



UNIVERSITÉ
DE GENÈVE

FACULTÉ DE MÉDECINE



Hôpitaux Universitaires de Genève



Sedation-Analgésie pour les Procédures Interventionnelles en Pneumologie

Quoi de neuf ?

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Service d'anesthésiologie



Sedation-Analgesia in Chest Medicine

- Survey of clinical practice
- Guidelines
 - Pneumologists (UK, France)
 - Anesthesiologists (USA)
- Gastroenterologists' experience
- Proposals

Indications for Sedation-Analgesia

THORAX

British Thoracic Society guidelines on diagnostic flexible bronchoscopy 2001 56: i1-i21

- Sedation should be offered to patients where there is no contraindication. [B]

- **Contraindication = myoc. infarct < 6 months**

80% patients prefer to be sedated

Why ?

Indications for Sedation - Analgesia

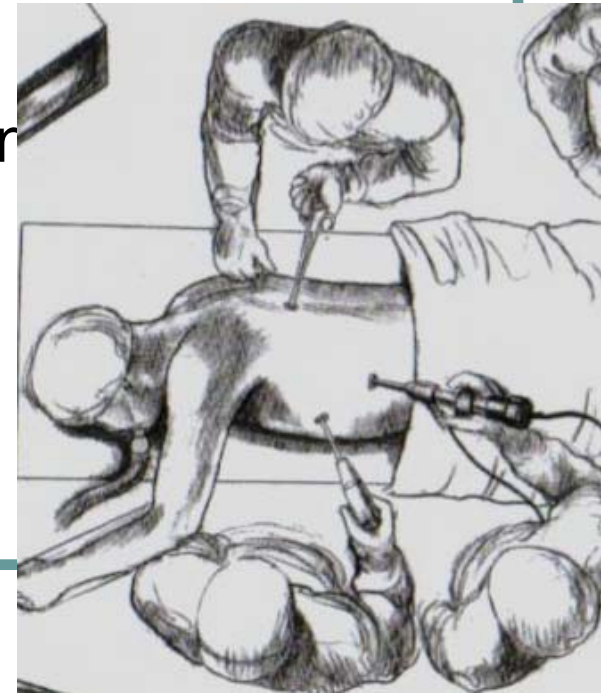
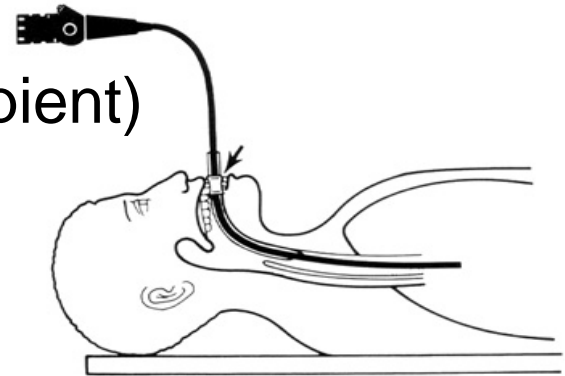
- **Patient comfort**

- Repeated FB (e.g., transplant recipient)
- Long & painful procedure

- **Operating conditions**


- Bronchoalveolar lavage
- Stent placement, cryotherapy, brushing
- IBUS, needle biopsy
- Thoracoscopy (e.g., talc pleurodesis)

FLEXIBLE FIBEROPTIC BRONCHOSCOPY



Sedation : Definition


« ...continuum of states ranging from minimal sedation (anxiolysis) through general anesthesia. »



Grade	Term	Description
0	Alert and calm	Modified Richmond Agitation – Sedation Score
- 1	Sleepy	Not completely alert, but at least awake phases (eyes open, eye contact) lasting at least 10 s when patient is addressed
- 2	Mild sedation	Awake phase (eyes open, eye contact) lasting less than 10 s when patient is addressed
- 3	Moderate sedation	Movement or eye opening when patient is addressed (but no eye contact)
- 4	Deep sedation	No reaction when patient is addressed, but movement or eye opening when physically stimulated (shaking shoulder or rubbing sternum)
- 5	No reaction	No reaction when patient is addressed or physically stimulated

Assessment of Sedation according to the American Society of Anesthesiologists

	Minimal Sedation (Anxiolysis)	Moderate Sedation/Analgesia (Conscious Sedation)	Deep Sedation/Analgesia	General Anesthesia
Responsiveness	Normal Response to Verbal Stimulation	Purposeful* response to verbal or tactile stimulation	Purposeful response after repeated or painful stimulation	Unarousable, even w/painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous Ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular Function	Unaffected	Usually maintained	Usually maintained	May be impaired



OPTIMAL Moderate Sedation is achieved when patient ...

- Maintains consciousness
- Independently maintains airway control
- Retains protective reflexes (swallow and gag)
- Responds to verbal and physical commands
- Is not anxious or afraid
- Experiences acceptable pain control
- Has a minimal change in vital signs
- Remains cooperative during the procedure
- Has mild amnesia for the procedure
- Recovers to baseline (pre-procedure) status safely and promptly

Risk-related to bronchoscopy

Complications of bronchoscopy: comparison of rigid bronchoscopy under general anesthesia and flexible fiberoptic bronchoscopy under topical anesthesia. G I Lukomsky, *Chest* 1981;79:316-321

N= 4'595 procedures

Rigid B **Flexible B**

+ General Anesth **+ Sedation**

Complications

Bronchoscopic procedure	Rigid B + General Anesth				Flexible B + Sedation				Percent of all RB Procedures 100			
Complications	Anesthesia-related				2.9%				1.5%			
Related to anesthesia	Discomfort				4.4%				0.5%			
Minor	Minor				5.5%				2.9%			
Major	Major				1.5%				0.5%			
Due to anesthetics	4	1.27	2	0.21*	—	—	1	0.18	8	1.02	1	0.13*
Minor	—	—	—	—	1	1.45	—	—	—	—	—	—
Major	—	—	—	—	—	—	—	—	—	—	—	—
Due to insufficient anesthesia	1	0.32	25	2.67*	—	—	12	2.19	1	0.2	5	0.67
Minor	1	0.32	22	2.35*	—	—	12	2.19	1	0.2	5	0.67
Major	—	—	3	0.32	—	—	—	—	—	—	—	—
Due to hypoxemia	—	—	3	0.32	—	—	1	0.18	—	—	1	0.13
Minor	—	—	2	0.21	—	—	—	—	—	—	1	0.13
Major	—	—	1	0.11	—	—	1	0.18	—	—	—	—

Complication of flexible fiberoptic bronchoscopy. *Literature Review*

- Metasearch criteria "flexible", "fiberoptic", "bronchoscopy" and "complications" 1974 to 2006
- 50 publications on 107'969 bronchoscopies
- **Complications**
 - Hypoxemia 0.2-2.1%
 - Arrhythmia 1-10%
 - Bleeding 0.12-7.5%
 - Pneumothorax-Mediast 1-6%
 - Fever 0.9-2.5%
 - Death 0.1-0.2%

FB = SAFE procedure
if basic precautions:

- Patient selection
- Indications
- Drug
- Equipment

British Thoracic Society guidelines on diagnostic flexible bronchoscopy 2001 56: i1-i21

Les bonnes pratiques de la bronchoscopie souple diagnostique, en 2007

Rev Mal Respir 2007 ; 24 : 1363-92

- NPO for 4 hrs (solid), 2 hrs (liquid)
- IV line & SpO₂ monitoring
- Supplemental if SpO₂ < 92%
- Sedatives should be given in incremental doses
- Not routine requirement for :
 - ECG, BP measurement
 - Atropine
- Availability of ≥ 2 endosc. assistants + Resuscitation equipment
- Sedated pts should accompanied home, advised not to drive, not to sign any document, operate machine, ...
- Topical anesthesia : maximum 8.2 mg/kg lidocaine

• **No Risk Stratification**

• **No minimal standards for monitoring**

• **No Assessment of Sedation Level**

• **Qualification of Sedation Provider ??**

Is preparation for bronchoscopy optimal?

Survey regarding compliance to BTS guidelines for flexible bronchoscopy (344 responses to 452 questionnaires)

- **Sedation**
 - 85% Midazolam
 - 27% Sedative + Analgesics
 - 27% No sedation
- **Topical anesthesia**
 - 65% lidocaine gel to the nose
 - 70% spray to the throat, 84% spray « as you go »
+ 13% atropine routinely

Survey of flexible fiberoptic bronchoscopy in the United Kingdom

Frequency of use of monitoring and support during bronchoscopy

	Always	Sometimes	Never
Pulse oximeter	99	1	0
ECG monitor	22	24	54
Supplemental oxygen	66	34	0
Venous cannula	87	8	5
BP	10	8	82

Clinical observation 44%

Respiratory Rate 8%

Drug-induced respiratory depression = Primary cause of morbidity-mortality

**5% serious adverse events
⇒ TOO MUCH !!**

- ⇒ Preop Risk Assessment
- ⇒ Monitoring
- ⇒ Qualified / trained « sedationists »

Pre-procedural Risk Assessment

ASA General Classification

Grade I	Healthy individual
Grade II	Mild disease, not limiting daily activities
Grade III	Severe disease, limiting daily activities
Grade IV	Severe disease, life-threatening
Grade V	Unlikely to survive for 24 hours regardless of surgical intervention

Cardiac Risk ⇒ MI, HF, arryth.

- Coronary artery disease
- Heart failure
- Prior stroke
- Diabetes mellitus
- Renal dysfunction

Respiratory Risk ⇒ hypoxemia

- Airway assessment
- Morbid Obesity
- Pulmonary Hypertension
- Severe COPD, Heart fail.
- Alcohol ++
- Sleep apnea syndrome

Airway Assessment

- Positive pressure ventilation (with tracheal intubation) may be necessary if respiratory compromise develops.

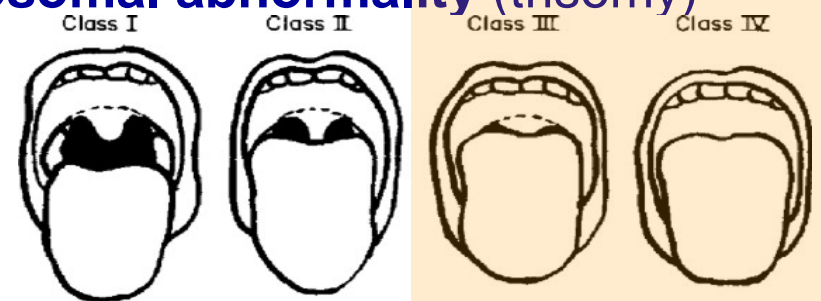
This may be more difficult in pts with atypical airway anatomy

History

- Previous problem with anesthesia
- Stridor, snoring or sleep apnea
- Rheumatoid arthritis; or chromosomal abnormality (trisomy)

Physical examination

- Significant obesity
- **MALLAMPATI score**
- Short neck, limited extension; hyoid-mental distance < 3cm
- Small mouth opening (< 3cm), protruding incisors, loose/capped teeth; macroglossia; tonsillar hypertrophy
- Micrognathia, retrognathia, trismus, ...



Monitoring, equipment, training

- **Patient's response to verbal command, stimulus**
- **SpO₂, HR, BP (ECG)**
- **Designated individual(s) to perform sedation & rescue therapy**
 - Knowledge of drugs
 - Skills to establish an IV line, a patent airway, positive pressure ventilation and advanced life support.
- **Emergency equipment**
 - Antagonists agents, emergency medications
 - Suction device, basic & advanced airway equipment
 - Defibrillator

How to administer Sedative-Analgesics?

- IV sedatives/analgesics should be given in **small incremental doses** (up to 100% of the initial dose) (up to 100% of the initial dose endpoint)
- Even if moderate sedation is intended, pts receiving **propofol or methohexital** should receive care consistent with that required for deep sedation. Accordingly, **practioners should be qualified to rescue pts from any level of sedation, including general anesthesia**

**Conflict
Anesthesiologists
- Endoscopists**

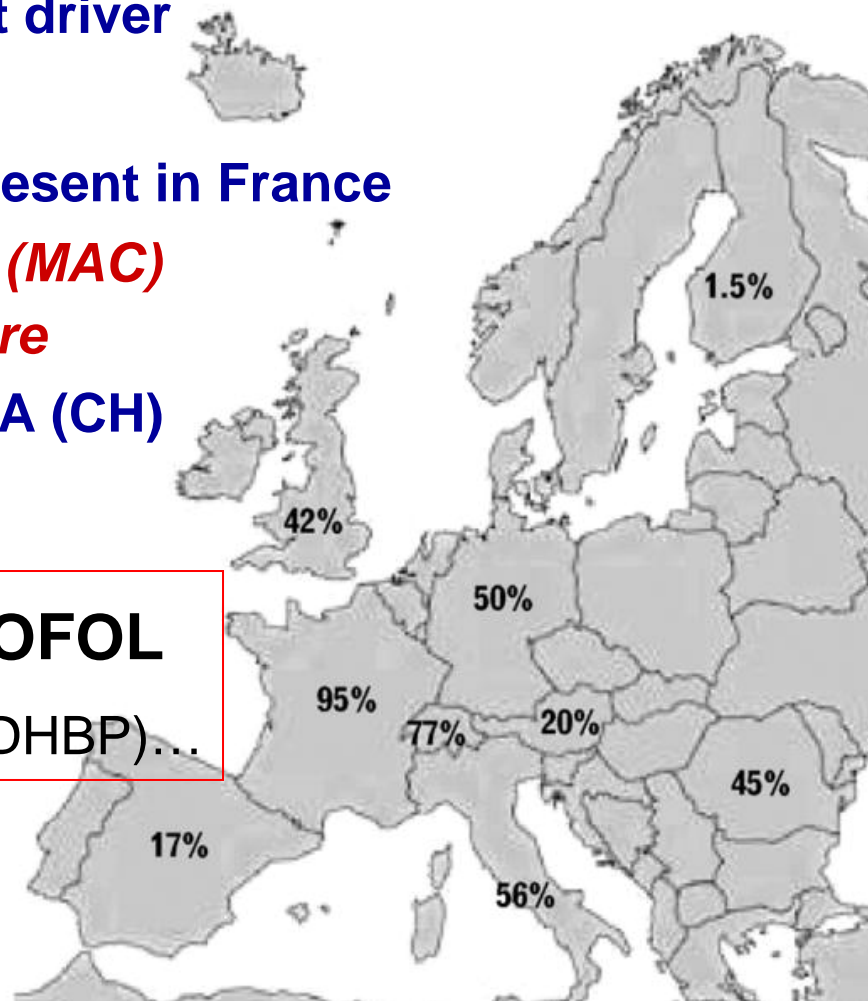
Sedation-Analgesia in Chest Medicine

- Definition, Indications & Purpose
- Survey of clinical practice
- Guidelines
 - Pneumologists (UK, France)
 - Anesthesiologists (USA)
- **Experience of gastroenterologists**
- Proposals for new sedation protocols

Anesthesia or sedation for gastroenterologic endoscopies

- GI endoscopy = important cost driver
- For sedation :
 - Anesthesiologists must be present in France
 - ⇒ **Monitored Anesthesia Care (MAC)**
+ 150 – 1'500 \$ /procedure
 - Nurses are allowed in UK, USA (CH)
 - ⇒ **Moderate Sedation**

Midazolam (MDZ) vs. PROPOFOL
± Opiate, anti-His, neuroleptic (DHBP)...





Sedation and anesthesia in GI endoscopy

- **Sedation should be offered to EVERY patient**
- **Use ASA classification (I-V)**
- **Assess clinically the level of sedation**
- **Propofol should be preferred to Midazolam**
supportive data on efficacy, recovery, and complications
Adjustments still need to be made taking into account the individual patient situation, the nature of the intervention, and the personal, personnel, equipment, and structural requirements indicated in this guideline.
- The **intermittent bolus method** currently regarded as the standard procedure.

Assistance of an anesthesiologist ?

Anesthesiologist assistance may be considered in the following situations:

- Prolonged or therapeutic endoscopic procedures requiring deep sedation
- Anticipated intolerance to standard sedatives
- Increased risk for complication because of severe comorbidity (ASA greater than class III)
- Increased risk for airway obstruction because of anatomic variant

Personnel training & Equipment (1)

- A sedation team with appropriate education and training. At least 1 person who is qualified in advanced life support skills (ie, airway management, defibrillation and the use of resuscitative medications).
- Trained personnel dedicated to the uninterrupted monitoring of the patient's clinical and physiologic parameters throughout the procedure
- Physiologic monitoring must include pulse oximetry, electrocardiography, and intermittent blood pressure measurement. Monitoring oxygenation by pulse oximetry is not a substitute for monitoring ventilatory function. Capnography should be considered because it may decrease the risks during deep sedation.

Personnel training & Equipment (2)

- Personnel should have the ability to rescue a patient who becomes unresponsive or unable to protect his or her airway or who loses spontaneous respiratory or cardiovascular function.
- Age-appropriate equipment for airway management and resuscitation must be immediately available.
- A physician should be present throughout propofol sedation and remain immediately available until the patient meets discharge criteria.

Advantages & Disadvantages of Propofol

Advantages

- Rapid onset
- Favorable pharmacodynamics
- Mild antiemetic properties
- Potentially more effective
- Rapid termination of effect
- Expedited recovery

Disadvantages

- Potency
 - o Potential to induce general anesthesia
 - o Potential to cause hemodynamic and respiratory depression
 - o No pharmacologic antagonist

⇒ **Need for an anesthesiologist ?**

Endoscopist-directed Administration of Propofol : a Worldwide Safety Experience

REX DK et al, Gastroenterology, 2009

28 Publications

Papers and Abstracts) From Our Literature Search for Endoscopist-Directed Propofol Sedation

	No. of procedures	No. of mask ventilations	No. of endotracheal intubations	No. of neurologic injuries	No. of deaths
Kulling et al, ⁶ Switzerland	27,061	6	0	0	0
Vargo et al, ⁵ United States	38	0	0	0	0
Sipe et al, ²⁵ United States	100	0	0	0	0
Peter et al, ²⁴ Switzerland	5444	0	0	0	0
Tagle et al, ²⁶ Peru	400	0	0	0	0
Tohda et al, ²¹ Japan	27,500	0	0	0	0
Tohda et al, ²² Japan	120	0	0	0	0
Cohen et al, ¹² United States	100	0	0	0	0
Barbi et al, ²³ Italy	811	N/A	0	0	0
Vargo et al, ¹⁴ United States	5720	0	0	0	0
Cohen et al, ²⁷ United States	819	0	0	0	0
Saenz-Lopez et al, ³¹ Spain	102	0	0	0	0
Rex et al, ⁷ United States	36,743	49	0	0	0
Chen et al, ²⁰ China	70	0	0	0	0
Riphaus et al, ¹⁹ Germany	75	0	0	0	0
Heuss et al, ¹³ Switzerland	82,620	157	0	0	0
Wehrmann et al, ²⁸ Germany	99	1	0	0	0
Carlsson and Grattidge, ³⁰ Sweden	45	0	0	0	0
Sinnott et al, ¹⁷ United States	1759	0	0	0	0
Yusoff et al, ¹⁶ Canada	500	0	0	0	0
Koshy et al, ¹⁵ United States	150	0	0	0	0
Wehrmann et al, ²⁹ Germany	80	0	0	0	0
Clarke et al, ⁸ Australia	22,379	1	0	0	0
Kongkam et al, ⁹ Thailand	41	0	0	0	0
Gonzalez-Huix et al, ¹⁰ Spain	2839	4	0	0	0
Meah and Parikh, ¹⁸ United States	254	0	0	0	0
Kulling et al, ¹¹ Switzerland	1391	0	0	0	0
Morse et al, ³² Canada	6396	N/A	0	0	0
Total	223,656	218	0	0	0

223'656 Propofol-sedation

- 218 Mask Ventilation
- 0 Intubation
- 0 Neurological Injuries
- 0 Deaths

Endoscopist-directed Administration of Propofol : a Worldwide Safety Experience

UNPUBLISHED data

Unpublished Data of Safety for Endoscopist-Directed Propofol Sedation^a

Center	No. of procedures	No. of mask ventilations	No. of endotracheal intubations	No. of neurologic injuries	No. of deaths
1	4080	4	2	0	1
2	7547	1	1	0	0
3	64,152	22	0	0	0
4	14,367	0	0	0	0
5	9068	0	0	0	0
6	12,966	N/A ^b	1	0	1
7	7159	7	0	0	0
8	41,838	59	0	1	0
9	1830	2	0	0	0
10	15,702	6	0	0	0
11	12,721	3	0	0	0
12	21,751	27	2	0	1
13	33,215	1	0	0	0
14	45,007	N/A ^b	0	0	0
15	12,886	2	0	0	0
16	17,450	17	0	0	0
17	690	5	0	0	0
18	26,002	5	0	0	0
19	3667	2	0	0	0
20	3190	89	2	0	1
21	11,680	N/A ^b	0	0	0
22	322	0	0	0	0
23	47,802	3	1	0	0
24	457	0	0	0	0
25	1107	0	0	0	0
26	4277	15	2	0	0
27	891	1	0	0	0
28 ^c	600	0	0	0	0
Total	422,424		11	0	4

422'424 Propofol-sedation

- 270 Mask Ventilation
- 11 Intubation
- 0 Neurological Injuries
- 4 Deaths

REX DK et al,
Gastroenterology 2009

Sedation-Analgesia in Chest Medicine

- Definition, Indications & Purpose
- Survey of clinical practice
- Guidelines
- Experience of gastroenterologists
- **Experience in Chest Medicine**
 - **Importance of a standardized approach**
 - **Which type of drugs**
 - **Proposaly**

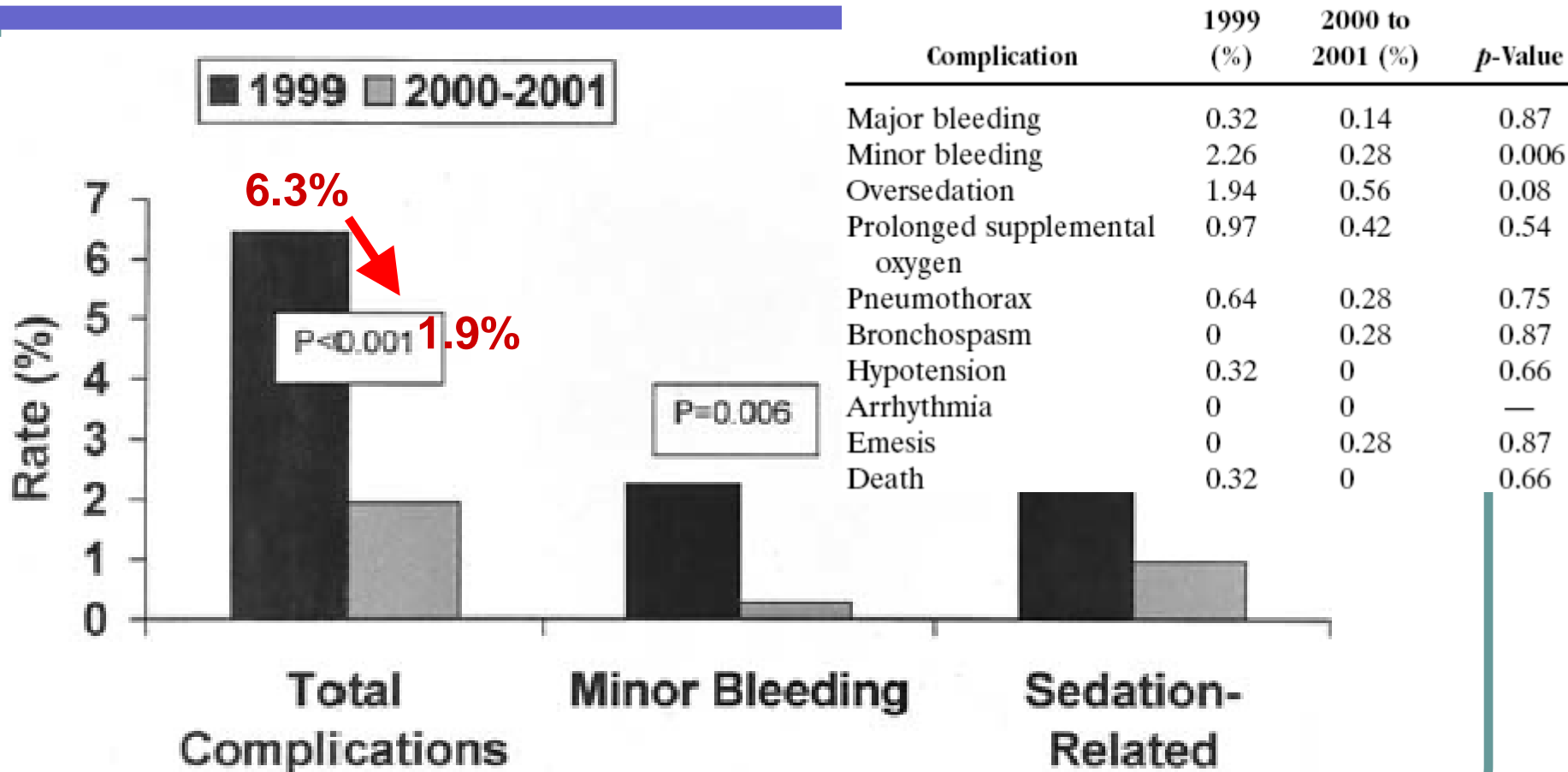
Standardized approach for transbronchial needle biopsy in transplant patients (1)

TABLE I

Summary of Preprocedural Guidelines

- **Exclude High-Risk patients** (cardiac, renal disease, bleeding, PHT)
 - **Normal hemostasis, NPO 6 hrs**
 - **Topical anesthesia (Lido 1% max 300 mg)**
 - **Meperidine (max 100 mg) + MDZ (max 10 mg)**
 - **Assess vital signs, comfort**
- Avoid elective bronchoscopy in patients with uncontrolled congestive heart failure or uncorrectable hypoxemia.
- Pulmonary hypertension (pulmonary artery systolic pressure > 45) is a contraindication to transbronchial biopsy.
- Desmopressin should be administered to patients with blood urea nitrogen (BUN) levels >30 mg/dl.
- Patients with platelet counts <40,000/mm³ or INR >1.5 should not undergo bronchoscopic biopsy.
- Aspirin and anti-platelet agents should be discontinued 24 hours prior to the procedure.
- Patients should be NPO for at least 6 hours prior to initiating the procedure.
- Atropine as pre-medication is generally not required.
- A combination of meperidine and midazolam should be used for conscious sedation. Appropriate starting doses for patients under 65 are 50 mg meperidine intravenously (IV) and 1 mg midazolam IV with additional doses given 3 to 5 minutes later after careful assessment of blood pressure, respiratory effort, and oxygen saturation. These additional doses should be given at half the aforementioned doses. No more than 100 mg meperidine should be given. If additional sedation is needed, midazolam may be given up to a total of 8 to 10 mg. For patients >65 years, half the aforementioned doses are appropriate.
- Lidocaine 1% solution is used for topical anesthesia with total dosing not to exceed 300 mg.

Standardized approach for transbronchial needle biopsy in transplant patients (2)



Is it reasonable to combine BZD with opiates ?

Respiration

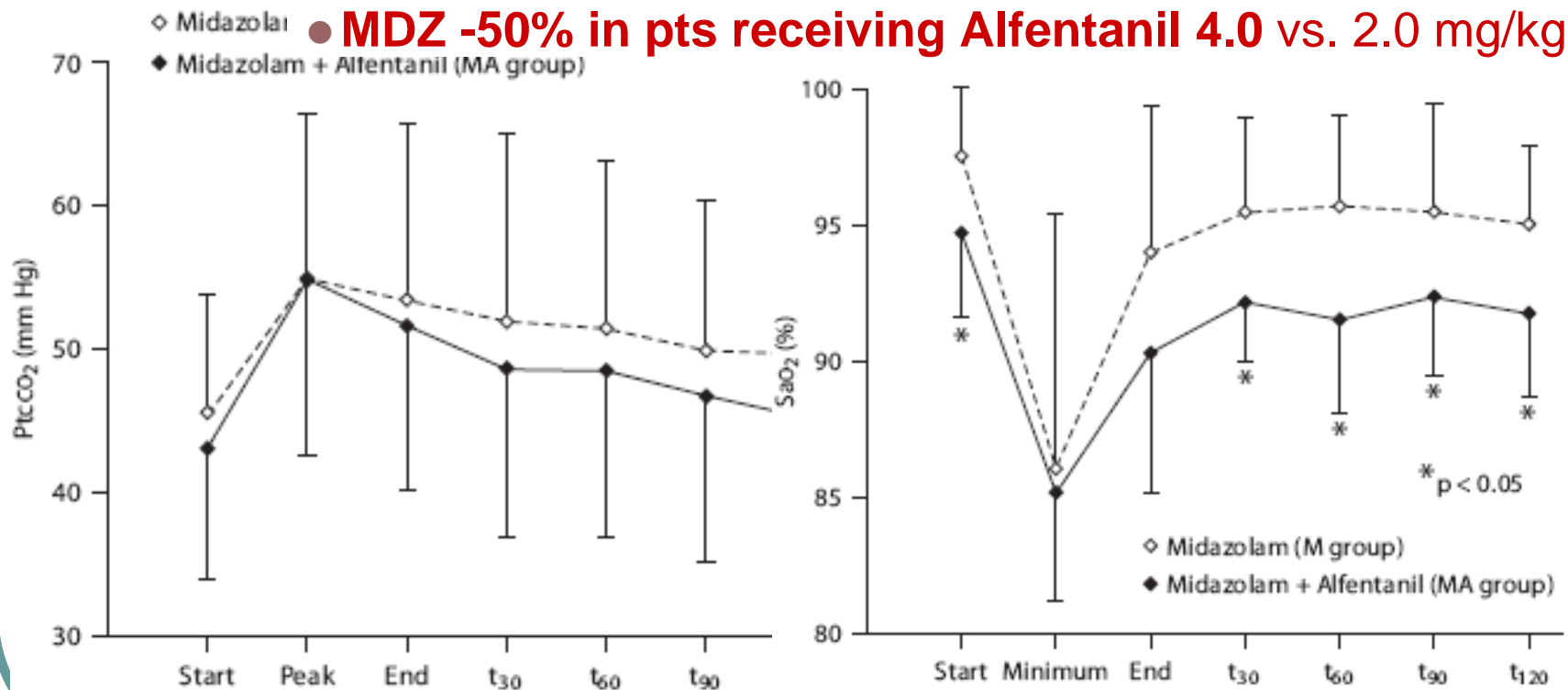
Sedation during Flexible Bronchoscopy in Patients with Pre-Existing Respiratory Failure: Midazolam versus Midazolam plus Alfentanil

2010;79(4):307-14

Michael Dreher Emelie Ekkernkamp Jan Hendrik Storre Hans-Joachim Kabitz
Wolfram Windisch

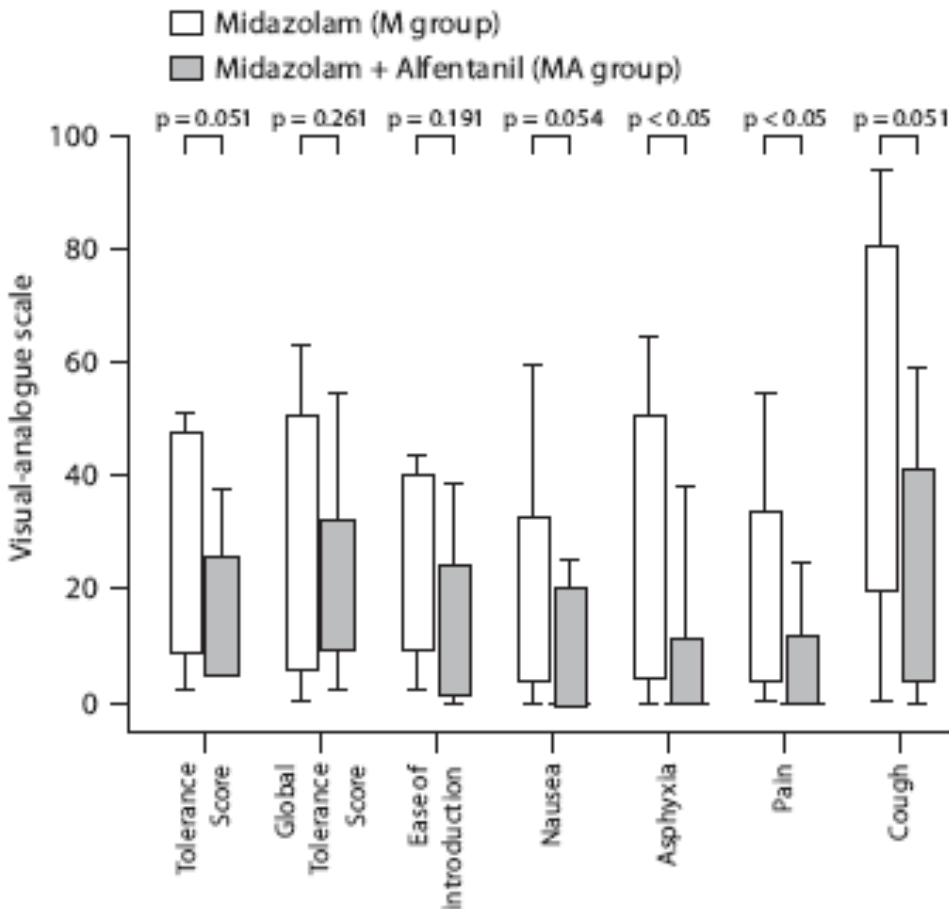
● 2 groups: MDZ vs. MDZ + Alfentanil (N=30)

● MDZ -50% in pts receiving Alfentanil 4.0 vs. 2.0 mg/kg

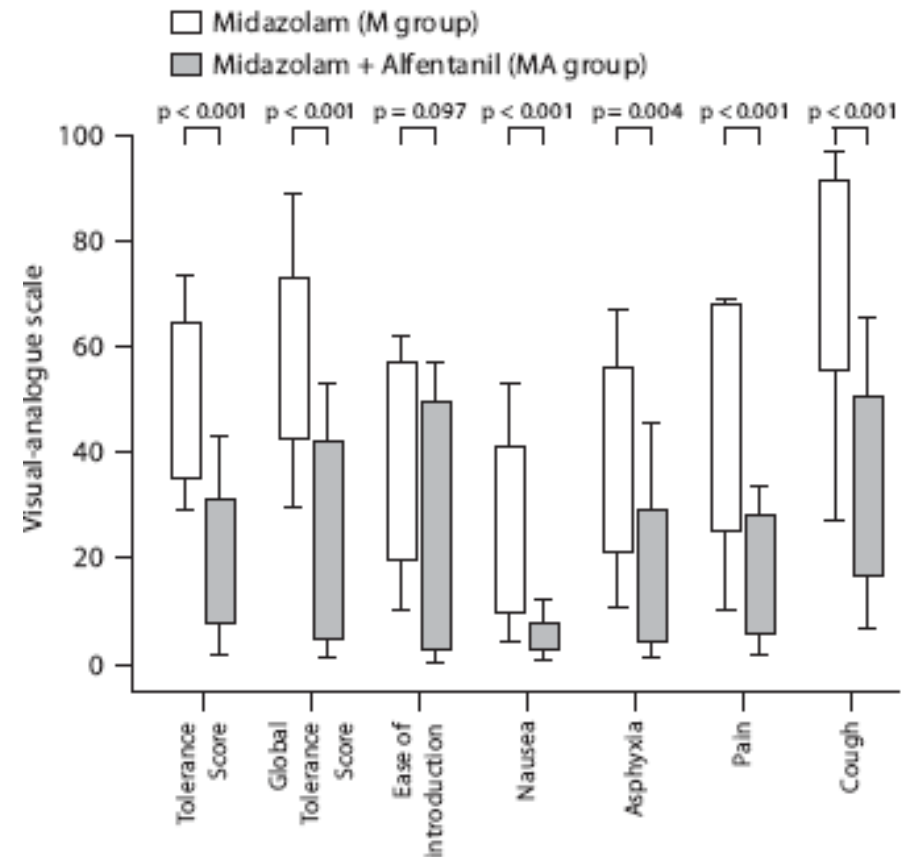


How comfortable is it ?

For the patient



For the operator



Sedation for Thoracoscopy

Comparison of two protocols of conscious analgesedation in video-assisted talc pleurodesis

- 65 pts with lung cancer, ASA 3-4
- 2 groups: **MDZ** 0.15-0.2 mg/kg VS **MDZ + Rémifentanil**
- Monitoring: BP, ECG, SpO₂, TcCO₂

Side effect	MDZ (%)	MDZ + REMI (%)
Hypotension	33.6	34.3
Respiratory depression (SpO ₂ <90% and tcCO ₂ >50 mmHg)	9	6.2
Muscle rigidity	3.3	3.1
Nausea	18	15
Vomiting	6	6.2
Pruritus	6	6.2
Pain moderate or severe requiring rescue analgesia	6	9

Using Propofol in chest medicine

6 clinical trials

- Bosslet GT et al. Nurse-Administered Propofol Sedation: Feasibility and Safety in Bronchoscopy. *Respiration*. 2009 Dec 23 (Pub Ehead).
- Stolz D et al. Propofol versus combined sedation in flexible bronchoscopy: a randomised non-inferiority trial. *Eur Respir J* 2009;34(5):1024-30
- Clark G. et al. Titrated sedation with propofol or midazolam for flexible bronchoscopy. *Eur Respir J*. 2009;34(6):1277-83
- Silvestri GA et al. phase 3, randomized, double-blind study to assess the efficacy and safety of fospropofol disodium injection for moderate sedation in patients undergoing flexible bronchoscopy *Chest*. 2009;135(1):41-7
- Hassan RA et al. Sedation with propofol for flexible bronchoscopy in children *Pediatr Pulmonol*. 2009;44(4):373-8
- Anasthesiol Intensivmed Notfallmed Schmerzther. 2004;39(10):597-602

Nurse-Administered Propofol Sedation: Feasibility and Safety in Bronchoscopy

Indication	n (%)
Pulmonary infiltrates	112 (22)
Lung mass	73 (15)
Research	63 (13)
Lymphadenopathy	53 (11)
Pneumonia	49 (10)
Cancer	36 (7)
Hemoptysis	35 (7)
Atelectasis	17 (3)
Cough	11 (2)
Tracheomalacia/stenosis	9 (2)
Interstitial lung disease	8 (2)
Bronchiectasis	7 (1)
Surveillance	7 (1)
Broncholith	5 (1)
Tracheoesophageal fistula	5 (1)
Cavitary lesion	3 (<1)
Tracheal papillomatosis	3 (<1)
Foreign body	2 (<1)

- **N = 588 procedures**
- **Operation Time**
25 min (3-123)
- **Propofol dose**
total 242 mg (10-1320)
3.1 mg/kg (0.1-20)

ADVERSE EVENTS

- **11.8% (n=59)**
 - **6.4% due to anesthesia**
 - **2.8% Hypoxemia**
 - **1.0% Hypotension**

Using Propofol in chest medicine

Eur Respir J 2009; 34: 1024–1030
DOI: 10.1183/09031936.00180808
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A Phase 3, Randomized, Double-Blind Study To Assess the Efficacy and Safety of Fospropofol Disodium Injection for Moderate Sedation in Patients Undergoing Flexible Bronchoscopy
Chest 2009;135;41-47;

Gerard A. Silvestri, Brad D. Vincent, Momen M. Wahidi, Emory Robinette, James R. Hansbrough and Gordon H. Downie

Propofol *versus* combined sedation in flexible bronchoscopy: a randomised non-inferiority trial

D. Stolz^{*,#}, G. Kurer^{*,}, A. Meyer^{*,}, P.N. Unhaged^{*,}, E. Pilamin^{*,}, W. Strobel^{*} and M. Tamm^{*}

Eur Respir J 2010; 34: 1–7
DOI: 10.1183/09031936.00142108
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- **N=280, Propofol vs. MDZ + oxycodone**
- **Propofol is as effective and safe**

Titrated sedation with propofol or midazolam for flexible bronchoscopy: a randomised trial

G. Clark^{*,#}, M. Licker[†], A.B. Younossian[#], P.M. Soccia^{#,+}, J-G. Frey^{*}, T. Rochat[#], J. Diaper[†], P-O. Bridevaux[#] and J-M. Tschoopp^{*}

- **N=83, No pretreatment**
- **Propofol titrated by BIS**
- **Higher quality of sedation**
- **Faster neuropsychometric recovery**

- **N=252**
- **Pretreatment Fentanyl 50mcg**
- **Fospropofol 2.0 vs 6.5 mg/kg**
- **Success 41.2% vs 91.3%**
- **No recall 55% vs 83%**
- **Hypoxemia 15.4% vs 12.6%**

Bispectral Index (BIS)

A practical, processed EEG parameter that measures the direct effects of sedatives on the brain

Frontal montage

Provides objective information about an individual patient's response to sedation

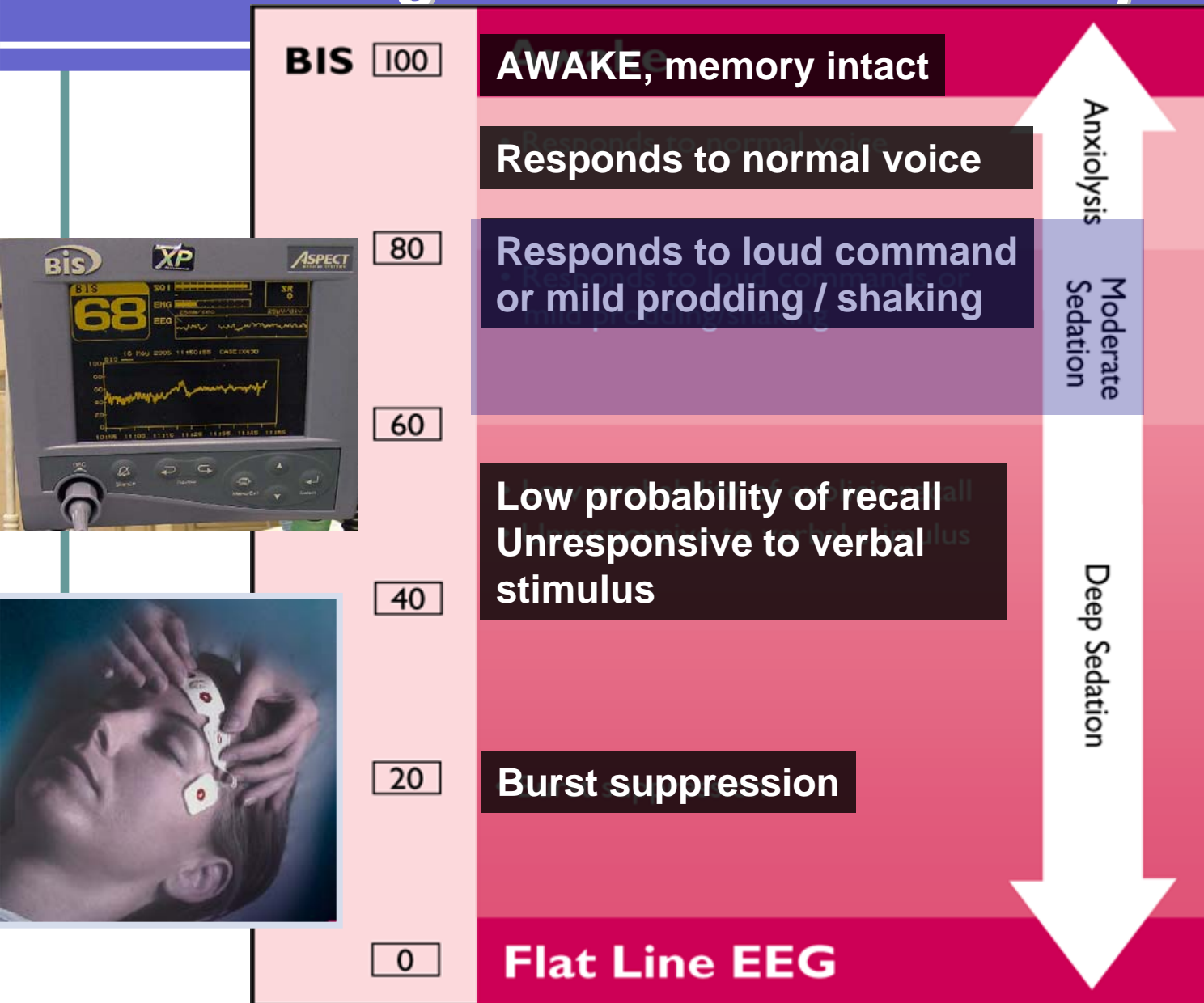
Numerical scale correlates to sedation endpoints

Optimizes sedation assessment and titration



Depth of sedation

BIS-guided titration of Propofol



Proposal

Protocol for SAFE sedation

- **Assess the Risks**

- Patient : ASA, cardiac, respiratory
- Procedure : difficulties ?

⇒ **Anesthesiologists
for high-risk patients**

- **IV Drugs**

- BZD vs. Propofol ± Opiates, ...
- Doses : fixed vs. titrated

- **Apply standard monitoring**

- SPO₂, vital signs (HR, BP, ECG)
- Depth of sedation :
clinical scale, BIS

⇒ **Nurses, physicians**

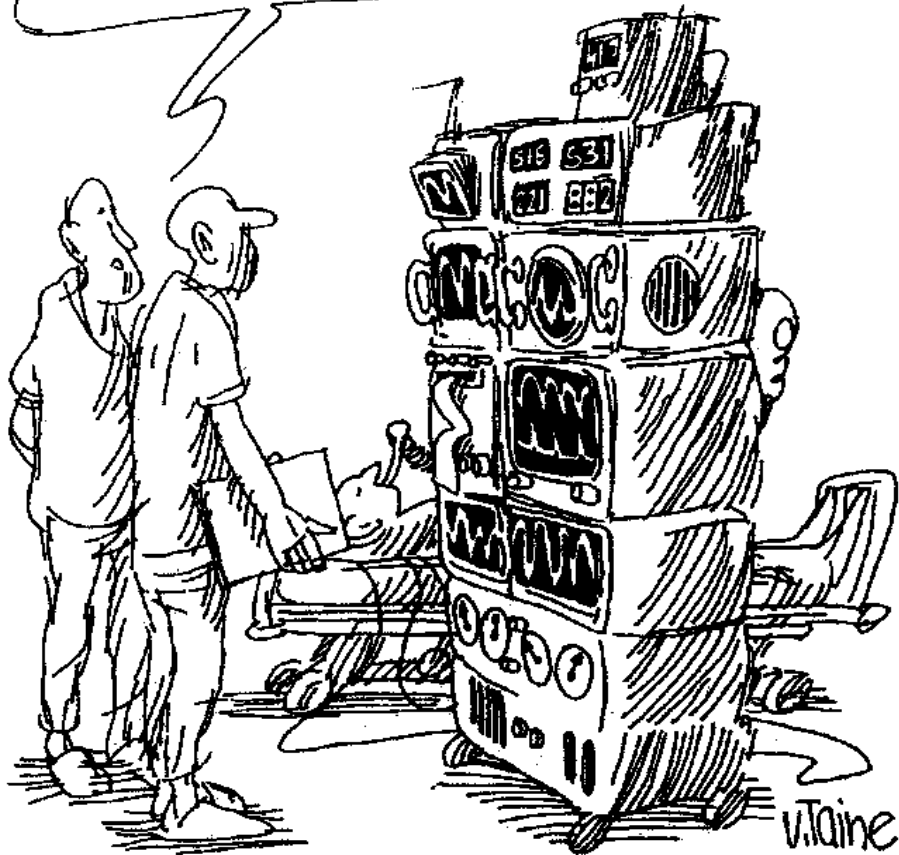
- **Qualified personal**

Guidelines for non-anesthesiologists-administered sedation

- **Didactic training session** (books, CD, web-based)
 - RISK assessment ⇒ patient's selection
 - Sedative drugs, monitoring
- **Airway workshop**
 - how to restore airway patency, how to do bag ventilation
- **Simulation training**
 - Critical events, near-misses, debriefing
 - Resuscitation skills
- **Preceptorship**
 - Adopt standard protocol
 - Collaborate with anesthesiologist

**Merci pour
votre attention**

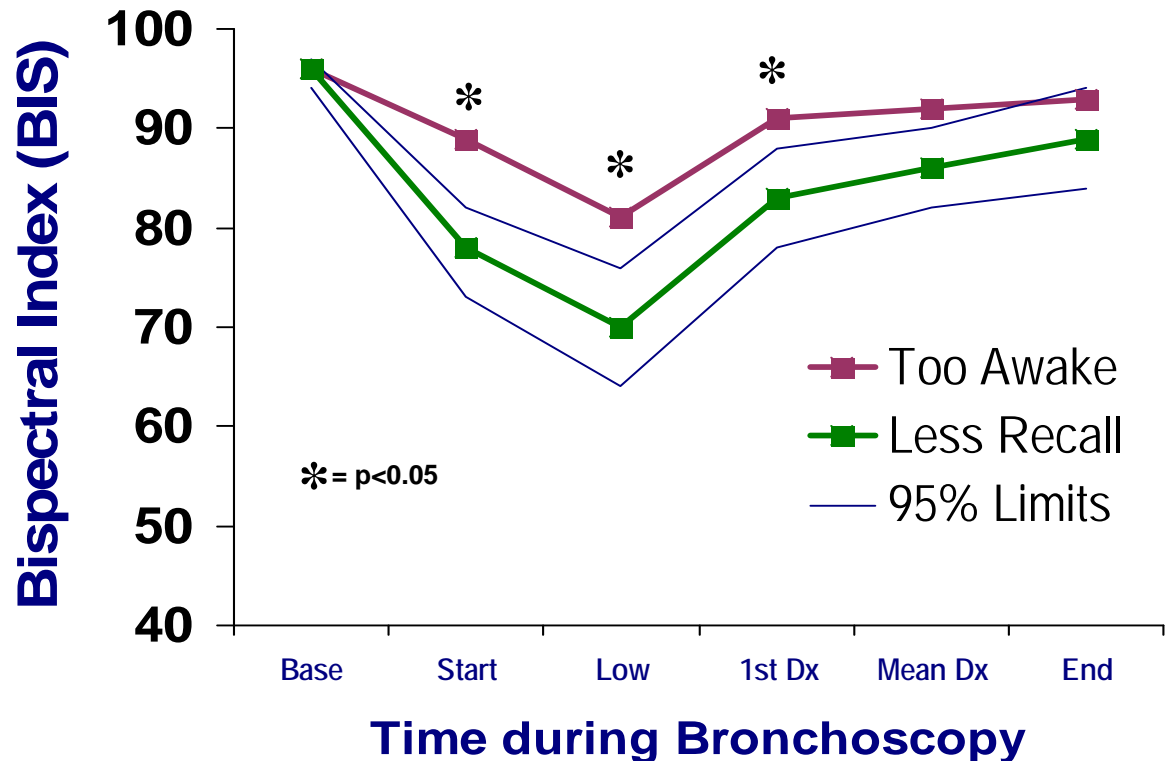
JE ME DEMANDE CE QU'IL
ESSAIE DE NOUS DIRE...





BIS: Procedural Monitoring

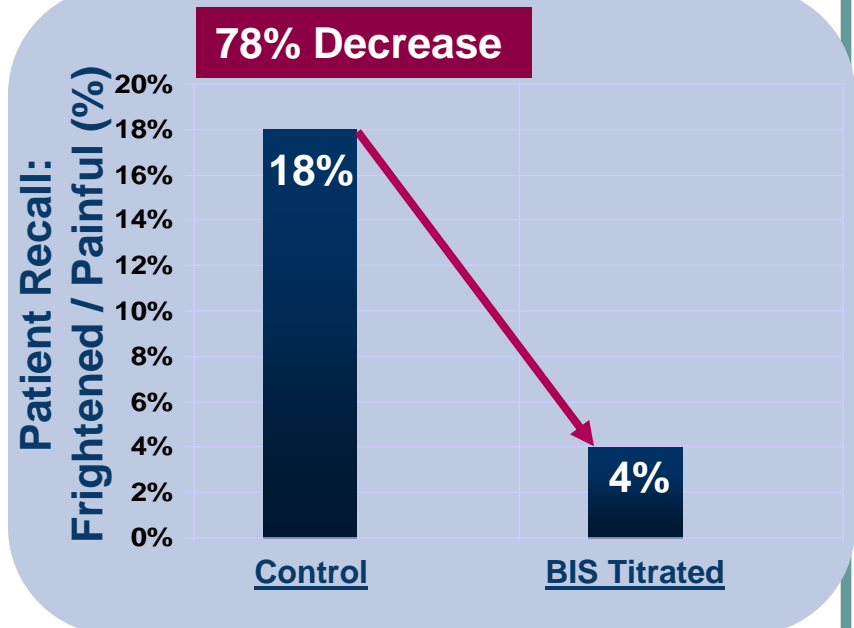
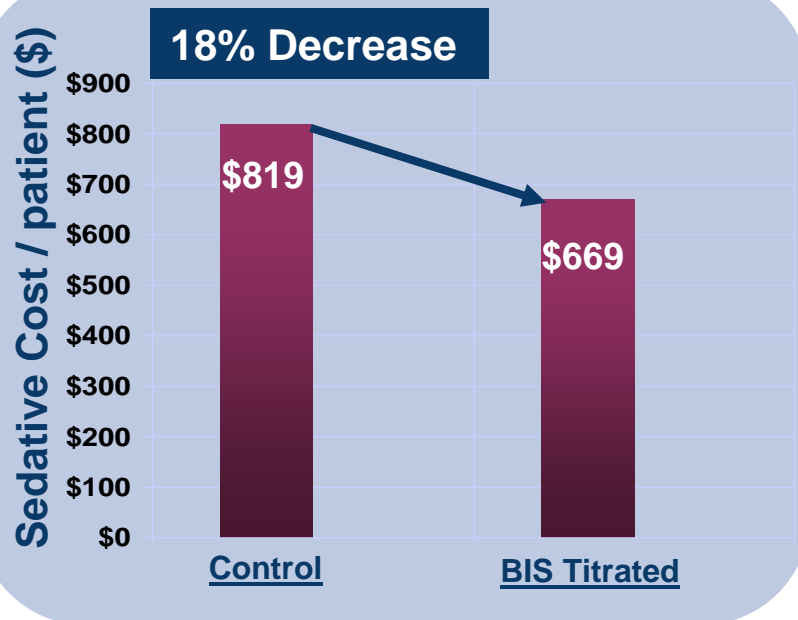
- Sedation drugs and doses administered at discretion of bronchoscopist
- Bronchoscopists blinded to BIS values



Results:

- *Patients who recalled feeling “too awake” were less sedated as measured by the BIS, despite receiving similar sedative doses.*
- *Physicians usually overestimate the adequacy of sedation compared to patients.*

BIS Reduces Sedative Cost & Improves Patient Experience



SICU patients (n=57): Infusions of sedatives & paralytics

Control: Sedatives titrated to vital signs and comfort

BIS: Sedatives titrated to BIS 70-80 (post-stimulation)

BIS-Guided Titration Results:

- **Average sedative savings of \$150 per patient**
- **Unpleasant recall reduced from 18% to 4% ($p < 0.05$)**

- In three RCTs, propofol has been shown to produce adequate sedation, which is of rapid onset and resolution.
- Propofol does appear to offer advantages over other sedative agents but is expensive and requires expertise and experience in its administration.

Scoring sedation during the procedure

Modified Observer's Assessment of Alertness/Sedation Scale (2) **OAASs**

Responsiveness	Score
Agitated	6
Responds readily to name spoken in normal tone (alert)	5
Lethargic response to name spoken in normal tone	4
Responds only after name is called loudly and/or repeatedly	3
Responds only after mild prodding or shaking	2
Does not respond to mild prodding or shaking	1
Does not respond to deep stimulus	0

Is preparation for bronchoscopy optimal?

- **Survey regarding compliance to BTS guidelines for flexible bronchoscopy (344 responses to 452 questionnaires)**

Table 1. – Intercollegiate Working Party: safe sedation guidelines

Verbal contact should be maintained at all times (*i.e.* "conscious sedation")

When the intravenous route is used, intravenous access should be present at all times

Avoid polypharmacy

When using an opioid/sedative combination the opioid should be administered first

There should be a defined and trained person who records monitoring

Oxygen and devices to deliver it should be available

Patient trolleys should be equipped to tip the head down

Resuscitation equipment should be available

There should be defined methods of sedation

The operator should have received training in sedation

Survey of flexible fibreoptic bronchoscopy in the United Kingdom

- **60% Responses (n=328)**
- **MORTALITY 0.045% (n=27)**
 - **no relationship with sedation regimen**
 - 3 cardiac problems, 3 sepsis
 - 7 advanced malignancies
 - 7 unknown causes

Physicians' preferred sedation regimen for flexible bronchoscopy

Sedation regime	Physicians
Benzodiazepine alone	207 (63)
Opioid alone	45 (14)
Benzodiazepine and Opioid	38 (12)
Other	3 (1)
No sedation	34 (10)

Is preparation for bronchoscopy optimal?

Table 2. – Use of topical anaesthetic to the nose and throat

Topical agent used	Number (%) using topical agent
Topical cocaine	4 (1)
Lignocaine	
Spray to nose	148 (43)
Gel to nose	225 (65)
Spray to throat	242 (70)
Nebulised	25 (7)
Amethocaine Lozenges	6 (2)

Is preparation for bronchoscopy optimal?

Table 4. – Sedation practices

	Routine	Often	Sometimes	Rarely	Respiratory failure
None	18	1	7	6	61
Midazolam	269	5	8	11	0
Other sedatives	77	1	6	9	0
Anxiolytic/opioid combinations					
Midazolam with					
Fentanyl/alfentanil			48		
Papaveretum			6		
Morphine			1		
Diazepam with					
Morphine			2		
Papaveretum			1		
Fentanyl			1		

Is preparation for bronchoscopy optimal?

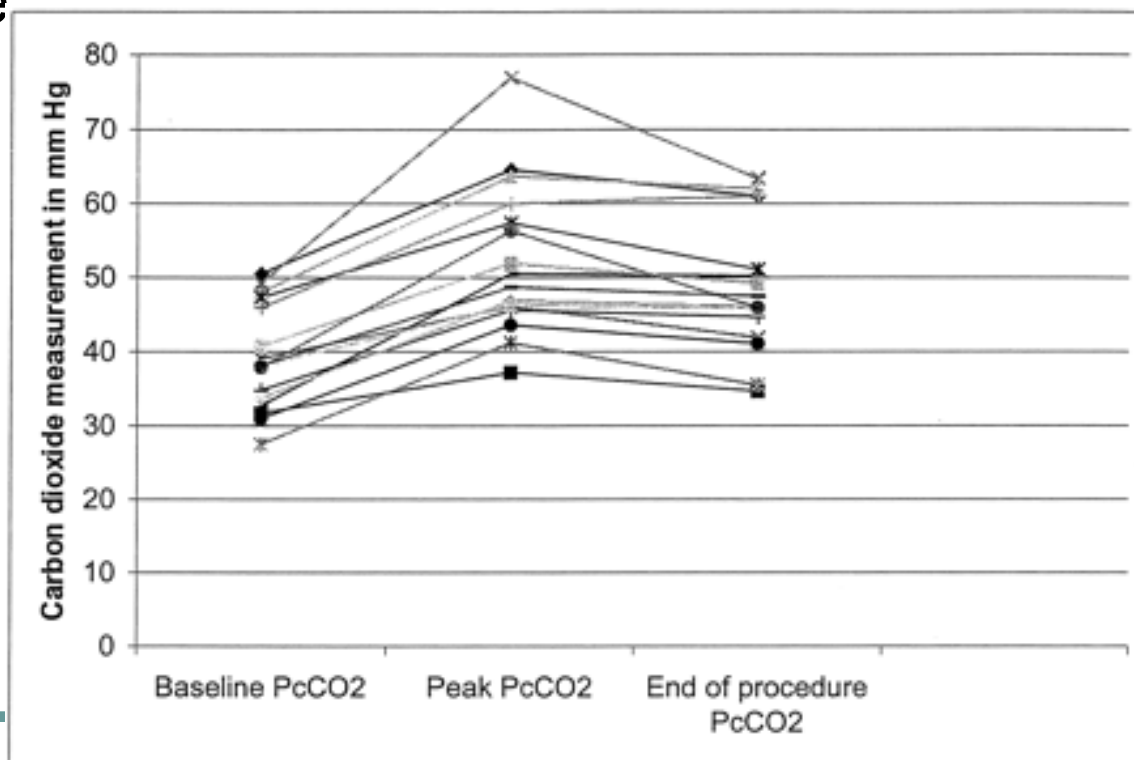
Table 6. – Assessment of sedation

	Operator n
Measurements	
Oxygen saturations	98
Cardiac frequency	21
Blood pressure	4
Respiratory rate	27
Vital signs	1
Patient observation	
Patient response	57
Verbal response	27
Eyelid flutter	16
Clinical acumen/experience	60
Tolerance/comfort/compliance	45
Conscious level/rousable/drowsiness	50
Cough	2
AVPU score	1

Sedation for Thoracoscopy

Chhajed PN, *Chest* 2005;127(2):585-8

- 16 patients undergoing thoracoscopy under hydrocodone, 5 mg + boluses of IV midazolam and/or pethidine



- **Intravenous access should be established in all patients**
- **Sedatives should be used in incremental doses to achieve adequate sedation and amnesia [B]**
- **Monitoring**
 - **Patients should be monitored by oximetry.[B]**
 - **Routine ECG monitoring is not required but should be considered in those patients with a history of severe cardiac disease and those who have hypoxia**
- **Oxygen supplementation should be used to achieve an oxygen saturation of at least 90% [B]**
- **Total dose of lignocaine should be limited to 8.2 mg/kg in adults [B]**
- **Atropine is not required routinely before bronchoscopy. [B]**

Migliore M, Chest. 2002;121(6):2032-5

- N=45 pts, 64 years (40-92), 28 pts ASA 3-4)
- Premedication : droperidol, 5 mg + atropine, 0.5 mg
- Sedation : IV diazepam 3 mg
- 4-step local anesthesia of the intercostal space with 10 ml Ropivacaine 0.75 %
- Operating Time : 45 min (20-90)
- Anesthesia Time : 71 min (30-150)
- Complications
 - 1 pt intraoperative bleeding
 - 8 pts hyperpyrexia
 - 2 pts atrial fibrillation

Video-assisted talc pleurodesis for malignant pleural effusions

Danby CA, Chest. 1998;113(3):739-42.

- N=45 pts, 63 years (36-84), 28 pts ASA 3-4)
- Sedation : IV propofol + fentanyl
- Intercostal nerve block with Lido 1% / Bupi 0.5%
- Operating Time : 44 min (20-90)
- Anesthesia Time : 71 min(30-150)
- Complications
 - 1 pt intraoperative bleeding
 - 8 pts hyperpyrexia
 - 2 pts atrial fibrillation

Increased sedative drug requirements during FB

- Stem cell transplant recipients and selected HIV patients with drug abuse (MDZ)
Chhadjed PN. *Respiration*. 2005;72(6):617-21
- In lung transplant recipients with CF (MDZ and fentanyl)

Chhadjed PN *Transplantation*
2005;80(8):1081-5

Patient-Controlled Analgesia

Complications following FB

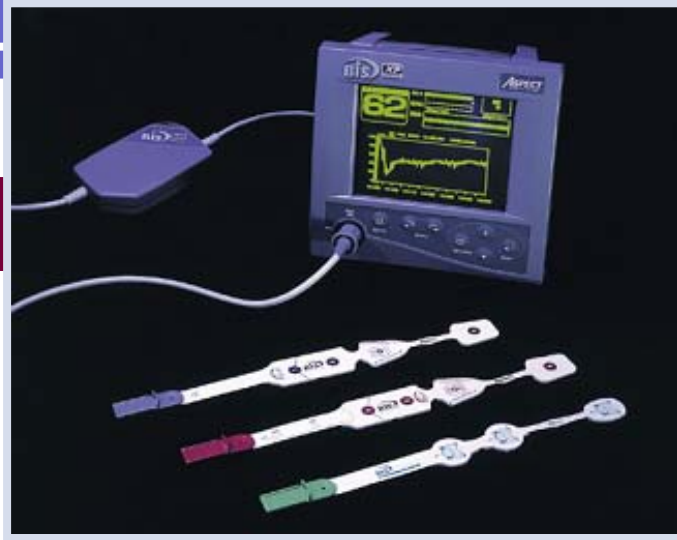
Impact of sedative agents

- 100 pts ASA 1-2, no cardiac disease
- Propofol vs. MDZ
- HR and SAP lower in group P than in MDZ

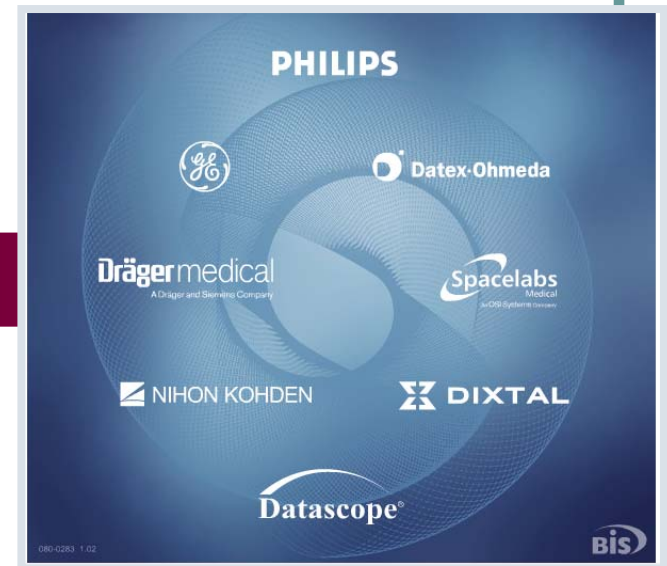
Anesthesiol Intensivmed Notfallmed Schmerzther. 2004;39(10):597-602

BIS Technology

BIS Monitor



BIS Modules



BIS Sensor





Sedation and anesthesia in GI endoscopy

This is one of a series of statements discussing the use of GI endoscopy in common clinical situations. The Standards of Practice Committee of the American Society for Gastrointestinal Endoscopy (ASGE) prepared this text. In preparing this guideline, a search of the medical literature was performed by using MEDLINE and PubMed databases through May 2008 that related to the topic of "sedation and anesthesia for gastrointestinal endoscopy" by using the key word(s) "sedation," "anesthesia," "propofol," "gastrointestinal endoscopy," "endoscopy," "endoscopic procedures," and "procedures." The search was supplemented by accessing the "related articles" feature of PubMed, with articles identified on MEDLINE and PubMed as the references. Pertinent studies published in English were reviewed. Additional references were obtained from the bibliographies of the identified articles and from recommendations of expert consultants. When little or no data exist from well-designed prospective trials, emphasis is given to results from large series and reports from recognized experts. Guidelines for appropriate use of endoscopy are based on a critical review of the available data and expert consensus at the time the guidelines are drafted. Further controlled clinical studies may be needed to clarify aspects of this guideline. This guideline may be revised as necessary to account for changes in technology, new data, or other aspects of clinical practice. The recommendations were based on medical studies and were graded on the strength of the supporting evidence (Table 1).

This guideline is intended to be an educational device to provide information that may assist endoscopists in providing care to patients. This guideline is not a rule and should not be construed as establishing a legal standard of care or as constituting an advocacy, requiring, or discouraging any particular treatment. Clinical decisions in any particular case involve a complex analysis of the patient's condition and the available courses of action. Therefore, clinical considerations may lead an endoscopist to take a course of action that varies from these guidelines.

BACKGROUND

Sedation may be defined as a drug-induced depression in the level of consciousness. The purpose of sedation and

analgesia is to relieve patient anxiety and discomfort, improve the outcome of the examination, and diminish the patient's memory of the event. Practice guidelines have been put forth by the American Society of Anesthesiologists (ASA) Committee for Sedation and Analgesia by Non-Anesthesiologists, and approved by the ASGE.^{1,2} Four stages of sedation have been described, ranging from minimal to moderate, deep, and general anesthesia (Table 2). In general, most endoscopic procedures are performed with the patient under moderate sedation, a practice that was formerly referred to as "conscious sedation." At the level of moderate sedation, the patient, while maintaining ventilatory and cardiovascular function, is able to make purposeful responses to verbal or tactile stimulation. In contrast, a patient undergoing deep sedation cannot be easily aroused but may still respond purposefully to repeated or painful stimulation. Airway support may be required for deep sedation. At the level of general anesthesia, the patient is unarousable to painful stimuli, and cardiovascular function may be impaired.

The level of sedation should be titrated to achieve a safe, comfortable, and technically successful endoscopic procedure. Knowledge of the pharmacologic profiles of sedative agents is necessary to maximize the likelihood that the desired level of sedation is targeted accurately.

Individuals differ in their response to sedation such that patients may require different levels of sedation for the same procedure and patients may attain varying levels of sedation during a single procedure. Therefore, practitioners should possess the skills necessary to resuscitate or rescue a patient whose level of sedation is deeper than initially intended. This statement will evaluate the strength of evidence in the medical literature to provide guidelines for the use of sedation and anesthesia during GI endoscopic procedures and is an update of 3 previous ASGE documents.³⁻⁵

PREPROCEDURE PREPARATION AND ASSESSMENT

Patients should be informed of—and agree to—the administration of sedation/analgesia/anesthesia, including discussion of its benefits, risks, and limitations and possible alternatives. The level of sedation should be commensurate with the patient's level of expectation, if possible. The literature contains varying recommendations for oral intake before procedural sedation. No practice

Risk assessment

ASA classification

Grade I	Healthy individual
Grade II	Mild disease, not limiting daily activities
Grade III	Severe disease, limiting daily activities
Grade IV	Severe disease, life-threatening
Grade V	Unlikely to survive for 24 hours regardless of surgical intervention

Grades III & IV in relation with specific patient risk factor

Decompensated heart failure

Coronary heart disease

Heart valve disease/replacement

Liver and kidney failure

Pulmonary disease

Coagulation disorders

Modified Richmond Agitation – Sedation Score

Ely EW et al. JAMA 2003; 289: 2983–91

Grade	Term	Description
0	Alert and calm	
– 1	Sleepy	Not completely alert, but at least awake phases (eyes open, eye contact) lasting at least 10 s when patient is addressed
– 2	Mild sedation	Awake phase (eyes open, eye contact) lasting less than 10 s when patient is addressed
– 3	Moderate sedation	Movement or eye opening when patient is addressed (but no eye contact)
– 4	Deep sedation	No reaction when patient is addressed, but movement or eye opening when physically stimulated (shaking shoulder or rubbing sternum)
– 5	No reaction	No reaction when patient is addressed or physically stimulated

Which drug should I use ?

TECHNIQUE

- Anesthesia
 - Best accomplished in the operating room
 - May be performed bedside in an ICU setting
 - Continuous monitoring
 - Light anesthesia--allows continued spontaneous breathing
 - May be done with conscious sedation in older individuals

TECHNIQUE

- Additional procedures
 - Bronchoalveolar lavage
 - Brushings
 - Bronchial biopsy
 - Transbronchial biopsy
 - Laser
 - Others: cryotherapy, stent placement, foreign body removal, needle biopsy

Sedation during Flexible Bronchoscopy in Patients with Pre-Existing Respiratory Failure: Midazolam versus Midazolam plus Alfentanil

Michael Dreher Emelie Ekkernkamp Jan Hendrik Storre Hans-Joachim Kabitz
Wolfram Windisch

Procédure interventionnelle : peut-on se passer de l'anesthésiste-réanimateur ?

F Clergue

1. I....
2. Quelles solutions ?

Anaesthesia & Sedation Outside the OR

Example of the Mass Gen Hosp, Boston

R Pino, Curr Opin Anaesth 2007

Table 1 Number of procedures performed under sedation and monitored anesthesia care (MAC)

Sedation classification	Number of procedures
Total anesthesia cases	36 869
Total anesthesia cases outside of operating room	4555 (12.4%) ^a
Endoscopy, cardiology, radiology anesthetics	1693 (4.6%) ^a
MAC anesthetics (total)	1817 (4.9%) ^a
MAC anesthetics outside of operating room	144 (0.4%) ^a
MAC anesthetics using propofol <100 µg/kg/min	
Total	1033 (56%) ^b
Out of operating room	60 (3.2%)
MAC anesthetics using propofol ≥100 µg/kg/min	
Total	46 (2.5%) ^b
Out of operating room	6 (0.32%)
Nonanesthesia sedation (total)	25 774
Moderate sedation	25 282
Deep sedation	492 (1.9%)

Anaesthesia outside the OR

Example of the Mass Gen Hosp, Boston

R Pino, Curr Opin Anaesth 2007

Table 2 Procedures performed under nonanesthesia sedation

Location	Procedure
Gastrointestinal endoscopy (64%)	Colonoscopy, endoscopic retrograde cholangiopancreatography, esophagoscopy, percutaneous endoscopic gastrostomy
Cardiology and vascular (30.5%)	Ablation of dysrhythmias, carotid artery stent placement, coronary angiography and stent placement, implantable cardioverter defibrillator, percutaneous mitral valvulotomy, percutaneous aortic valvulotomy, pericardiocentesis catheter placement, peripheral arterial stent placement, transesophageal echocardiology, vascular angiography
Radiology (2%)	Arterial embolization, biopsy, drainage catheter placement, cerebral angiography, computerized tomography, inferior vena cava filter placement, MRI nephrostomy, tube placement, vascular access catheter placement, vascular stent placement, vertebroplasty/kyphoplasty
Surgery (2%)	Arteriovenous fistula placement, breast biopsy, cosmetic surgery, rhinoplasty, blepharoplasty, rhytidectomy, excision of lesions, inguinal/umbilical hernia repair
Pulmonary medicine (1%)	Bronchoscopy
Emergency department (0.5%)	Lumbar puncture, reduction of dislocation, removal of foreign body, suture of laceration

Anaesthesia outside the OR

Example of the Mass Gen Hosp, Boston

R Pino, Curr Opinion Anaesth 2007

Year 2005 : 25'774 cases of nonanesthesia sedation:

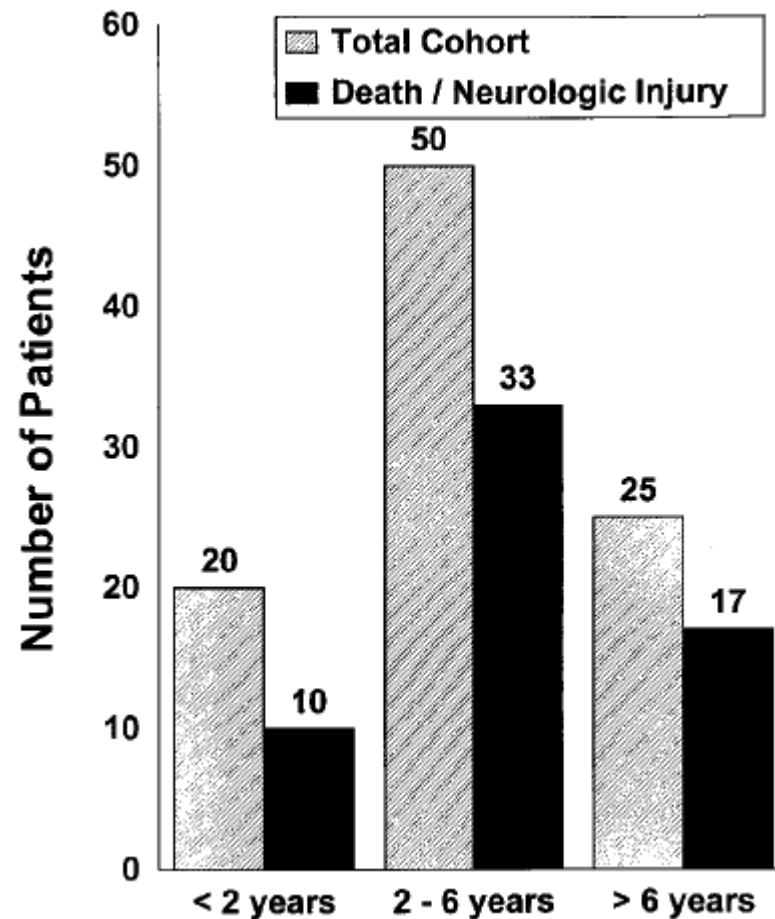
- **Moderate sedation : 25'282**
- **Deep sedation : 492 (1.9%)**

Table 4 Events associated with procedural sedation

Event	Number of cases (%)
SpO ₂ < 90%	31 (0.12)
Systolic blood pressure < 20% baseline	28 (0.1)
Apnea or use of naloxone or flumazani	31 (0.12)
Nausea/vomiting	30 (0.11)
Cardiac arrest	17 (0.06)
Death	2 (0.007)
Pain/anxiety	31 (0.12)
Anesthesia assistance	28 (0.01)

Adverse Sedation Events in Pediatrics: A Critical Incident Analysis of Contributing Factors

Charles J. Cote et al; Pediatrics 2000



Adverse Sedation Events in Pediatrics*

TABLE 3. The Presenting Order of Observed Events*

Event	First			Second			Third		
	Entire Cohort	Hospital-Based	Nonhospital-Based	Entire Cohort	Hospital-Based	Nonhospital-Based	Entire Cohort	Hospital-Based	Nonhospital-Based
Respiratory depression	30.5	44.2	46.4	2.1	2.3	3.4	0.0	0.0	0.0
Respiratory arrest	43.2	27.9	28.6	14.7	14.0	25.0	2.2	2.3	3.6
Desaturation	5.3	9.3	3.6	10.5	16.3	4.0	0.0	0.0	0.0
Respiratory distress	2.1	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Laryngospasm	3.2	4.7	3.6	0.0	0.0	0.0	0.0	0.0	0.0
Cardiac arrest	8.4	2.3	10.7	30.5	14.0	53.6†	10.5	7.0	25.0†
Seizure	5.3	7.0	7.1	2.1	0.0	0.0	1.1	2.3	0.0
Unresponsive	1.0	2.3	0.0	2.2	2.3	4.0	1.1	0.0	0.0
Bradycardia	0.0	0.0	0.0	1.1	2.3	0.0	1.1	2.3	0.0
Unknown or no other event	1.0	0.0	0.0	36.8	48.8	10.0	84.0	86.0	71.4
Probable Causes of Adverse Events				Entire Cohort (n = 95)		Hospital-based (n = 43)		Nonhospital-based (n = 28)	
				n	%	n	%	n	%
Drug-drug interaction				44	46.3	19	44.2	18	64.3
Drug overdose				34	35.8	20	46.5	7	25.0
Inadequate monitoring				27	28.4	11	25.6	13	46.4
Inadequate resuscitation				19	20.0	1	2.3	16	57.1*
Inadequate medical evaluation				18	18.9	6	14.0	7	25.0
Unknown				12	12.6	4	9.3	1	3.6
Premature discharge				11	11.6	5	11.6	4	14.3
Inadequate personnel				10	10.5	4	9.3	5	17.9
Prescription/transcription error				9	9.5	4	9.3	1	3.6
Inadequate recovery procedures				8	8.4	4	9.3	2	7.1
Inadequate equipment				8	8.4	4	9.3	3	10.7
Inadequate understanding of a drug or its pharmacodynamics				8	8.4	2	4.7	2	7.1
Prescription given by parent in unsupervised medical environment				4	4.2	0	0	0	0
Local anesthetic overdose				4	4.2	1	2.3	3	10.7
Inadequate fasting for elective procedure				3	3.2	1	2.3	1	3.6
Unsupervised administration of a drug by a technician				2	2.1	1	2.3	1	3.6

* $P < .001$ Nonhospital-based versus hospital-based. Note that some patients had >1 cause for an adverse sedation event.

Sedation and general anaesthesia in children undergoing MRI and CT : adverse events and outcomes

Malviya S et al; Br J Anaesth 2000

Sedative (<i>n</i>)	Oxygen desaturation (<i>n</i> = 27)	Airway management (<i>n</i> = 9)	Inadequate sedation (<i>n</i> = 146)	Oversedation (<i>n</i> = 4)	Failed procedures (<i>n</i> = 65)
Single agents					
Chloral hydrate (679)	21 (3%)	7 (1%)	63 (9%)	4 (<1%)	26 (4%)
mean (sd), mg kg ⁻¹	69 (9.9)		62 (16.4)	95 (44.1)	60.1 (15.5)
Benzodiazepine (90)	1 (1%)	0	17 (19%)†	0	8 (9%)*
mean (sd), mg kg ⁻¹			0.09 (0.05)		0.099 (0.07)
Barbiturate (2)	0	0	0	0	0
Multiple agents					
Anxiolytic combination (117)	2 (2%)	1 (<1%)	59 (50%)	0	28 (24%)**
Analgesic-anxiolytic combination (7)	1 (14%)	0	1 (14%)	0	0

Table 6. Primary Provider Types and Case Numbers (~Data on 49,805 Cases)

Table 6. Primary Provider Types and Case Numbers (~Data on 49,805 Cases)

Provider type	Total no. of cases	Percent of cases
Anesthesiologist (Pedi-anesthesiologist)	5,117 (4,175)	10.27
Advanced practice registered nurse/pediatric nurse, Practitioner/physician's assistant	15	0.03
Emergency medicine MD (Pedi emergency medicine)	18,034 (17,972)	36.19
Fellow level trainee	1,215	2.44
Intensivist (pedi intensivist)	24,296 (23,661)	48.76
Pediatrician	1,123	2.25
Radiologist	5	0.01

Numbers in parentheses represent the subtotal of providers who identified as "pediatric" subspecialists.

Cravero, J. P. et al. *Anesth Analg* 2009;108:795-804

Table 7. Procedure Types (~Data on 51,056 Procedures 49,836 Sedations)

Table 7. Procedure Types (~Data on 51,056 Procedures & 49,836 Sedations)

Procedure	Total no. of cases	Percent
Airway/pulmonary procedure	701	1.41
Bone fracture fixation	412	0.83
Cardiology procedure	851	1.71
Dental procedure	397	0.80
Remove foreign body	8	0.02
Gastrointestinal procedure	5,451	10.94
Hematology/oncology procedure	7,125	14.30
Nerve/brain/ear (conduction)	2,452	4.92
Ophthalmology procedure	44	0.09
Radiology procedure	30,106	60.41
Sexual abuse examination	13	0.03
Minor surgical procedure	2,969	5.96
Other	527	1.06

Cravero, J. P. et al. *Anesth Analg* 2009;108:795-804

Adverse Events and Related Factors

Table 13. Adverse Events and Related Factors

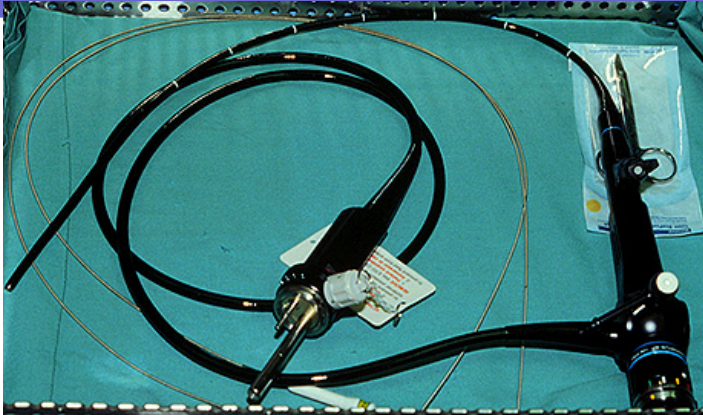
Variable	Proportion	<i>n/N</i>	OR	95% CI	<i>P</i>
Provider					
Anesthesiologist	0.04	226/5,117	Reference		
Other	0.06	2,724/44,714	1.38	1.21–1.57	<0.001
ASA					
I or II	0.05	2,178/41,191	Reference		
III or higher	0.09	714/7,727	1.75	1.61–1.89	<0.001
Age					
8–18 yr	0.07	965/14,440	Reference		
4–8 yr	0.05	740/13,954	0.79	0.72–0.87	<0.001
2–4 yr	0.05	497/10,346	0.72	0.65–0.80	<0.001
1–2 yr	0.06	346/5,965	0.87	0.77–0.98	0.019
6–12 mo	0.07	211/3,192	0.99	0.86–1.14	0.88
0–6 mo	0.10	191/1,939	1.47	1.27–1.71	<0.001
NPO solids					
Greater than 8 h	0.06	2,277/40,592	Reference		
Less than 8 h	0.07	619/8,679	1.27	1.17–1.39	<0.001
NPO liquids					
Longer than 2 h	0.06	2,880/48,835	Reference		
Less than 2 h	0.06	18/315	0.97	0.62–1.52	0.89
Opioids					
Not given	0.05	2,455/44,775	Reference		
Given	0.10	495/5,061	1.78	1.63–1.96	<0.001

Adverse Events During Pediatric Sedation/Anesthesia With Propofol for Procedures Outside the Operating Room: A Report From the Pediatric Sedation Research Consortium

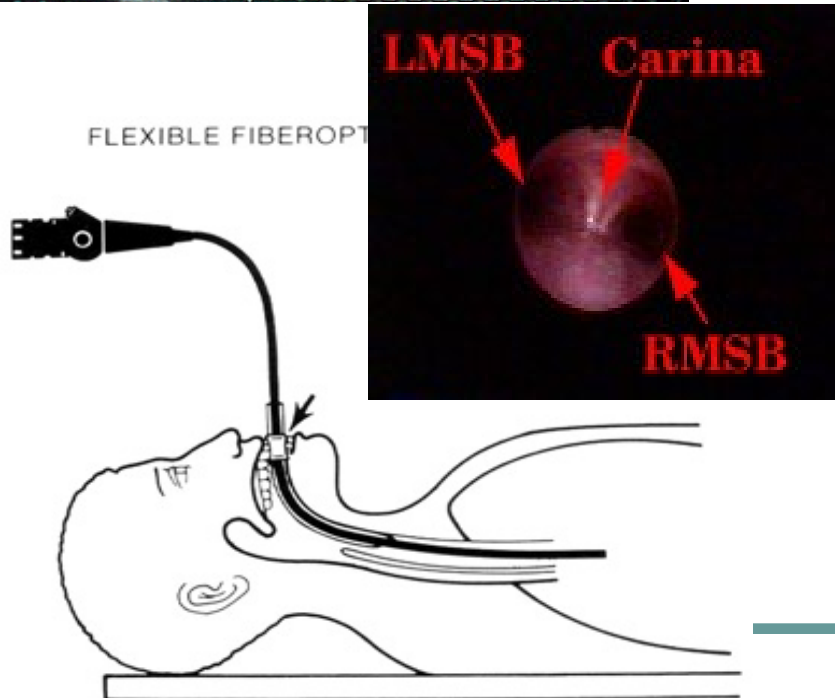
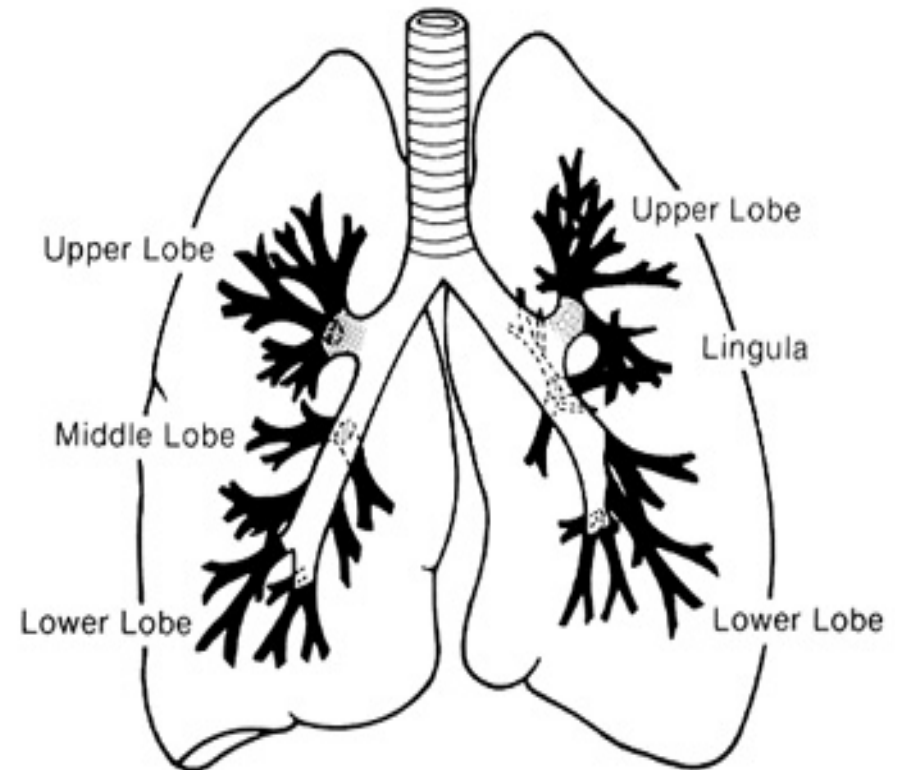
Table 10. Summary Data on Procedure Complications (Data on 49,836 cases)

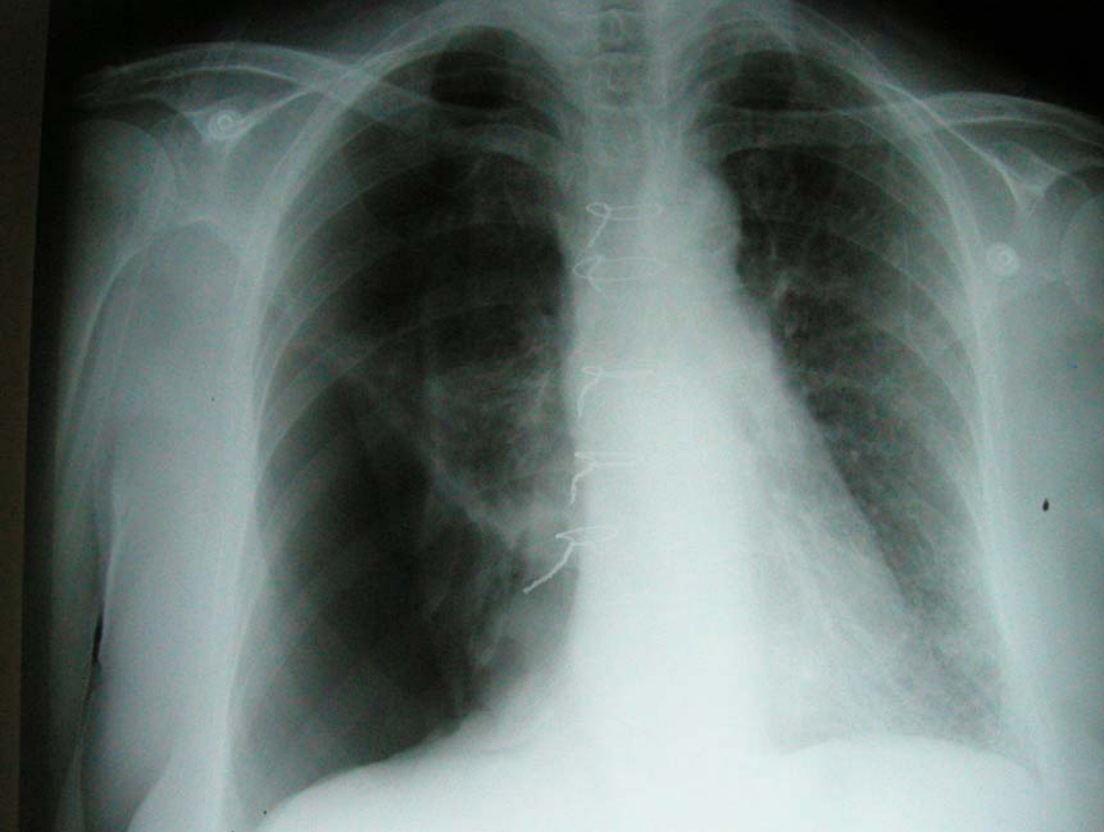
Type of complication	Total no. of cases	Rate/10 K sedations
Cases with pulmonary complications	1,170	235
Cases with any complication	2,950	592

Bronchoscopy

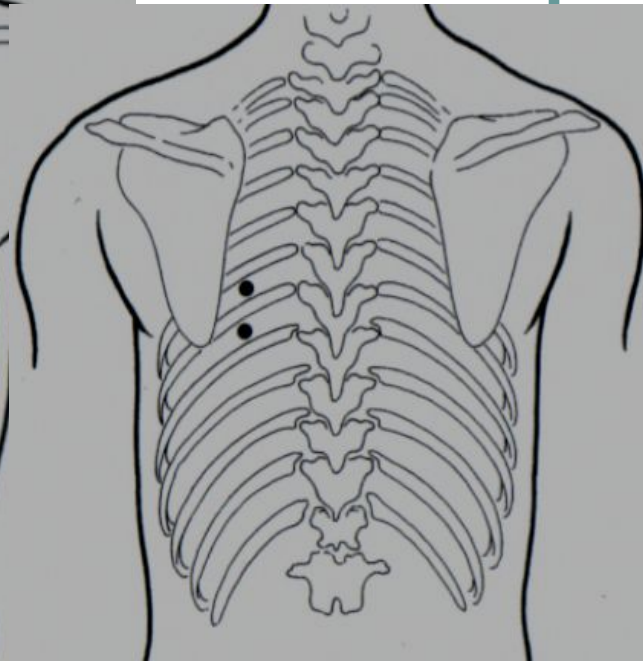
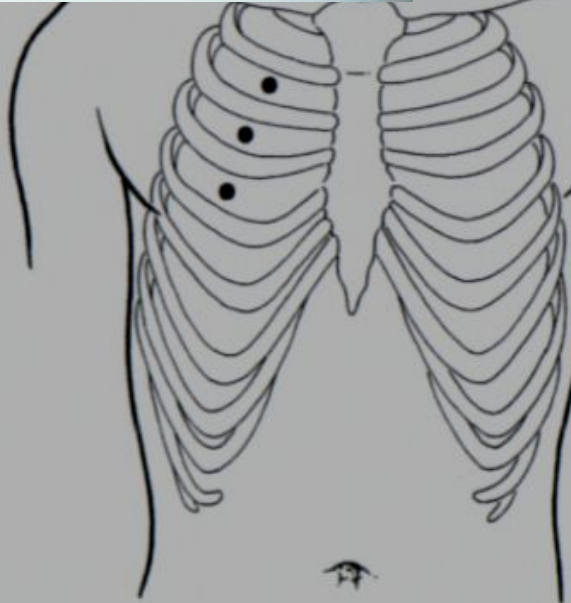
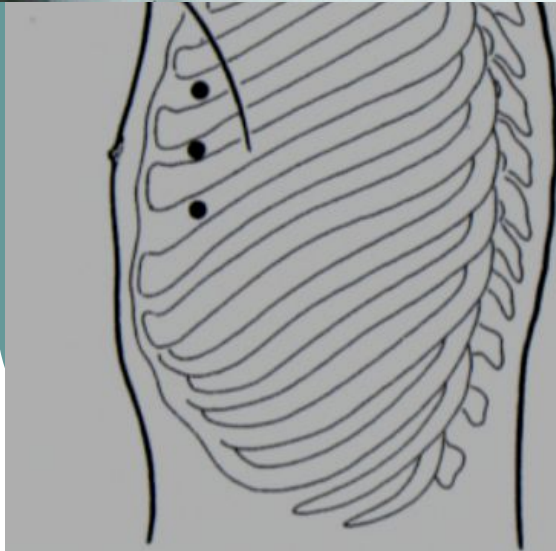


RANGE OF OBSERVATION
(Flexible & Rigid Bronchoscopes)

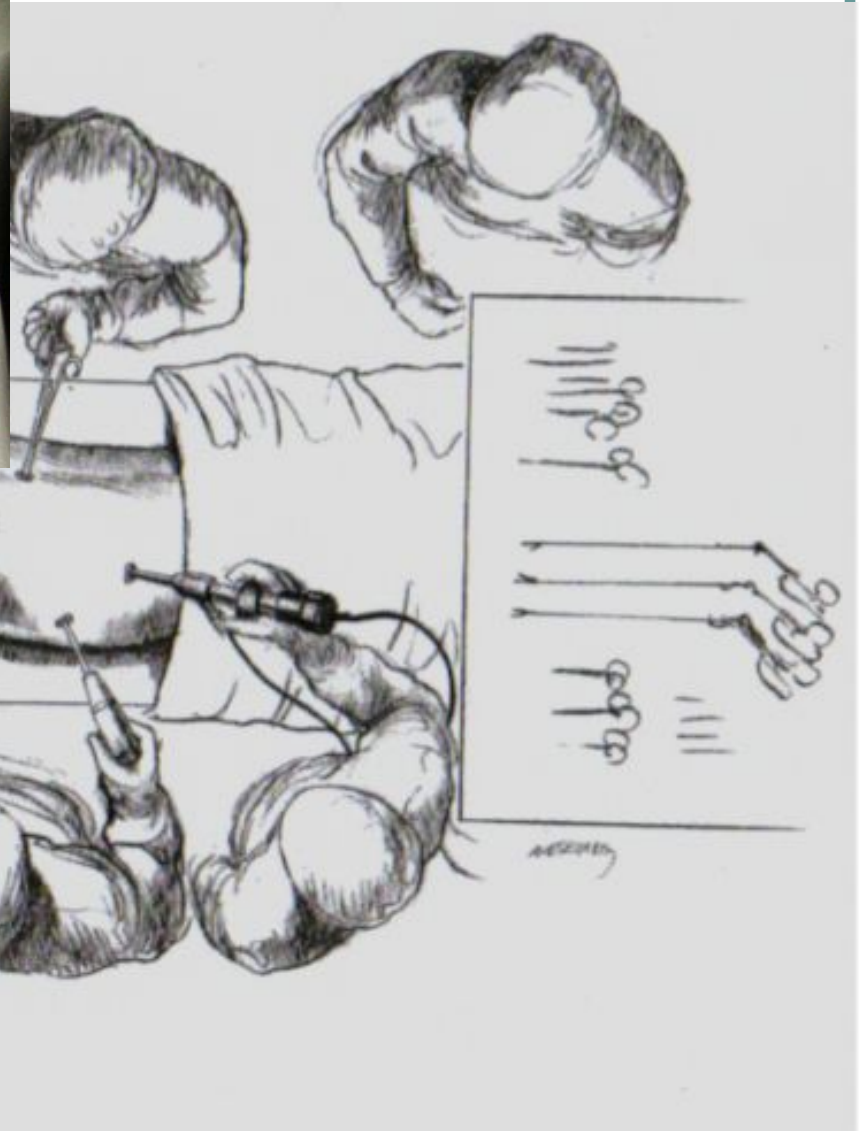
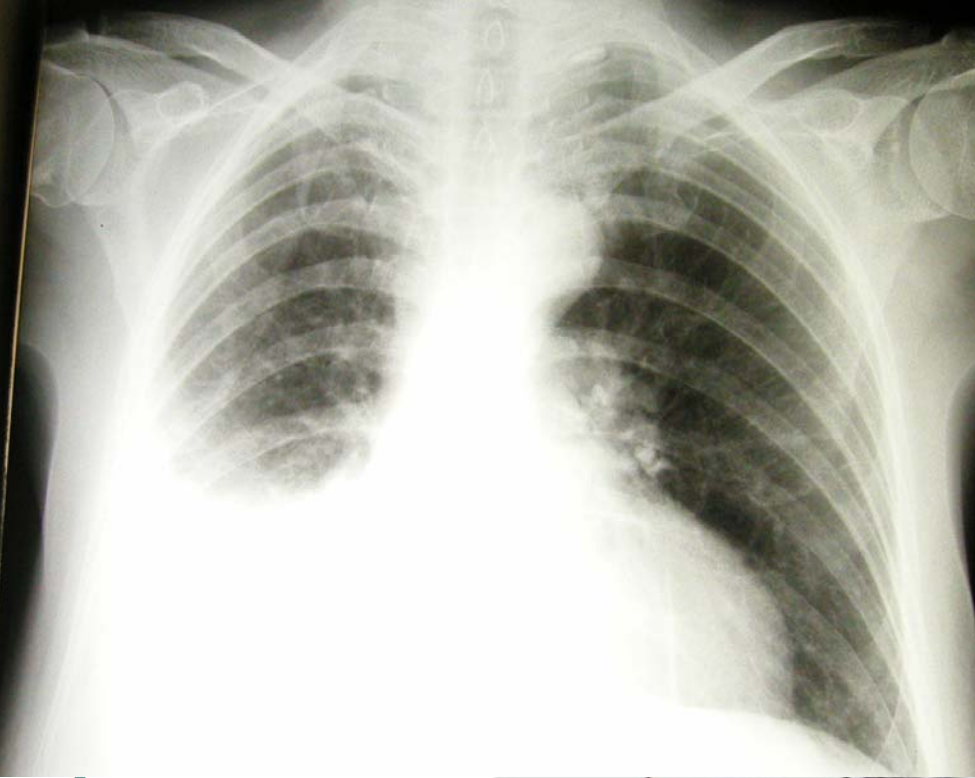




Thoracoscopy



Video Assisted Thoracic Surgery



Prof JM Tschopp Hôpital du Valais
3963 Montana
Switzerland

Marseille november 2009



Neuroleptoanalgesia (N)

- Why I don't want to speak about N
- How we did thoracoscopy under local anesthesia
- Sedation and flexible bronchoscopy: state of the art
- Space for improvement
- How we do now thoracoscopy, bronchoscopy under local anesthesia

Neuroleptics

- Haloperidol
- Thioridazine
- Chlorpromazine
- Olanzapine
- Risperidone

Harrisson's Principles of Internal Medicine
18th edition 2008, ch 11, Medications for
the management of delirium

neuroleptoanalgesics

- « modern drugs which combine properties of sedation, analgesia, and amnesia and are excellent adjunctive medications »
 - droperidol 5 – 10 mg
 - nefopam 40 mg
 - pethidine 5 – 10 mg
 - midazolam 5 – 10 mg
 - diazepam
 - fentanyl 50 mcg

3.3.5 Conclusion

As a practical matter today, we prefer the lightest anesthesia possible, usually a simple combination of premedication, local anesthesia and a neuroleptic, which permits the patient to remain conscious as much as reasonably possible during the procedure and does not preclude prompt awakening as soon as the lung is reexpanded to the chest wall. One should not, therefore, give in to the unexperienced anesthetist who desires the security of intubation with its attendant risks of secondary respiratory depression. Nowadays, endotracheal intubation should be elected only when the practitioner determines that the procedure requires it.

« *Thoracoscopy has to be done under local anesthesia* »

~~Neuroleptoanal~~

Keep it simple and stupid



- Why?
- Kiss principle
- Any pulmonologist does endoscopy as a routine without general anesthesia
- Are pulmonologists more afraid of the airways they regularly look into than gastroenterologists who look into the gut?

Sedation for thoracoscopy: a way to do it

- Midazolam
- Pethidine
- N₂O (always 50% O₂; 50% N₂O)

Flexible bronchoscopy: guidelines

- Sedation should be offered to patients where there is no contraindication (B)
- Patients who have been sedated should be advised not to drive, sign legally binding documents or operate machinery for 24 hours after the procedure (C)

BTS guidelines on diagnostic flexible bronchoscopy Thorax 2001;56 (suppl I) 1-

Midazolam: benzodiazepine $T_{1/2}$: 2h

- preferred to diazepam
- rapid onset of action
- 10% of population prolonged $T_{1/2}$ (Dundee 1986)

memory disturbances

respiratory depression

cognitive impairments

- Antagonist: flumazenil



a forbidden drug

Propofol: lipid emulsion

- Rapid onset of sedation
- Faster recovery than midazolam in FB (Crawford 1993, Steinbacher 2001)
- Commonly and safely used by gastroenterologists (Heuss 2004, Carlsson 1995, Koshy 2000)

Sedation for FB? (n = 344)

- Midazolam: 85 %
- No sedation: 27%

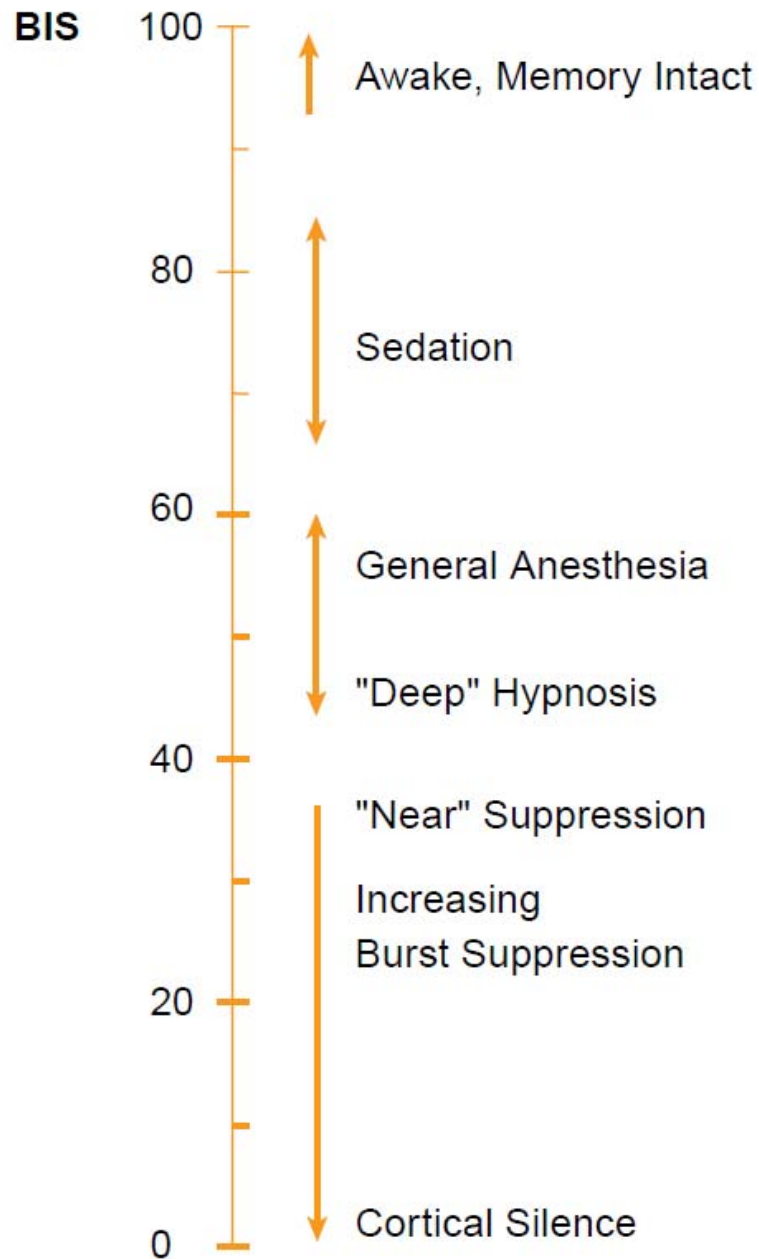
Need for
better
evidence and
improvement

Pickles J. ERJ 2003;22:303



RCT: titrated sedation with propofol (P) or midazolam (M)

- Patient tolerance?
- Recovery of brain function?
- Safety?



FT9



AF7



FP1



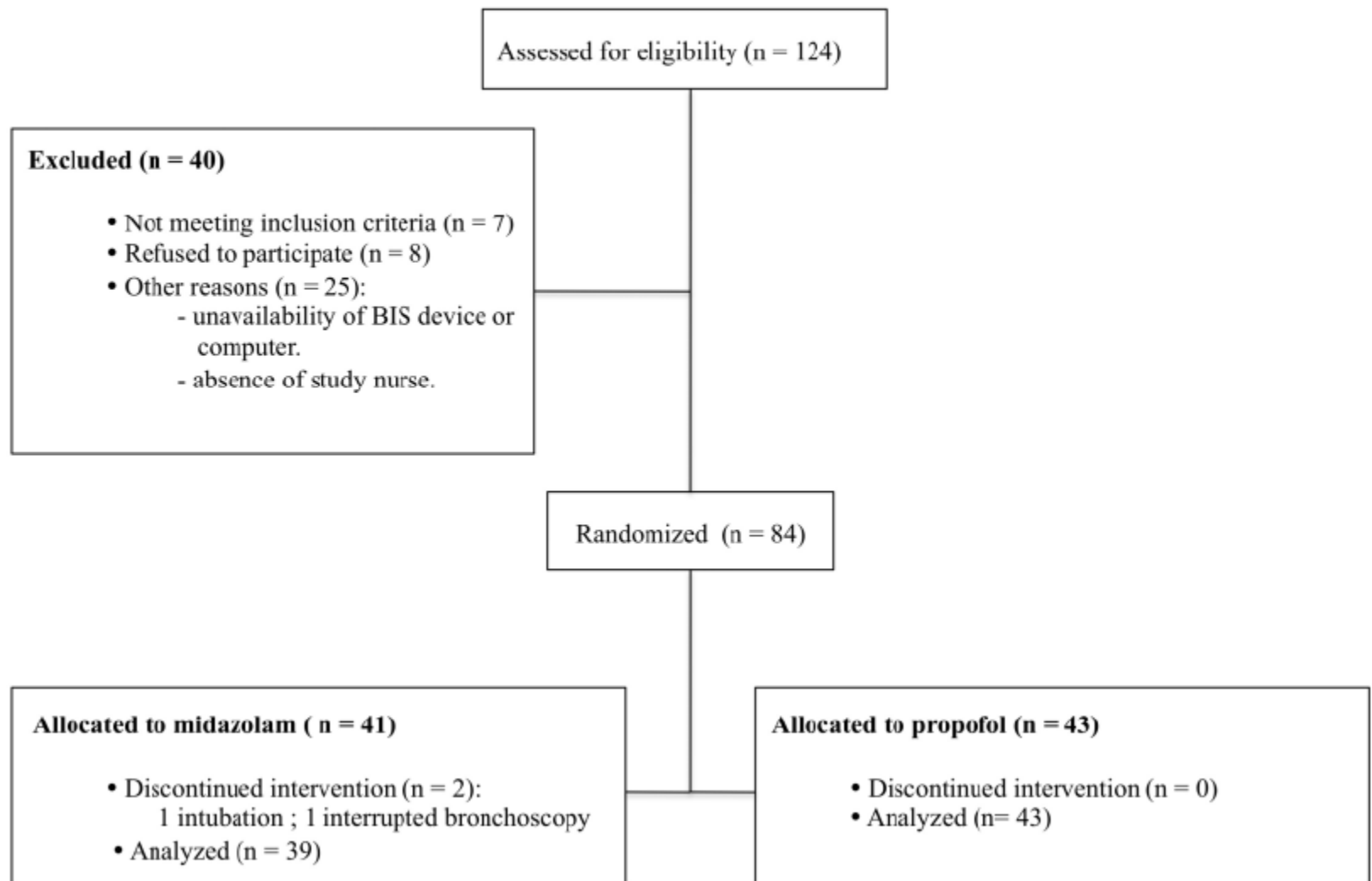
FPz

A



B





Methods: conscious sedation

- EEG BIS monitor
- Staff: blinded operator, « sedator », 2 nurses
- Local anesthesia: xylocaine 1%
- Initiation: 40 mg P or 2 mg M per 2 min
→ BIS 70 – 85
- 5- grade observer assessment of alertness/sedation score (OAAS/S)

Recorded parameters

- BIS values and OAAS/S values
- Time to BIS during and after the procedure
- Cardiopulmonary parameters
- 1 and 24 h after procedure: tolerance, key symptoms by VAS
- 15 and 60 min after procedure: psychometric tests (335 letters with 170 changes) reaction time

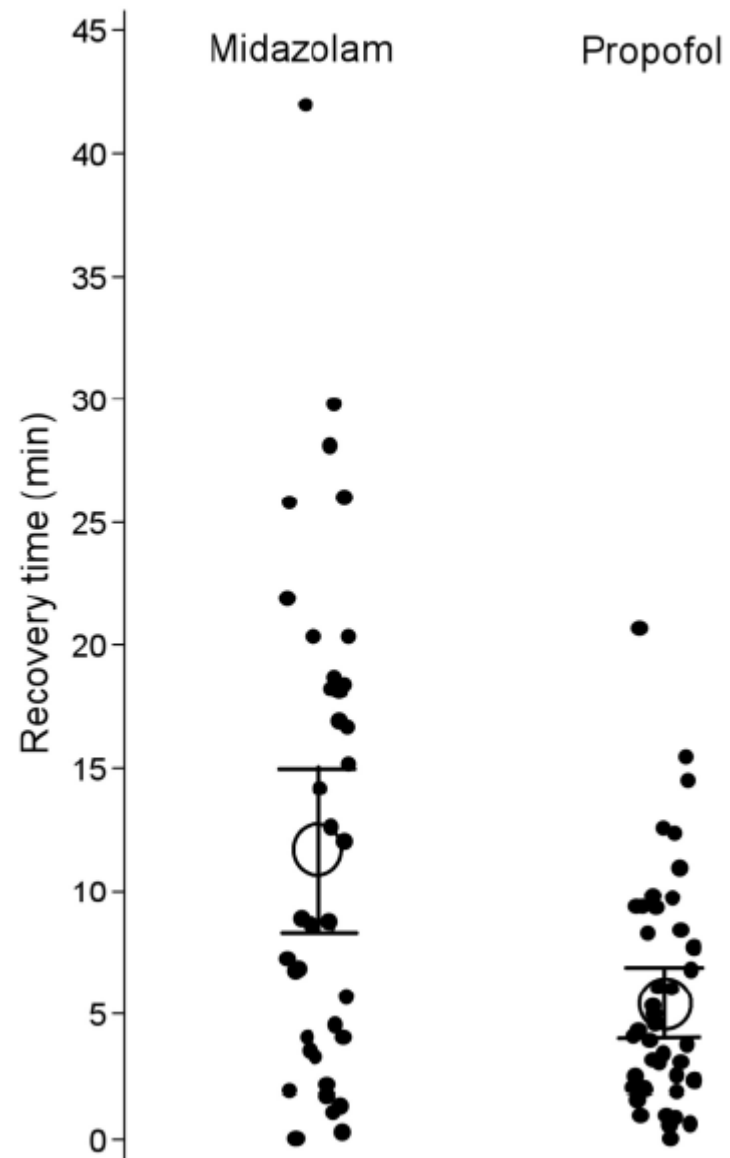
Study endpoints

- Primary endpoint: time delay after the procedure
- Secondary endpoints: patient's tolerance, operator evaluation of patient's tolerance, cardiopulmonary side-effects
- Cognitive impairments after P or M

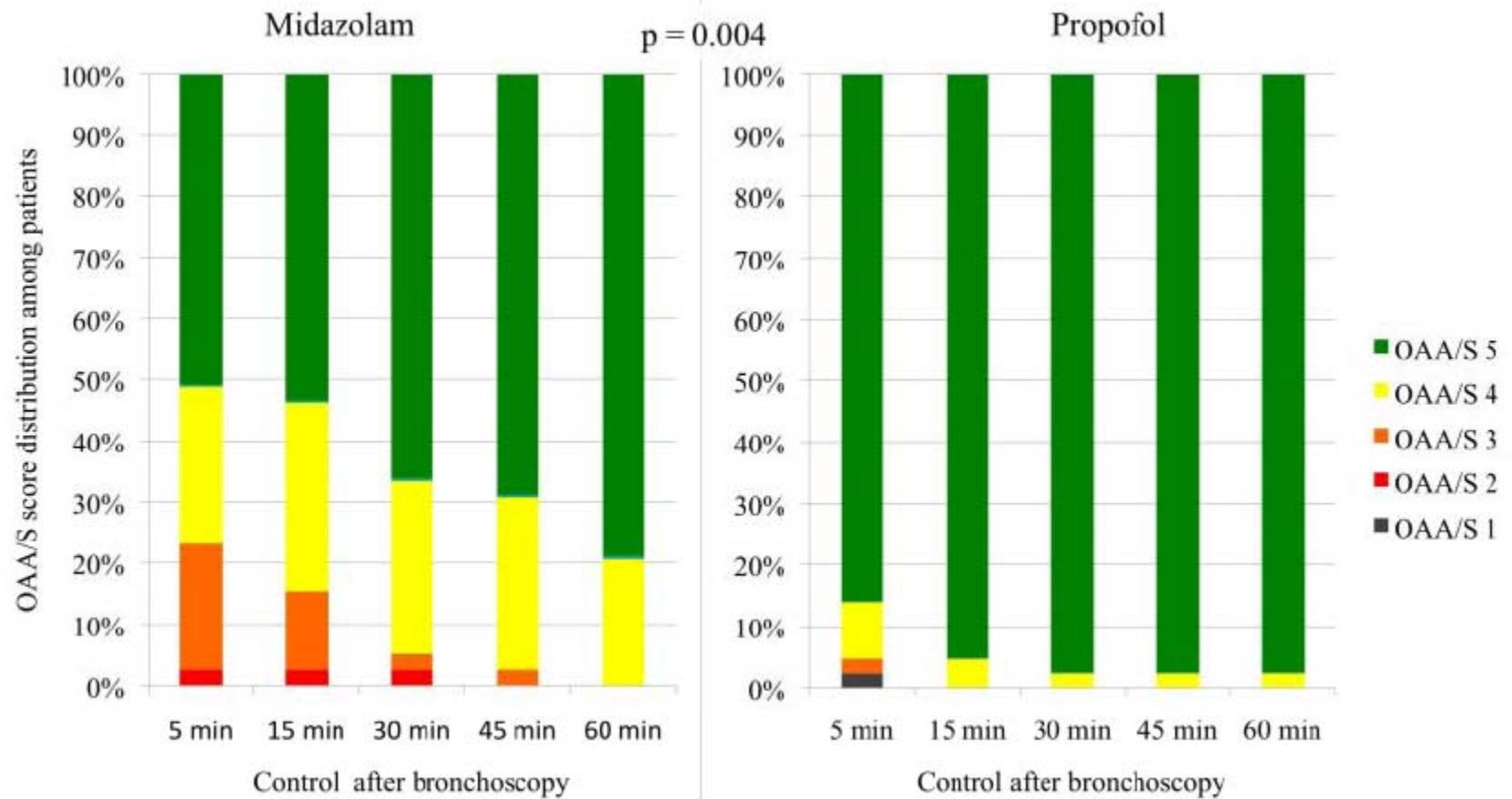
		Midazolam (n=39)	Propofol (n=43)
<i>sex</i>	Male, n (%)	28 (72)	27 (63)
	Female, n (%)	11 (28)	16 (37)
<i>ASA class</i>	I, n (%)	18 (46)	14 (33)
	II, n(%)	17 (44)	26 (60)
	III, n (%)	4 (10)	3 (7)
<i>Base</i>	Age	55.2 (14.3)	57.9 ± 11.4
	Weight (kg)	71.6 ± 12.4	74.9 ± 15.6
	Systolic BP (mmHg)	136.5 ± 18.5	135.8 ± 16.6
	Diastolic BP (mmHg)	80.1 ± 10.1	82.1 ± 11.7
	Heart Rate(min ⁻¹)	79.5 ± 17.8	73.6 ± 12.3
	SaO ₂ (%)	96.0 ± 3.7	95.8 ± 2.9
<i>CPT results</i>	CE score	8.2 (14.8)	8.1 (15.7)
	OE score	13.4 (15.0)	10.7 (8.9)
	Reaction time (ms)	463.9 ± 73	452.9 ± 128.0

Bronchoscopy and sedation parameters

	Midazolam (n=39)	Propofol (n=43)	p value*
T _{IB}	2.3 (1.3)	2.4 (1.7)	0.731
FB duration	12.2 (9.9)	12.4 (9.6)	0.368
Recovery time after FB (BIS > 90)	9.5 (15.6)	3.8 (7.2)	0.010
Drug dose (mg)	6.2 ± 2.7	135.1 ± 71.7	----



$p < .001$



$p < .001$

Table 3:

Continuous performance test results at 15 and 60 minutes after bronchoscopy in both groups

		Midazolam (n=39)	Propofol (n=43)	Difference (95%CI)	p value
<i>CPT results 15 min after bronchoscopy</i>	CE score	22.5 (13.1)	12.2 (10.7)	-10.3 (-15.7 ; -0.5)	<0.001*
	OE score	22.7 (16.1)	15.2 (13.6)	-7.5 (-14.2 ; -0.6)	0.032*
	Unable to complete, n	6	0		
	Reaction time, ms	486 (161)	450 (114)		0.011†
<i>CPT results 60 min after bronchoscopy</i>	CE score	19.2 (16.7)	12.0 (12.9)	-7.2 (-13.7 ; -0.6)	0.032*
	OE score	16.6 (11.8)	13.1 (11.4)	-3.4 (-0.9 ; 1.7)	0.186*
	Unable to complete, n	1	0		
	Reaction time, ms	464 (96)	429 (136)		0.043†

* Differences between groups and p values derived from robust linear regression using score as dependent variable and group as independent variable.

†: Wilcoxon test.

CPT results: CE, OE scores are expressed as mean and standard deviation. Reaction time is expressed as median and interquartile range in parentheses. CPT = continuous performance test; CE = commission error or false hit, OE = omission error or missed target; ms = millisecond. For CE and OE score: 0 = best score and 100 worst score.

Table 4:

Tolerance to bronchoscopy as assessed by the patient and the operator with a visual analogic scale (VAS)

		Midazolam (n=39)	Propofol (n=43)	Difference (95%CI)	p value*
<i>Global tolerance</i>	Patient 60 min	15.2 (18.7)	8.4 (11.1)	-6.8 (-13.5; 0.1)	0.051
	Patient 24 h	14.3 (16.7)	7.9 (8.7)	-6.4 (-0.4; -12.2)	0.036
	Operator	16.2 (17.4)	22.7 (24.9)	+6.5 (-2.9; 15.9)	0.171
<i>Pain</i>	Patient 60 min	8.8 (13.0)	3.9 (4.1)	-4.9 (-9.2; -0.6)	0.026
	Patient 24 h	8.1 (12.0)	4.8 (4.8)	-3.4 (-7.4; 0.7)	0.106
<i>Nausea</i>	Patient 60 min	7.7 (13.4)	3.2 (4.7)	-4.6 (-9.0; -0.1)	0.047
	Patient 24 h	8.9 (15.7)	4.3 (7.0)	-4.6 (-10.0; 0.8)	0.097
<i>Breathlessness</i>	Patient 60 min	13.3 (23.6)	4.4 (5.9)	-9.0 (-16.4; -1.2)	0.024
	Patient 24 h	12.3 (20.6)	5.9 (8.2)	-6.4 (-13.4; 0.64)	0.074
<i>Cough</i>	Patient 60 min	18.4 (23.5)	18.0 (20.9)	-0.3 (-10.2; -9.5)	0.946
	Patient 24 h	16.4 (19.1)	18.1 (21.3)	+1.6 (-7.3; -10.5)	0.715

Visual analogic scale: 0 mm corresponds to excellent tolerance and 100 mm to very low tolerance.

Table 5:

Adverse events for both groups during bronchoscopy

	Midazolam (n=39)	Propofol (n=43)	p value*
Hypotension (%) [*]	0	2 (4.7)	0.495
Tachycardia (%) ⁺	11 (28.2)	7 (16.3)	0.285
Hypoxemia (%) [§]	14 (35.9)	15 (34.9)	1
Bradycardia (%)	0	0	1

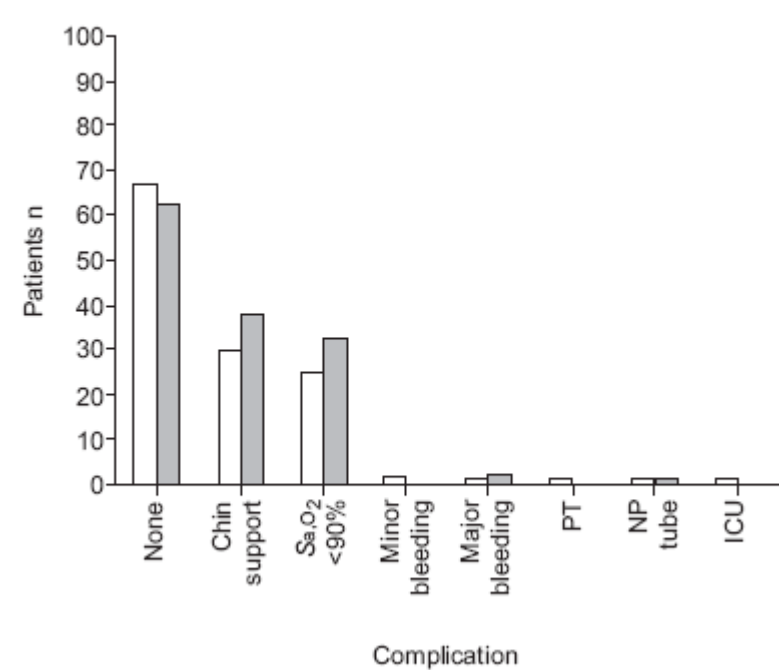
Titrated sedation with propofol or midazolam for flexible bronchoscopy: a randomised trial

G. Clark^{*,#}, M. Licker[¶], A.B. Younossian[#], P.M. Soccia^{#,+}, J-G. Frey^{*}, T. Rochat[#], J. Diaper[¶], P-O. Bridevaux[#] and J-M. Tschopp^{*}

Compared with midazolam, propofol provided a higher quality of sedation in terms of neuropsychometric recovery and patient tolerance. BIS-guided propofol administration represents a safe sedation technique that can be performed by the non-anaesthesiologist.

Propofol *versus* combined sedation in flexible bronchoscopy: a randomised non-inferiority trial

D. Stolz*,[#], G. Kurer*, A. Meyer*, P.N. Chhajed*, E. Pflimlin*, W. Strobel* and M. Tamm*



Propofol is as effective and safe as combined sedation in patients undergoing flexible bronchoscopy, thus representing an appealing option if timely discharge is a priority.

TABLE 1	Baseline characteristics of 200 consecutive patients undergoing flexible bronchoscopy		
	Midazolam/ hydrocodone	Propofol	p-value
Subjects n	100	100	
Age yrs	61.6 (21–87)	61.0 (23–89)	0.895
Male sex	65 (65)	62 (62)	0.659
Height cm	170.6±8.6	171.3±9.5	0.853
Weight kg	76.0±17.1	73.9±16.4	0.323
Current smoker	28 (28)	30 (30)	0.876
Ex-smoker	42 (42)	41 (41)	0.886
Smoking history pack-yrs	31.1±33.2	27.1±27.1	0.396
Comorbid conditions			
Malignancy	35 (35)	33 (33)	0.765
COPD	25 (25)	25 (25)	1.000
Immunosuppression	25 (25)	16 (16)	0.115
Cardiopathy	20 (20)	13 (13)	0.182
Renal failure	4 (4)	5 (5)	0.733
Stroke	3 (3)	3 (3)	1.000
Alcoholism	2 (2)	3 (3)	0.651
Platelets 10 ⁹ g·L ⁻¹	308±169	295±144	0.641
ASA physical status	3 (2–3)	3 (2–3)	0.777
Mallampati score	2 (2–3)	2 (2–3)	0.355

Data are presented as mean±sd, mean (range) for age, median (interquartile range) for ASA physical status and Mallampati score, or n (%), unless otherwise indicated. COPD: chronic obstructive pulmonary disease; ASA: American Society of Anesthesiologists.

Conclusion: propofol (P) versus midazolam (M) in conscious sedation

- P sedation is safe provided adequate training
- It can be performed by non anesthetists
- It provides better patient satisfaction
- It provides shorter stay in hospital with economic benefits
- It should be the first drug of choice in patients undergoing bronchoscopy

Are pulmonologists more afraid of the airways they regularly look into than gastroenterologists?



Intubation using

FF



Fiberoptic bronchoscopic intubation in children:

- An new method
- « this technique should be reserved for well trained physicians with adequalte equipment and experience »

Rucker RW. Chest 1979;76:56

A gastroenterologist database of NAP 1966 - 2007: $n = > 450.000$
- 4 deaths, 3 endotracheal intubations, mask ventilation 322 (.08%!)

883

Non-Anesthesiologist Administered Propofol Sedation for Endoscopic Procedures: A Worldwide Safety Review

Viju P. Deenadayalu, Emely E. Eid, John S. Goff, John A. Walker, Lawrence B. Cohen, Ludwig T. Heuss, Shajan Peter, Christoph Beglinger, James Sinnott, Patrick D. Gerstenberger, Anthony C. Clarke, Harold Munnings, Magdy Z. Rofail, Iyad M. Subei, Rodger A. Sleven, Akira Horiuchi, Kuldip Sandhu, Paul A. Jordan, Douglas K. Rex

Background: Propofol administration for endoscopic procedures by anesthesia specialists is costly. Non-anesthesiologist administered propofol sedation (NAP) is rapidly evolving but is controversial due to concerns about safety, mainly respiratory depression. Our goal was to determine the overall number of endotracheal intubations, neurologic injuries, and deaths and mask ventilations associated with NAP for endoscopic procedures. Methods: We reviewed all published abstracts and papers utilizing NAP for endoscopic procedures. To the best of our knowledge, we also contacted all gastroenterologists performing NAP for endoscopy to participate in our safety review. All contacted gastroenterologists submitted their updated data on safety. To perform our literature search, we queried Ovid Medline (1966-August 2007). The following complications were available in all patients: endotracheal intubations, neurologic injuries, and death. We also investigated whether mask ventilation was more frequent with EGDs versus colonoscopies, when available. Results: A total of 456,918 (213,527 published and 243,391 unpublished) NAP procedures were collected in our database. Endotracheal intubations, neurologic injuries, and deaths were 4, 1, and 3, respectively (data available for all patients). The deaths occurred in a patient with widely metastatic pancreatic cancer, a severely handicapped patient with mental retardation, and a patient with an extensive history of polysubstance abuse. In 2 of the 3 deaths, a decision to withdraw life support was made by the families of the patients. The overall number of cases requiring mask ventilation was 322 out of 400,769 cases with data available. Mask ventilation rates were compared between EGDs and colonoscopies for studies and sites specifying risk by procedure type. Fifty of 123,768 patients and 11 of 97,429 patients required mask ventilation during their EGD or colonoscopy, respectively ($p < 0.001$; chi-square test). In the remaining 261 patients requiring mask ventilation, the type of endoscopic procedure performed was unclear. Conclusions: The administration of propofol by non-anesthesiologists for endoscopic procedures is safe. Mask ventilation was required more frequently with EGDs compared to colonoscopies. NAP is one feasible solution to the high costs associated with anesthesiologist-delivered sedation for endoscopy.

CLINICAL-ALIMENTARY TRACT

Trained Registered Nurses/Endoscopy Teams Can Administer Propofol Safely for Endoscopy

DOUGLAS K. REX,* LUDWIG T. HEUSS,† JOHN A. WALKER,§ and RONG Q||

- n = 36743
- No death, no endotracheal intubation, no permanent injury
- Mask ventilation: 1/500 to 1/1000

centers. Conclusions: Trained nurses and endoscopists can administer propofol safely for endoscopic procedures. Nurse-administered propofol sedation is one potential solution to the high cost associated with anesthetist-delivered sedation for endoscopy.

Safety of Propofol for Conscious Sedation During Endoscopic Procedures in High-Risk Patients—A Prospective, Controlled Study

Ludwig T. Heuss, M.D., M.B.A., Patrizia Schnieper, M.D., Juergen Drewe, M.D., Eric Pflimlin, R.N., and Christoph Beglinger, M.D.

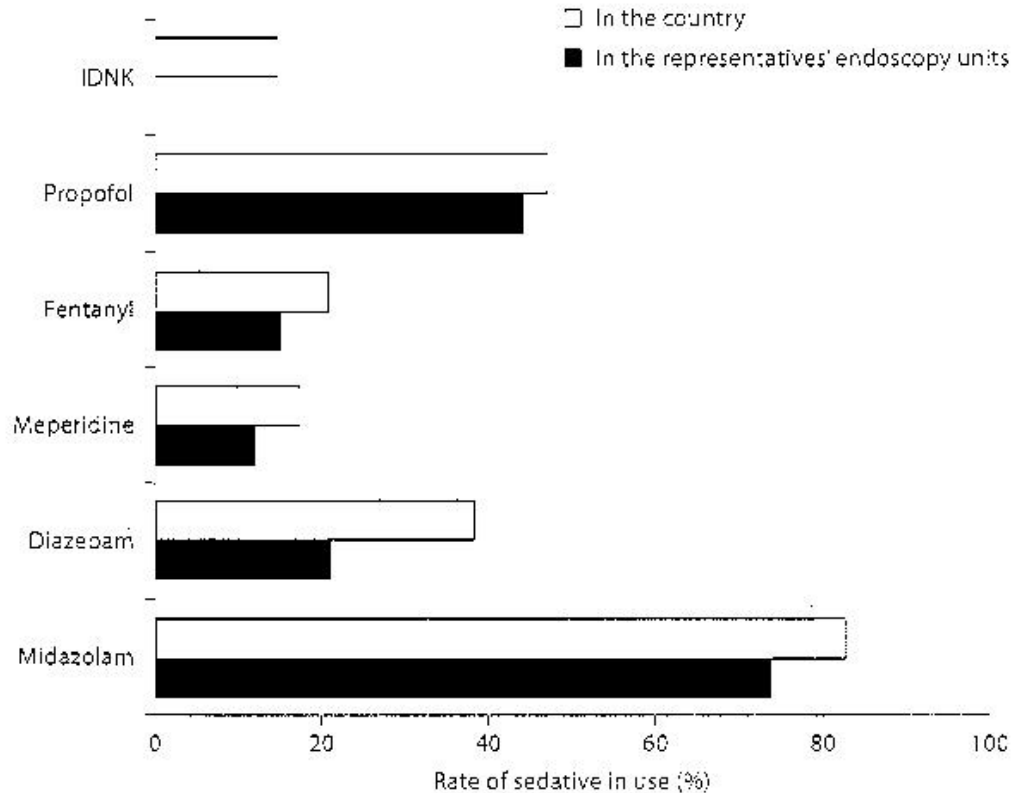
Department of Gastroenterology and Department of Clinical Pharmacology, University Hospital Basel, Basel, Switzerland

- Matched groups: n = 614 (ASA III and IV)
- versus n = 642 (ASA I and II)
- No more major complications
- More SaO₂ < 90% in group 1: 1.7% vs 3.6% (p = .03)

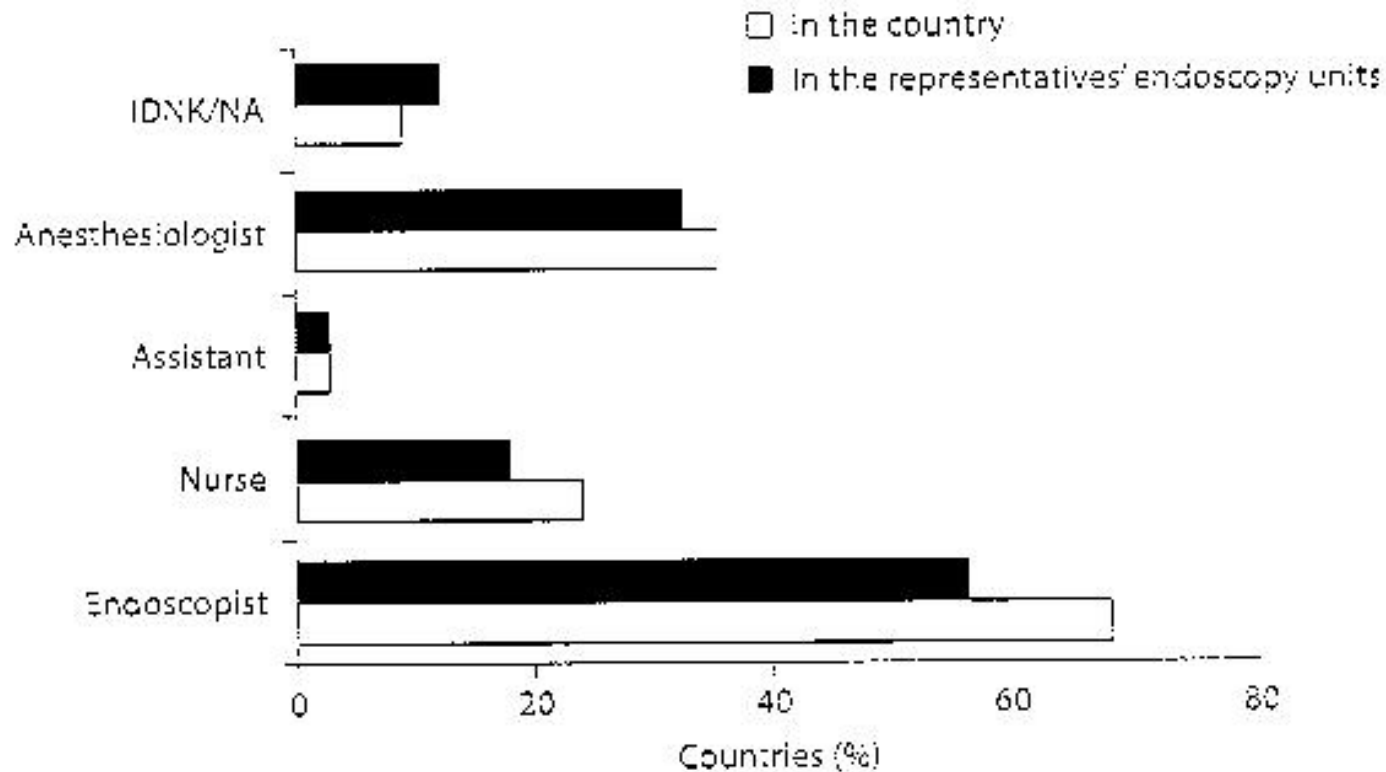
Sedation for endoscopy: the safe use of propofol by GP sedationists

- Audit of 28,472 procedures 1996 -2000 (colonoscopy, gastroscopy): 185 sedation related adverse events (AE; .65%): 107 airway or ventilation problems; 77 hypotensive episodes.
- No difference in all or respiratory related AEs between GP sedationists and anesthetists
- GP encountered a low incidence of AEs with adequate management

European Society of gastrointestinal endoscopy (ESGE): survey



Gastrosocopy: a European survey



Conclusion

- Sedation for thoracoscopy can be simplified provided good training of the team to get familiar using propofol
- General anesthesia ~~is~~ = conscious sedation
- Pulmonologists are able to control the airway of their patients if...
- New avenues in endoscopy

Sedation for endoscopy

Total dosage of propofol in each procedure.

	n= 104	mean mg ± SD [min-max]
FB with EBUS	29	393 ± 194 [160-980]
FB without EBUS	31	157 ± 100 [50-500]
MT for diagnostic pleural effusion	9	144 ± 65 [20-220]
MT with talc pleurodesis in case of MPE	22	138 ± 60 [50-310]
MT for talc pleurodesis in recurrent pneumothorax	13	154 ± 74 [50-300]



Thank you for your attention

TECHNIQUE

- Anesthesia
 - Best accomplished in the operating room
 - May be performed bedside in an ICU setting
 - Continuous monitoring
 - Light anesthesia--allows continued spontaneous breathing
 - May be done with conscious sedation in older individuals