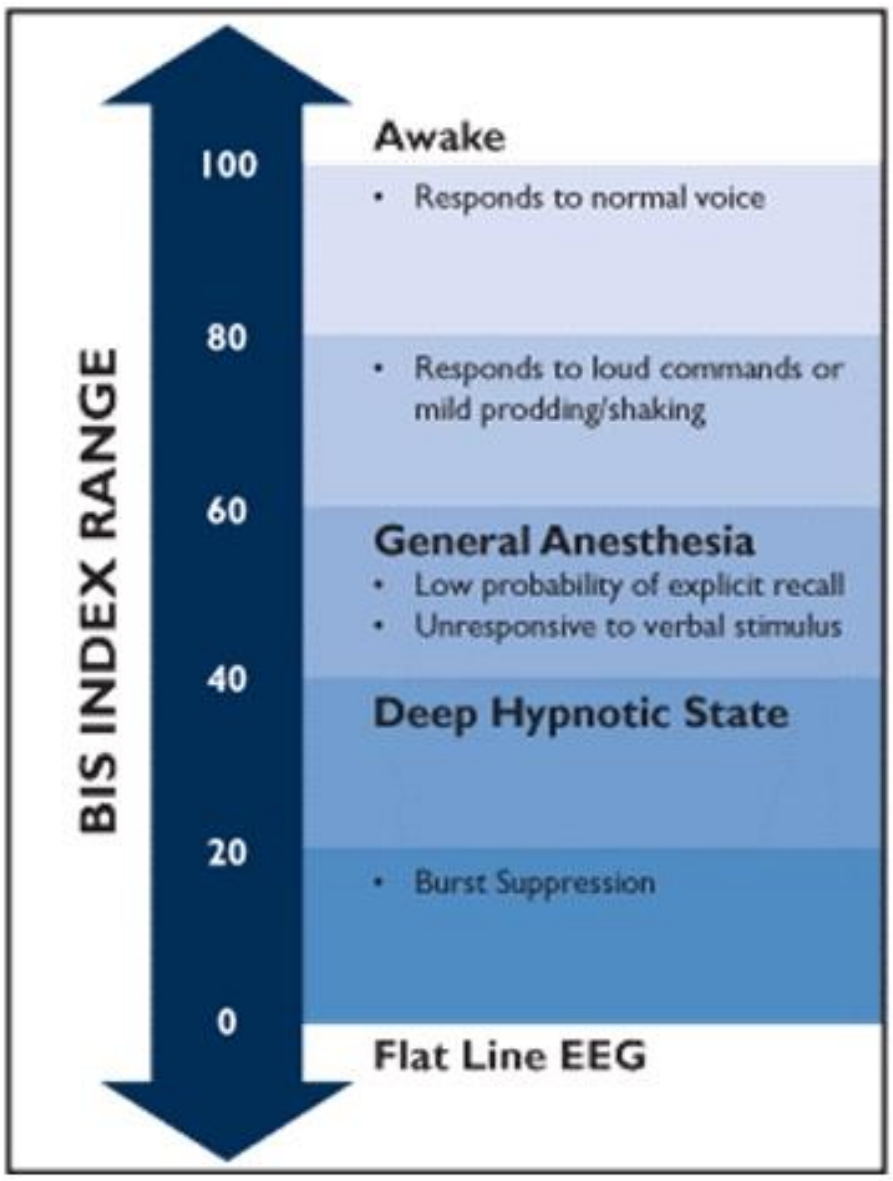
Sedation-Agitation Scale

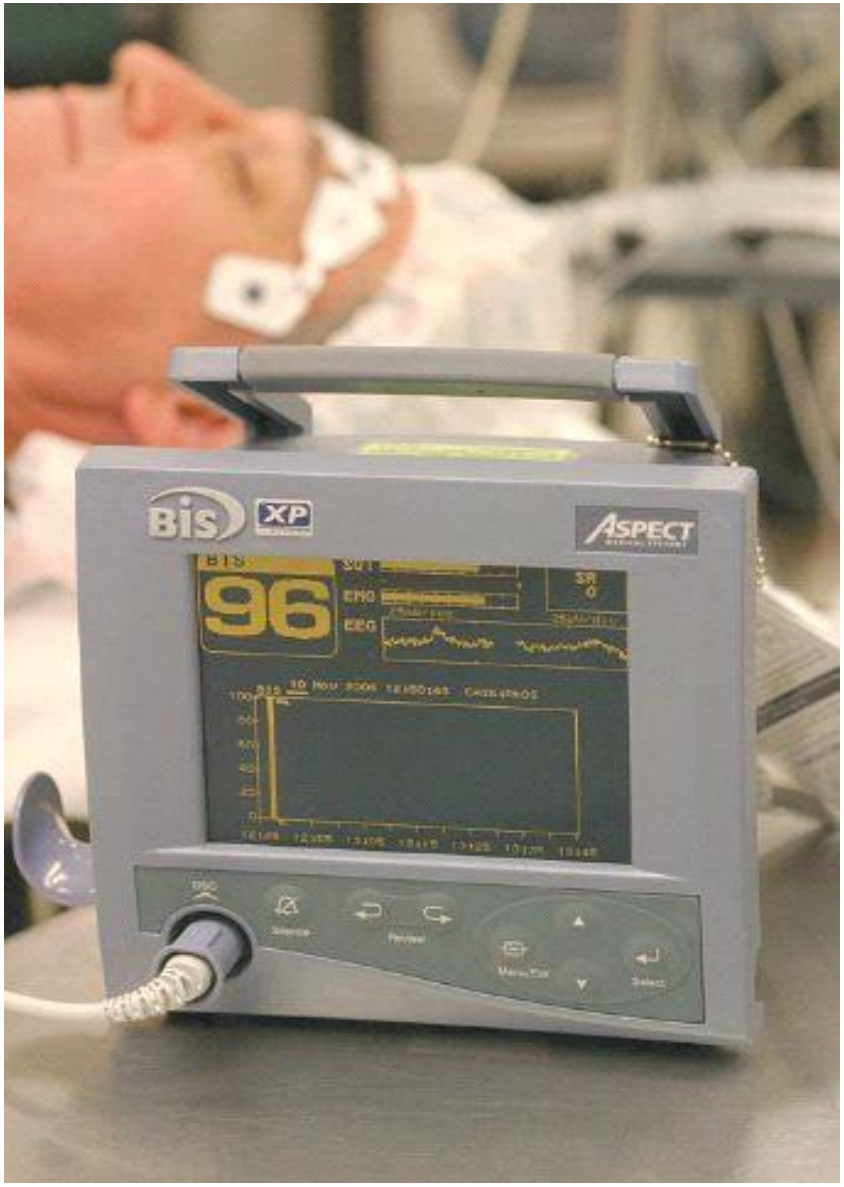
- 1: Unarousable
- 2: Very sedated
- 3: Sedated
- 4: Calm and cooperative
- 5: Agitated
- 6: Very agitated
- 7: Dangerous agitation

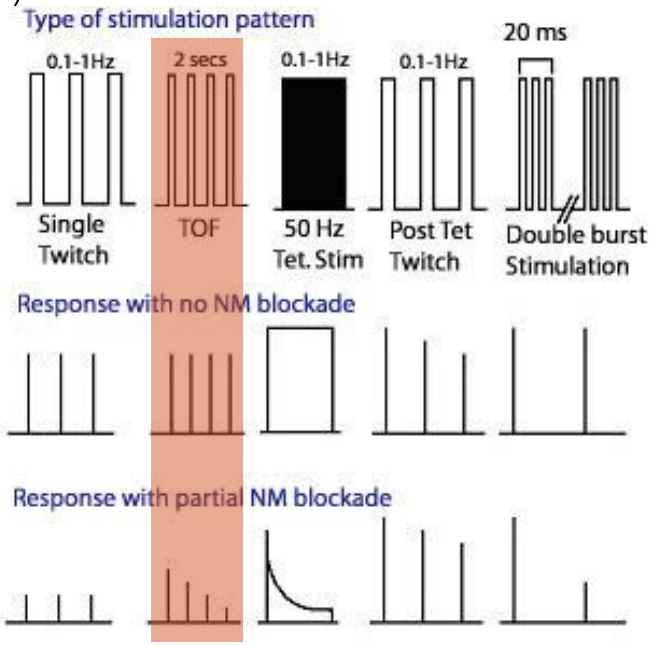
BIS Monitor (bispectral index)

- Based on EEG
- Information between cortical and sub-cortical region
- BIS measures electrical activity in the brain, it provides a direct correlation with depth of consciousness (hypnosis) Score between 0 and 100

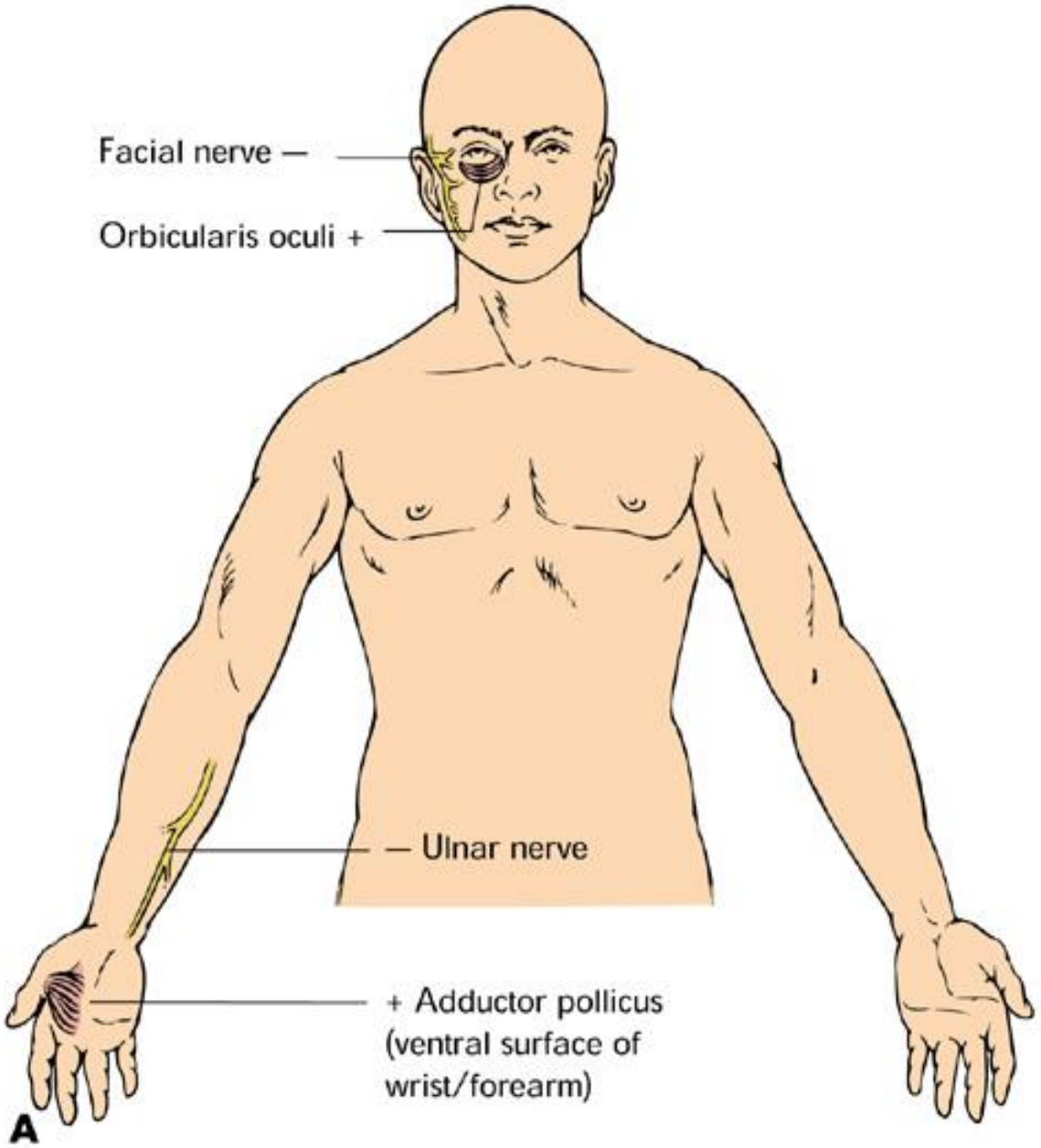
Bispectral Index






Type of stimulation pattern
0.1-1Hz
2 secs
0.1-1Hz
0.1-1Hz
20 ms
Single Twitch
TOF
50 Hz Tet. Stim
Post Tet Twitch
Double burst Stimulation
Response with no NM blockade
Response with partial NM blockade


TOF
90


Facial nerve –
Orbicularis oculi +
– Ulnar nerve
+ Adductor pollicus (ventral surface of wrist/forearm)
A

The Art of Sedation

*** Under sedation:**

- Fighting the ventilator.
- V/Q mismatch.
- Accidental extubation.
- Catheter displacement.
- CV stress → ischemia.
- Anxiety, awareness.
- Post-traumatic stress disorder.

*** Over sedation:**

- Tolerance, tachyphylaxis.
- Withdrawal syndrome.
- Delirium.
- Prolonged ventilation.
- CV depression.
- ↑ neuro testing.
- Sleep disturbance.

Levels of Sedation (JCAHO)

- 1) Minimal sedation-
  - anxiolysis, response to verbal command intact
  - CV function unaffected
- 2) Moderate sedation and analgesia
  - spontaneous ventilation
  - respond purposefully to verbal commands alone or accompanied by light tactile stimulation
  - CV function maintained

Levels of Sedation (JCAHO)

- 3) Deep sedation and analgesia-
  - repeated attempts with painful stimulation to arouse
  - airway may need to be supported
  - CV function maintained
- 4) General Anesthesia-
  - Loss of consciousness
  - unable to maintain airway
  - CV function impaired

	Minimal sedation anxiolysis	Moderate sedation (conscious)	Deep sedation	General anesthesia
Responsiveness	normal	Purposeful verbal / tactile	Purpose painful repeat	Unarousable
Airway	Not affected	No inter-vention required	May need interventi on	Often required interven
Spontaneous Ventilation	Not affected	Adequate	May be in-adequate	Frequent in-adequate
Cardiovascular function	Not affected	Usually maintained	Usually maintain	May be impaired

Assessment of Patients

American Society of Anesthesiologists Physical status Classification

- Classification
  - I normal healthy patient
  - II Mild systemic disease (asthma controlled DM)
  - III Moderate systemic disease (angina, COPD, hyperglycemia +DM)
  - IV Severe systemic disease(DKA, unstable angina)
  - V Moribund
  - E emergency status- modifier

Principles of PSA

- Patient eval
  - Appropriate candidates for ED sedation are pts in ASA class I/II
  - Consult w/ anesthesia if ASA class III/IV
- Equipment & monitoring
  - Continuous cardiac/pulse ox monitoring
  - O2 source with appropriate methods of delivery
  - Capnography
  - Suction
  - Intubation tray
  - Reversal meds (if indicated)

جدول۲ . تجهيزات مورد نياز براي آرام‌بخشي بدون بيهوشي

-
- آمبوبگ، ماسک صورت، راه‌هاي هوايي بيني و دهان، منبع اکسيژن
- وسيله ساکشن
- وسيله اندازه‌گيري فشار خون
- پالس اکسي‌متر
- پايشگر نوار قلب
- رديابدي‌اکسيد کربن انتهاي بازدمي
- وسايل مورد نياز براي دسترسي وريدي مانند سرنگ‌ها، سوزن‌ها، کاتترها و مايعات
- داروهاي اورژانس و ترالي اورژانس
-

Equipment & Supplies S O A P M E

- **Suction** – appropriate suction catheters and suction apparatus
- **Oxygen** – adequate O_2 supply, working flow/delivery devices
- **Airway** – appropriate airway equipment (e.g., ET tubes, LMAs, oral and nasal airways, laryngoscope blades, stylets, bag mask)
- **Pharmacy** – basic life-saving drugs, & reversal agents
- **Monitors** – **pulse oximeter,** BP monitor, ECG, $EtCO_2$
- **Equipment** – special equipment for particular patient (e.g., crash cart, respiratory box, IV access equipment)

MOST IMPORTANT ⇒ PERSONNEL SKILLED IN ADVANCED LIFE SUPPORT!

سر بلند و سرافراز باشید