

SEDAZIONE E ANESTESIA NEL BAMBINO

Aldo Mancino

Terapia Intensiva Pediatrica e Trauma Center Pediatrico



SEDAZIONE

Depressione della coscienza farmacologicamente indotta

SEDAZIONE PROCEDURALE

la somministrazione di uno o più agenti farmacologici per facilitare una procedura diagnostica o terapeutica mirando a uno stato durante il quale la pervietà delle vie aeree, la respirazione spontanea, i riflessi protettivi delle vie aeree e la stabilità emodinamica sono preservati, alleviando nel contempo l'ansia e il dolore

DEFINIZIONI





OBIETTIVI

**Mantenere la
sicurezza e il
benessere del
paziente**

**Minimizzare il
dolore fisico e
massimizzare il
comfort del
paziente**

**Controllare l'ansia,
minimizzare il
trauma
psicologico,
massimizzare
l'amnesia**

**Controllare il
movimento per
consentire
l'esecuzione sicura
delle procedure**

**Controllare la
risposta
iperdinamica o
vagale agli
interventi dolorosi**

Psychosocial determinants associated with success in undergoing peripherally inserted central catheter placement without sedation in pediatric patients

Brittany E. Bryant¹ | Andrew Jensen² | Arvind Chandrakantan^{1,2,3} |
Natasha Navejar¹ | Kamlesh Kukreja^{1,4} | Adam C. Adler^{1,2,3}

¹Baylor College of Medicine, Houston, Texas, USA

²Department of Anesthesiology, Baylor College of Medicine, Houston, Texas, USA

³Department of Anesthesiology, Perioperative and Pain Medicine, Texas Children's Hospital, Houston, Texas, USA

⁴Department of Interventional Radiology, Texas Children's Hospital, Houston, Texas, USA

Correspondence

Adam C. Adler, Texas Children's Hospital, Baylor College of Medicine, 6621 Fannin Street, Suite #A3300, Houston TX 77030, USA.
Email: adamc.adler@gmail.com

Funding information

None.

Section Editor: Thomas Engelhardt

1 | INTRODUCTION

Peripherally inserted central catheters (PICC) are commonly used for prolonged intravenous access in children. Select patients can successfully undergo the short and minimally invasive PICC insertion procedure without sedation. Limiting exposure to sedation is particularly beneficial to patients as members of this population often require many anesthetic events due to medical complexity. We performed a retrospective analysis of patients who successfully underwent PICC line placement without sedation to identify the predictive value of preprocedural screening using the modified Psychosocial Risk Assessment in Pediatrics (PRAP) tool.

TABLE 1 Demographic and psychosocial assessment domains by sedation classification for patients 8–18 years of age undergoing PICC placement

	Non-sedated N = 178
Age	
Mean, (SD)	14.6 (2.6)
Median, (IQR)	15 (12–17)
Weight (kg)	
Mean, (SD)	53.8 (20.5)
Median, (IQR)	49.6 (40.1–62.7)
Body Mass Index (kg/m ²) ^a	
Mean (SD)	21.7 (6.5)
Median, (IQR)	19.8 (17.5–24.2)
Respiratory conditions	
Yes	107 (6.0%)
No	71 (40%)
ASA Physical status n (%)	
1	4 (2.2%)
2	33 (18.5%)
3	115 (64.6%)
4	25 (14.0%)
5	1 (0.6%)
Required conversion to sedation	
Yes	0 (0%)
Psychosocial factors	
Anxiety	
Yes	44 (24.7%)
No	134 (75.3%)
Developmental delay/Communication deficit	
Yes	7 (3.9%)
No	171 (96.1%)
Special needs	
Yes	9 (5.1%)
No	169 (94.9%)
Baseline temperament	
Yes	9 (5.1%)
No	169 (94.9%)
Caregiver stress	
Yes	0 (0%)
No	178 (100%)
Number of psychosocial factors present	
Mean, (SD)	0.4 (0.7)
Median, (IQR) (range)	0 (0, 1) (0–4)

Abbreviations: ASA, American Society of Anesthesiologists; IQR, interquartile range.

^aBody mass index, n = 177 patients, one patient height missing.

RESEARCH REPORT

The influence of parents' voice on the consumption of propofol for pediatric procedural sedation—a randomized controlled trial

Eva Tschiedel, Victoria Heck, Ursula Felderhoff-Mueser & Christian Dohna-Schwake

Department of Pediatrics 1, University Hospital Essen, Essen, Germany

What is already known

- Parents' presence during invasive procedures in children reduces parents' anxiety.

What this article adds

- In children undergoing deep sedation for medical procedures listening to a parental voice is safe but does not affect the sedative dose or the latency until eye opening.

Summary

Background: In pediatric patients, invasive procedures such as the insertion of a central venous catheter or gastroscopy require deep sedation. It is unknown whether listening to parental voice during deep sedation in children can reduce sedative doses.

Aim: The aim of this prospective study was to determine the effect of listening to a parent's voice during deep sedation on consumption of sedatives in children.

Methods: Fifty children aged 2–14 years undergoing central line placement or gastroscopy under deep sedation with propofol were randomly assigned to two groups: (A) listening or (B) not listening their parents' recorded voice reading a standardized text by the use of earphones. Depth of sedation was monitored by Comfort Score and by Bispectral Index.

Results: Mean sedative dose of propofol in both groups was equal (A 0.25 mg·kg⁻¹·min⁻¹; B 0.28 mg·kg⁻¹·min⁻¹; Δ -0.03 mg·kg⁻¹·min⁻¹ (CI 95% -0.08 to 0.01); $P = 0.089$). Furthermore, complication rate ($P = 1.0$) and recovery time (A 14.5 min; B 16.1 min; $\Delta = -1.6$ min (CI 95% -6.98 to 3.81); $P = 0.60$) did not differ between the intervention and the control group.

Conclusion: Listening to parental voice during deep sedation does not result in a reduction of sedative dose in children undergoing short medical procedures.



Tipo di procedura

Durata della procedura

Farmaci

Parte del corpo
coinvolta

Grado di immobilità
richiesta

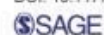
Development of a Pediatric PICC Team Under an Existing Sedation Service: A 5-Year Experience

Shane C Rainey^{1,2}, Girish Deshpande¹, Haley Boehm³, Kim Camp³, Annette Fehr³, Kimberly Horack³ and Keith Hanson¹

¹Department of Pediatrics, University of Illinois College of Medicine, Peoria, IL, USA.

²Department of Child Health, University of Arizona College of Medicine – Phoenix, Phoenix, AZ, USA. ³OSF Healthcare Children's Hospital of Illinois, Peoria, IL, USA.

Clinical Medicine Insights: Pediatrics
Volume 13: 1–5
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DOI: 10.1177/1179556519884040



ABSTRACT

OBJECTIVE: To examine our institutional experiences with ultrasound-guided peripherally inserted central catheter (US-PICC) placement by a dedicated US-PICC team under the umbrella of an existing pediatric sedation service.

METHODS: Retrospective review of quality data examining 968 US-PICC encounters over a 5-year period from 2012 to 2016. Data for each encounter included line indications, success rate, dwelling time, need for sedation, and incidence of complications including venous thrombosis, infection, and accidental removal.

RESULTS: US-PICC lines were successfully placed in 89% of patients with an average age of 5.4 years. Extended antibiotic treatment was

CONCLUSION: Results suggest that our endeavor of creating a dedicated US-PICC team under an existing pediatric sedation service is successful with regard to the number of lines placed, success rates, and incidence of complications. This approach may be beneficial to other institutions seeing to maximize resource utilization and streamline patient care.

KEYWORDS: Instrumentation, quality improvement, utilization, organization and administration

Table 1. Information on ultrasound-guided PICC placement location, sedation needs, timing of placement, and reasons for the procedure not being completed.

Sedation needs and location (N=961)	
Sedation team	319 (33%)
No sedation	202 (21%)
Operating room	27 (3%)
In PICU	400 (42%)
In NICU	13 (1%)
PICC placed within 24 hours of order? (N=946)	
Yes	824 (87%)
No	122 (13%)
Reason for delay in placement (N=95)	
Reattempt required	7 (7%)
Full schedule	31 (33%)

Reason for aborted procedure (N=101)	
Patient's clinical status	4 (4%)
Unable to access vessel	41 (41%)
Unable to thread wire	56 (55%)



SEDATION ROOM

Comparison between sedation room and operating room in central venous catheter positioning in children

Antonio Chiaretti¹, Mauro Pittiruti² , Giovanni Sassudelli¹,
Giorgio Conti³, Marco Rossi⁴, Silvia Maria Pulitano³,
Aldo Mancino³, Angela Pusateri⁴, Antonio Gatto¹ 
and Federica Tosi⁴

Abstract

Background: Placement of central venous access devices is a clinical procedure associated with some risk of adverse events and with a relevant cost. Careful choice of the device, appropriate insertion technique, and proper management of the device are well-known strategies commonly adopted to achieve an optimal clinical result. However, the environment where the procedure takes place may have an impact on the overall outcome in terms of safety and cost-effectiveness.

Methods: We carried out a retrospective analysis on pediatric patients scheduled for a major neurosurgical operation, who required a central venous access device in the perioperative period. We divided the patients in two groups: in group A the central venous access device was inserted in the operating room, while in group B the central venous access device was inserted in the sedation room of our Pediatric Intensive Care Unit. We compared the two groups in terms of safety and cost-effectiveness.

Results: We analyzed 47 central venous access devices in 42 children. There were no insertion-related complications. Only one catheter-related bloodstream infection was recorded, in group A. However, the costs related to central venous access device insertion were quite different: €330–€540 in group A versus €105–€135 in group B.

Conclusion: In the pediatric patient candidate to a major neurosurgical operation, preoperative insertion of the central venous access device in the sedation room rather than in the operating room is less expensive and equally safe.

ABSTRACT

Purpose: To compare the direct bundled costs of interventional radiology (IR) suite versus bedside placement of noncuffed central venous catheters in infants.

Methods: A single-center retrospective review was performed of all noncuffed upper extremity (peripherally inserted central venous catheter [PICC]) and tunneled femoral (tunneled femoral central venous catheter [TCVC]) catheters placed in infants between January 1, 2018, and December 31, 2018. Propensity score matching was performed adjusting for age, birth weight, procedure weight, and catheter days. Process maps for each procedure were created based on location and sedation type. Technical success and complications were recorded for each placement. The total direct bundled cost for each catheter placement was calculated by summing the procedure and complication costs.

Results: A total of 142 procedures were performed on 126 matched patients with a technical success of 96% at the bedside and 100% in the IR suite ($P = .08$). The complication rates did not significantly differ between the 2 groups ($P = .51$). The total direct bundled costs for catheter placement were $\$1421.3 \pm 2213.2$ at the bedside and $\$2256.8 \pm 3264.7$ in the IR suite ($P = .001$).

Conclusions: The bundled cost of bedside femoral catheter placement is significantly less than that of fluoroscopic TCVC and PICC placement performed in the IR suite, mainly related to differences in sedation costs.

CLINICAL STUDY

Time-Driven Cost Analysis of Noncuffed Venous Catheter Placement in Infants: Bedside versus IR Suite

Joseph Reis, MD, Kevin S.H. Koo, MD, Giri M. Shivaram, MD, Dennis W. Shaw, MD, Eric J. Monroe, MD, and Ramesh S. Iyer, MD

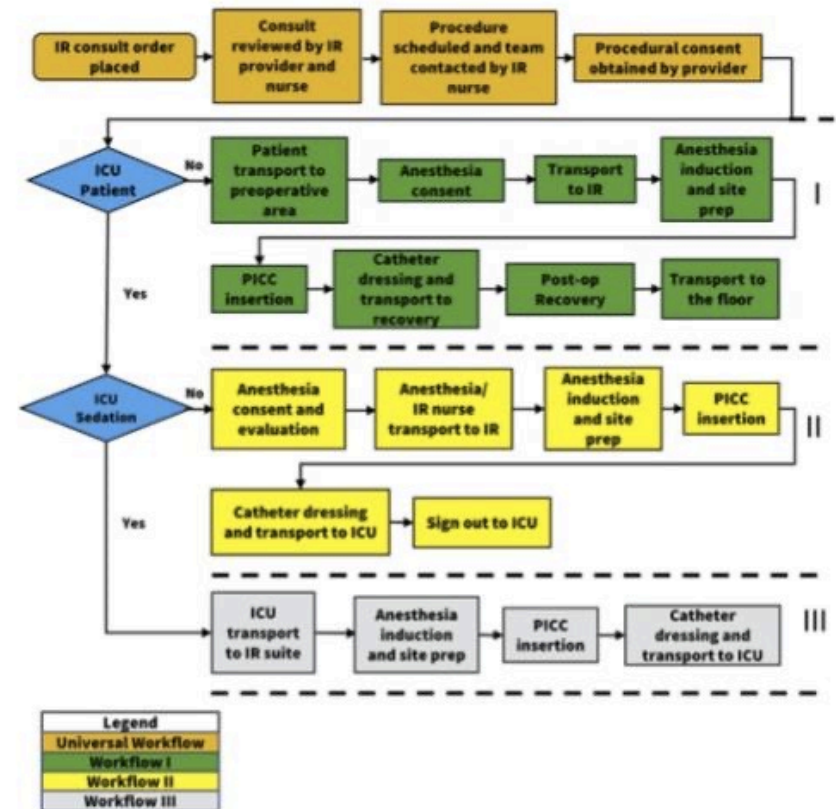


Figure 2. Peripherally inserted central venous catheter and tunneled femoral central venous catheter process map categorized by patient location and sedation type. ICU = intensive care unit.

CONTROINDICAZIONI E PRECAUZIONI

Nessuna controindicazione assoluta

Le controindicazioni relative alla sedazione procedurale includono vie aeree difficili o comorbidità mediche significative

Un'anamnesi di apnee notturne gravi o un'anomalia delle vie aeree richiede un'attenta considerazione quando si pianifica una sedazione

Le vere reazioni allergiche ai farmaci di sedazione comunemente usati sono rare

Mortalità 1:20000 – rischio analogo ad anestesia generale -

Human factors in pediatric anesthesia incidents

R. MARCUS MA MB BChir FRCA

Department of Anaesthesia, Birmingham Children's Hospital, Birmingham, UK

Table 2

Classification of the 668 reported events from 28 023 pediatric anesthetics

Event classification	Number (% of all incidents)
Airway/respiratory	349 (52.2)
Cardiovascular	98 (14.7)
Equipment	87 (13.0) ^a
Organization	50 (7.5)
Procedure complication	38 (5.7)
Pharmacological	28 (4.2)
Other	18 (2.7)

^aSixty-two of the 87 equipment problems were because of anesthetic equipment (9.3% of all incidents).

Summary

Background: Anesthesia and the operating theater environment is a complex system involving man-machine and human-human interactions. Although we strive for an error free system, we are humans and errors and mistakes will occur. The aim of this study was to investigate the human factors behind events and incidents in pediatric anesthesia at our institution.

Methods: This study consisted of a retrospective review and analysis of all contemporaneously reported anesthetic incidents between April 1, 2002 and March 31, 2004 at Birmingham Children's Hospital. Where there were anesthetic human factors involved in the event these were classified.

Results: There were 668 incidents reported, giving a rate of 2.4% of the 28 023 anesthetics recorded. Airway and respiratory incidents were the most common representing 52.2% of all incidents. A total of 284 anesthetic human factors could be identified and classified. Of these the most common were errors in judgment 43%, failure to check 17.8%, technical failures of skill 9.2%, inexperience 7.7%, inattention/distracted 5.6% and communication issues 5.6%.

Conclusions: In our institution anesthetic human factors occur in 42.5% of in-theater incidents in pediatric anesthesia. Knowledge of these is necessary so that changes can be made in practice both by individuals and departments of anesthesia, to make anesthesia as safe as possible.

Human factor	Number (%)	Sub-type	Number
Error of judgment	122 (43.0)	Inadequate depth of anesthesia	38 (13.4)
		Inadvisable anesthetic technique	26 (9.2)
		Anesthetizing child with URTI	24 (8.5)
		Trachea extubated at wrong time	22 (7.7)
		Other error of judgment	12 (4.2)
Failure to check	50 (17.6)	Equipment	24 (8.5)
		Tracheal tube	16 (5.6)
		Intravenous/arterial line	8 (2.8)
		Other failure to check	2 (0.7)
Technical failure of skill	26 (9.2)	Central venous access	15 (5.3)
		Local block/epidural	6 (2.1)
		Airway	5 (1.8)
Inexperience	22 (7.7)		
Inattention/distracted	16 (5.6)		
Communication	16 (5.6)		
Poor preoperative preparation/assessment	10 (3.5)		
Lack of care	7 (2.5)		
Drug dosage slip	5 (1.8)		
Teaching	4 (1.4)		
Pressure to do case	3 (1.1)		
Other	3 (1.1)		

PREPARAZIONE

Storia di infezioni del tratto respiratorio inferiore nelle ultime due settimane

Malattie mediche importanti, specialmente quelle che interessano il sistema respiratorio, cardiovascolare e neurologico

Storia di russamento o apnea centrale o ostruttiva del sonno

Storia di precedenti sedazioni o anestesie generali, comprese eventuali complicazioni precedenti

Storia di prematurità

Storia familiare di reazioni avverse alla sedazione, all'analgesia o all'anestesia generale

Stato di gravidanza, se applicabile

Allergie a farmaci o alimenti

Farmaci in uso, compresi i preparati su prescrizione, da banco e a base di erbe

Recente uso di droghe illecite

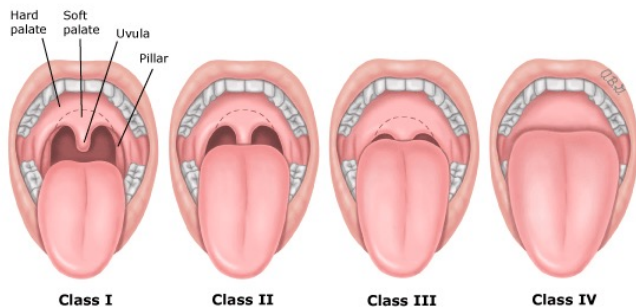
Revisione dei sistemi di valutazione della funzionalità cardiaca, polmonare, renale, intestinale ed epatica

VALUTAZIONE DELLE VIE AEREE

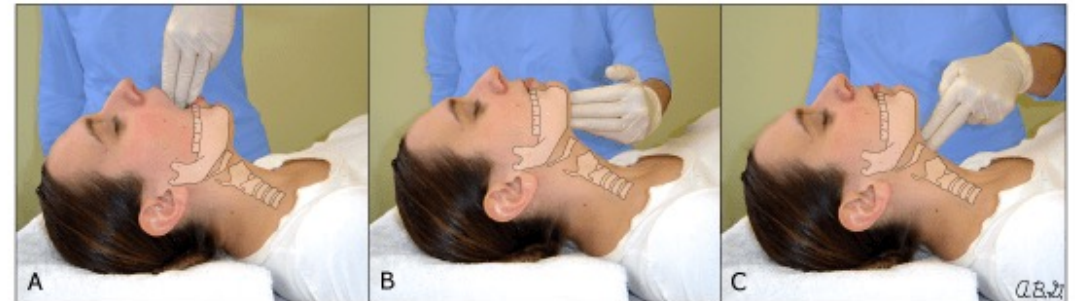
Look
Evaluate
Mallampati
Obstruction
Neck mobility



The modified Mallampati classification for difficult laryngoscopy and intubation



The 3-3-2 rule for identifying a difficult airway



DIGIUNO

DIGIUNO PREOPERATORIO

Liquidi chiari	2 ore
Latte Materno	4 ore
Latte vaccino	6 ore
Latte in formula	4 ore < 3 mesi 6 ore >3 mesi
Pasto	6 ore

NE sospensione di lipidi e aminoacidi 2 ore prima
Glu 5% continuarla sino all'intervento

Fasting guidelines of international anesthesia societies

Country, year	Fasting requirements at time of induction	Comments
American Society of Anesthesiologists, 2017 ^[1]	2 hours clear liquids, excluding alcohol 4 hours breast milk 6 hours nonhuman milk, formula, light meal 8 hours or more for fatty meal, fried food, meat	- Healthy patients, not in labor, elective surgery - Light meal defined as toast or cereal with clear liquid
European Society of Anesthesiology ^[2]	2 hours clear liquids 4 hours breast milk 6 hours milk, formula, solid food - Chewing gum and sucking hard candy allowed up until induction	Encourage oral fluid up to 2 hours
Australian and New Zealand College of Anaesthetists ^[3]	1 hour clear fluid (≤ 3 mL/kg/hour) for infants and children 2 hours clear liquids adults 3 hours breast milk for infants <6 months 4 hours formula for infants <6 months 6 hours breast milk, formula, limited solid food for children >6 months and adults	Up to 400 mL of clear liquid up to 2 hours prior to induction for adults is likely safe
Association of Anaesthetists in Great Britain and Ireland ^[4]	2 hours clear liquids 4 hours breast milk 6 hours solid food, formula, and cow's milk	Gum chewing treated as clear
Canadian Anesthesiologists' Society ^[5]	2 hours clear liquids 4 hours breast milk 6 hours light meal, infant formula, or nonhuman milk 8 hours meat, fried or fatty food	
Scandinavian Society of Anaesthesiology and Intensive Care Medicine ^[6]	2 hours clear liquids 4 hours breast milk and infant formula 6 hours solid food and cow's milk 2 hours chewing gum and any tobacco product - Up to 1 hour prior to induction, 150 mL of water	2 hours for preoperative carbohydrate drinks intended for preoperative nutrition
German Society of Anesthesiology and Intensive Care ^[7]	2 hours clear liquids 4 hours breast milk and infant formula 6 hours meal	
Pediatric societies		
Joint statement from Association of Paediatric Anaesthetists of Great Britain and Ireland, European Society for Paediatric Anaesthesiology, L'Association Des Anesthésistes-Réanimateurs Pédiatriques d'Expression Française ^[8]	1 hour clear liquids for children up to 16 years of age	Encourage intake of clear liquids
Canadian Pediatric Anesthesia Society ^[9]	1 hour clear liquids for children	Encourage intake of clear liquids
The Society for Paediatric Anaesthesia of New Zealand and Australia ^[10]	1 hour clear liquids for children	Encourage intake of clear liquids

GERD: gastroesophageal reflux disease.

Autism:

GUIDELINES

Pre-operative fasting in children

A guideline from the European Society of Anaesthesiology and Intensive Care

6-4-3-0

SUMMARY OF RECOMMENDATIONS (R) AND SUGGESTIONS (S)

R1	Prolonged fasting time should be avoided in all children, whenever possible.	1C
R2	We recommend that healthy children are encouraged to drink clear fluids (including water with or without sugar, pulp-free juice and milk-free tea or coffee) up to 1 h before anaesthesia induction for elective procedures.	1C
S3	Avoid prolonged fasting, as it may be associated with ketone body accumulation.	2C
S4	Avoid prolonged pre-operative fasting, as it may be associated with lower SBP during anaesthesia.	2C
S5	There is conflicting evidence of reduced incidence of hunger, thirst or discomfort with more liberal fasting regimens.	2B
S6	There is conflicting evidence regarding gastric content volume if pre-operative clear fluid fasting is reduced to less than 2 h.	2B
R7	We recommend pre-operative fasting regimens with less than 2 h of clear fluid fasting, as they provide reduced real-world fasting times.	1B
R8	For infants, breast milk feeding should be encouraged until 3 h before anaesthesia induction.	1C
R9	Fortified breast milk does not delay gastric emptying in a clinically significant manner compared with breast milk and can therefore be encouraged for infants until 3 h before anaesthesia induction	1B
S10	For infants, formula (or nonhuman) milk may be encouraged until 4 h before anaesthesia induction.	2B
R11	Solid food should be allowed until 6 h before anaesthesia induction.	1C
S12	A light breakfast of solids or nonclear fluids may be allowed up to 4 h prior to anaesthesia induction.	2C
S13	The presence of gastro-oesophageal reflux disease per se does not necessitate fasting instructions different from those for healthy children.	2B
S14	Gastric emptying in preterm infants may be slightly prolonged compared with term infants, but the clinical significance of this is unclear within this guideline's recommendations R8-S10.	2C

Basic monitoring during anesthesia

Primary physiologic process/parameter targeted	Monitoring equipment	Principle	Derived information	Additional function	
Oxygenation	Inspired gas O ₂ content	O ₂ analyzer (with a low-limit alarm in use)	Paramagnetic sensor, fuel (galvanic) cell, polarographic (Clark) electrode, mass spectroscopy, or Raman scattering	Inspired/expired O ₂ concentration when placed downstream from fresh flow control valves	A low-level alarm is automatically activated by turning on the anesthesia machine
	Blood oxygenation	Pulse oximeter	The Beer-Lambert law applied to tissues and pulsatile blood flow. The relative absorbcency at wavelengths of 660 and 940 nm is used to estimate saturation, which is derived from the ratio of oxyhemoglobin to the sum of oxyhemoglobin plus deoxyhemoglobin.	Hemoglobin saturation, pulse rate, relative pulse amplitude displayed on plethysmography waveform	Continuous evaluation of circulation, variable pitch pulse tone, and audible low-threshold alarm
Ventilation	Exhaled CO ₂	Capnograph	CO ₂ molecules absorb infrared radiation at 4.26 micrometers, proportionate to the CO ₂ concentration present in the breath sample	ETCO ₂ , inspired CO ₂ , diagnostic waveforms, respiratory rate, apnea detection	Instantaneous information about: - Perfusion (how effectively CO₂ is being transported through the vascular system) - Metabolism (how effectively CO₂ is being produced by cellular metabolism) - Confirmation of tracheal tube placement after intubation
	Integrity of ventilation system during mechanical ventilation	Disconnection alarm	Detects the cyclical changes in airway pressure in the normal range	Alarms if a significant decrease in rate or pressure occurs	Alarms if high pressures are sensed
	Pulmonary mechanics (volume, flow, pressure)	Pulmonary flow and pressure sensors	Volume of gas proportional to a drum movement, changes in differential pressure (near the Y-connector) or in electrical resistance (hot wire housed in a monitor or ventilator)	Inspired and expired volume, flow, and airway pressure	Pressure volume and flow volume loops
Circulation	Cardiac activity	ECG	The ECG monitor detects, amplifies, displays, and records the ECG signal.	Heart rate and rhythm	ST segment depression/elevation and trend over time, with an audible alarm warning of significant arrhythmias or asystole
	Arterial BP	Noninvasive BP monitor	Oscillometric devices automatically inflate and deflate the cuff, and have electronic pressure sensors that record the pressure oscillations of the arteries. The pressure at which maximal oscillations occur as the cuff is deflated corresponds with MAP. Proprietary algorithms are used to calculate systolic and diastolic BP.	Arterial BP	Indicator of organ perfusion
Temperature		Temperature monitor	Devices with a semiconductor, electrical resistance decreases as temperature decreases	Core or peripheral temperature	A greater than 2°C core-to-periphery temperature gradient is indicative of low cardiac output.

O₂: oxygen; CO₂: carbon dioxide; ETCO₂: end-tidal carbon dioxide; ECG: electrocardiogram; BP: blood pressure; MAP: mean arterial pressure.

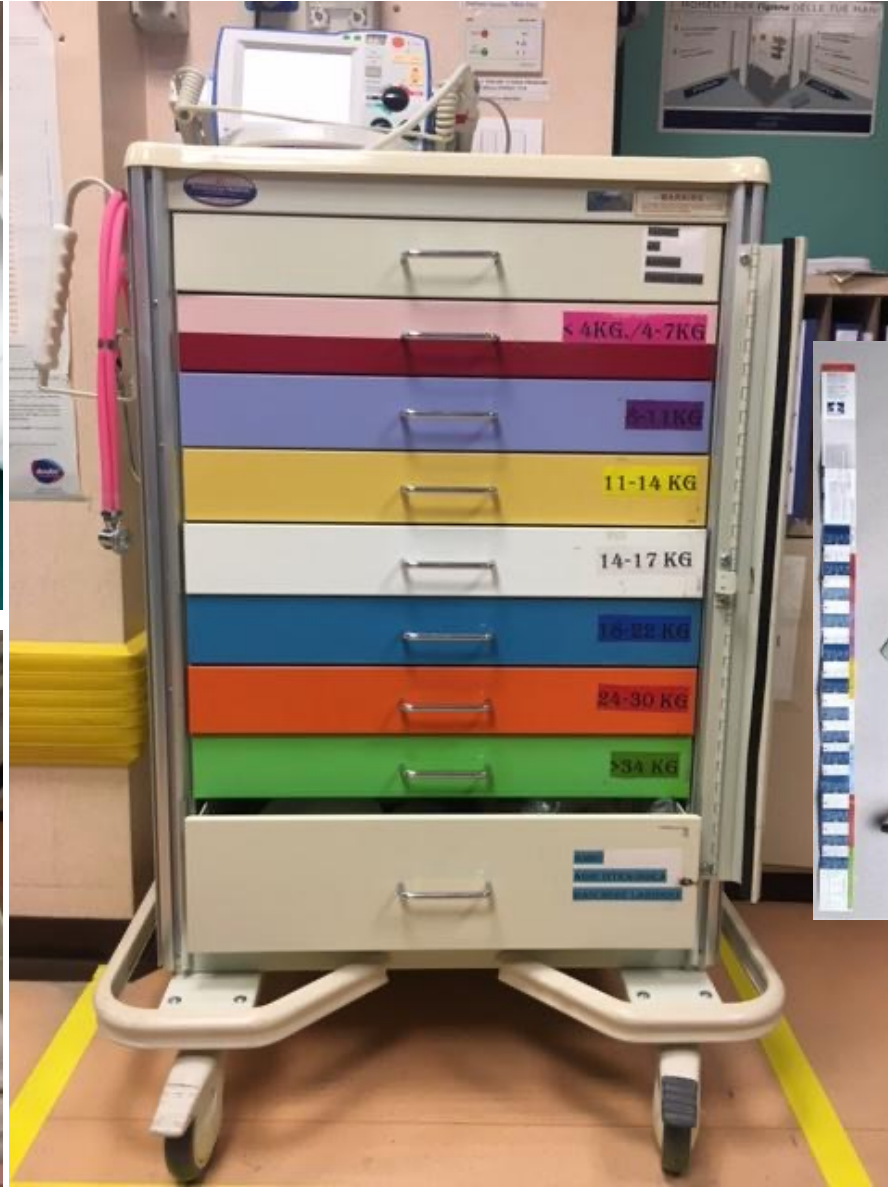


MONITORAGGIO

DISPOSITIVI

- Ossigeno
- Sistema di maschera e pallone per la ventilazione a pressione positiva
- Laringoscopio con lame e tubi endotracheali di dimensioni adeguate e dispositivi appropriati per le vie aeree di soccorso
- Cateteri e apparecchi di aspirazione
- Carrello d'emergenza con farmaci appropriati
- Defibrillatore





POSIZIONE



POSIZIONE

Glabella – Chin Plane
HORIZONTALLY ALIGNED

1

Neck

WIDE AND OPEN

2

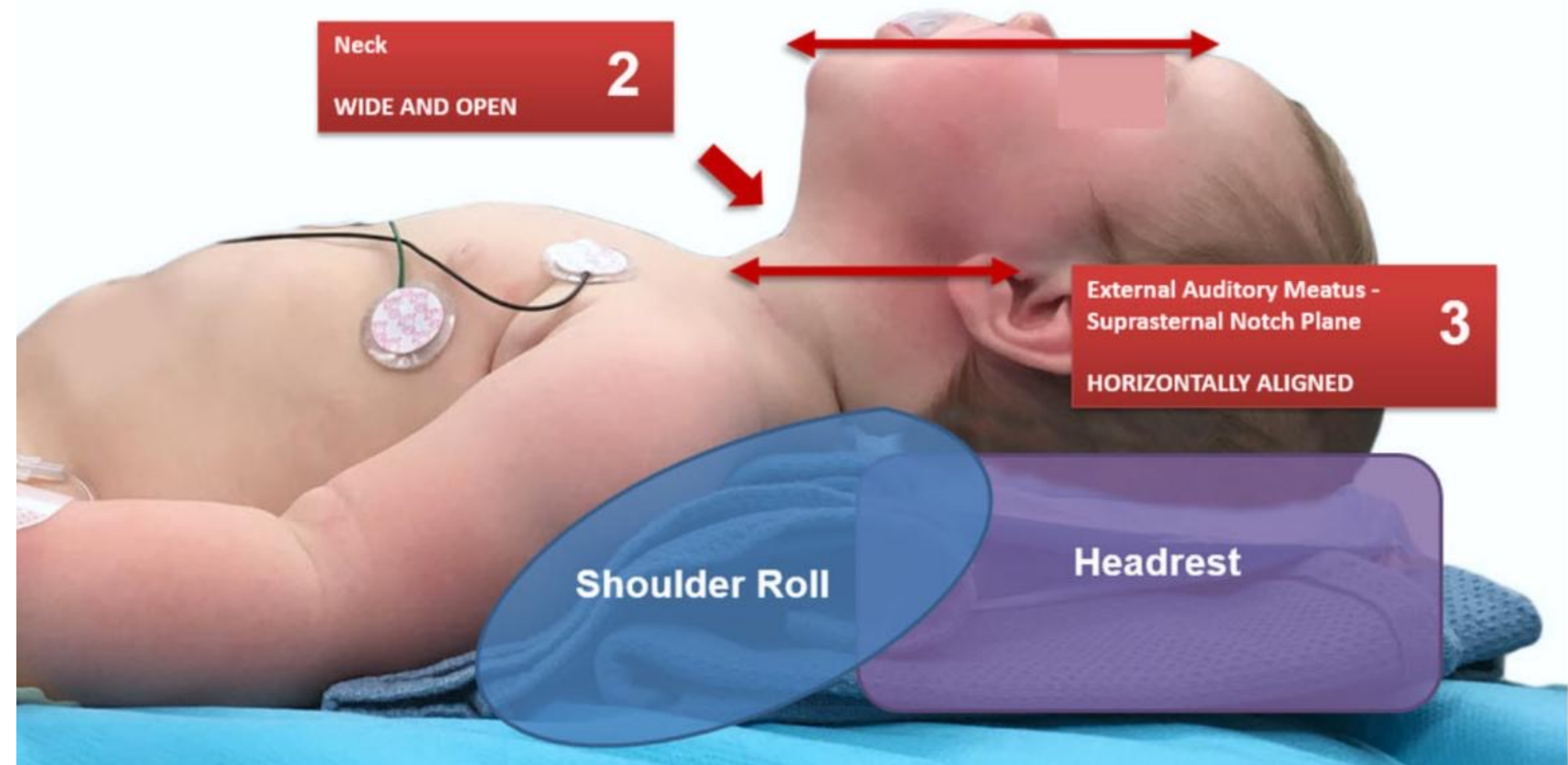
External Auditory Meatus -
Suprasternal Notch Plane

HORIZONTALLY ALIGNED

3

Shoulder Roll

Headrest



POSIZIONE

Anterior Neck Space
Wide open



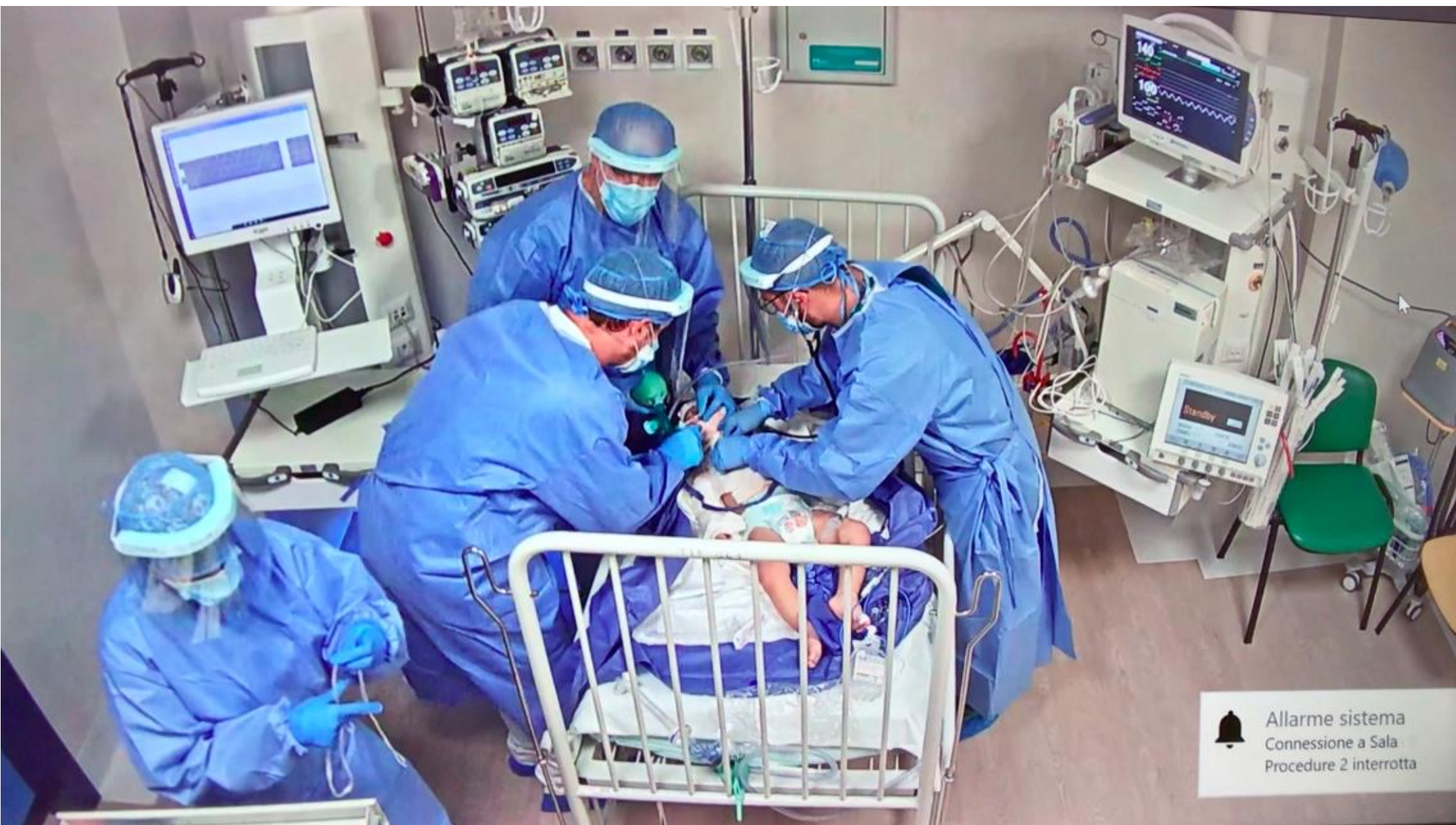
**External Auditory Meatus –
Suprasternal Notch Plane**
Very tilted and not horizontally aligned



Glabella - Chin Plane
Very tilted – “too much extension”







Allarme sistema
Connessione a Sala
Procedure 2 interrotta

**REQUISITI
DI UNA
BUONA
SEDAZIONE**

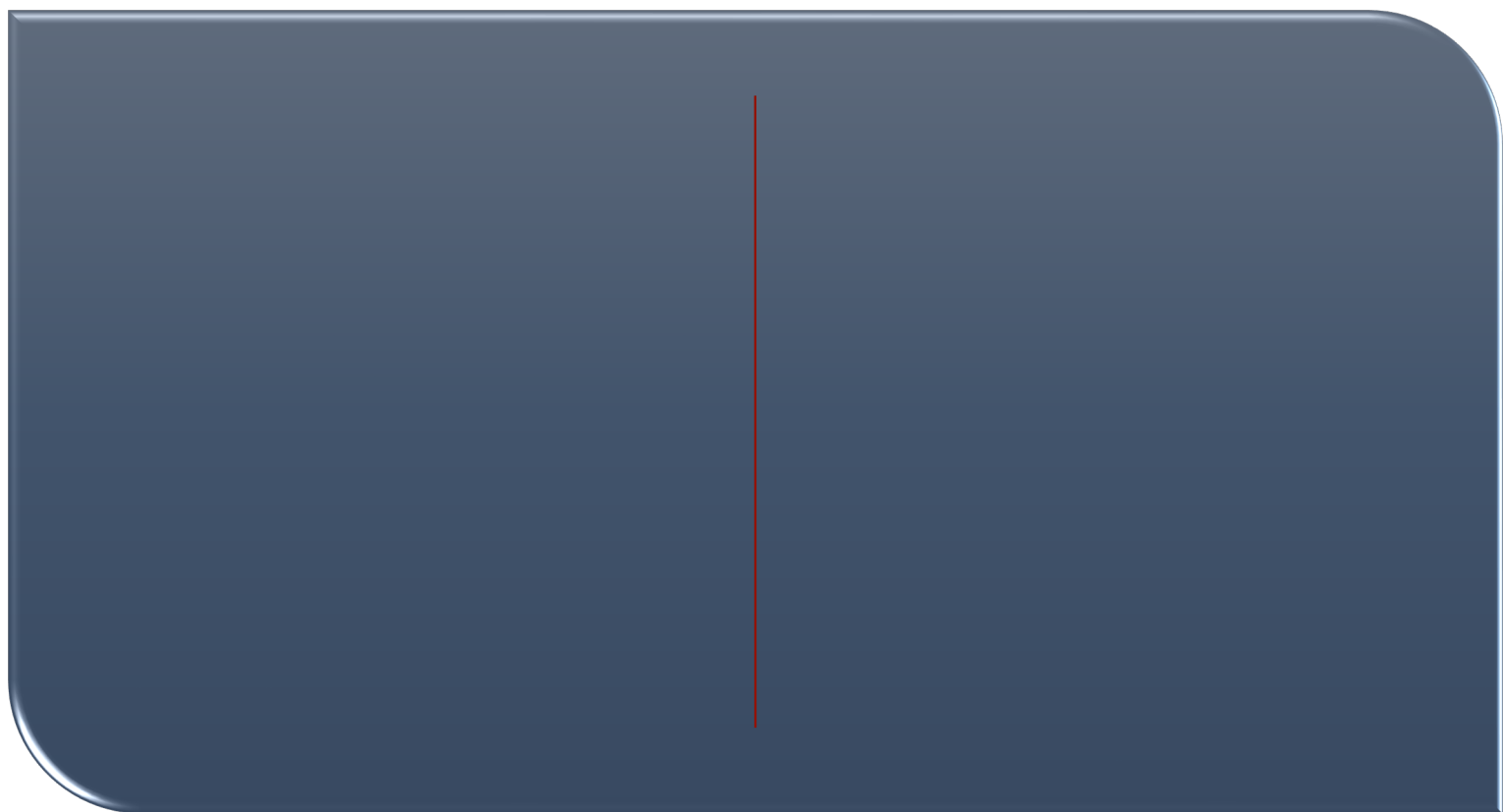
Sicurezza

Comfort del paziente

Immobilità

Rapido recupero

Analgesia



ANESTETICO IDEALE

RAPIDA AZIONE E RISOLUZIONE

SICURO

NO ACCUMULO

FACILE DA TITOLARE

NO TACHIFILASSI

NO DIPENDENZA E SINDROME DI ASTINENZA

NO INSTABILITÀ EMODINAMICA

ECONOMICO

AUTORIZZATO IN ETÀ PEDIATRICA



COMBINAZIONE TRA DIVERSE CLASSI DI FARMACI

SEDATIVI

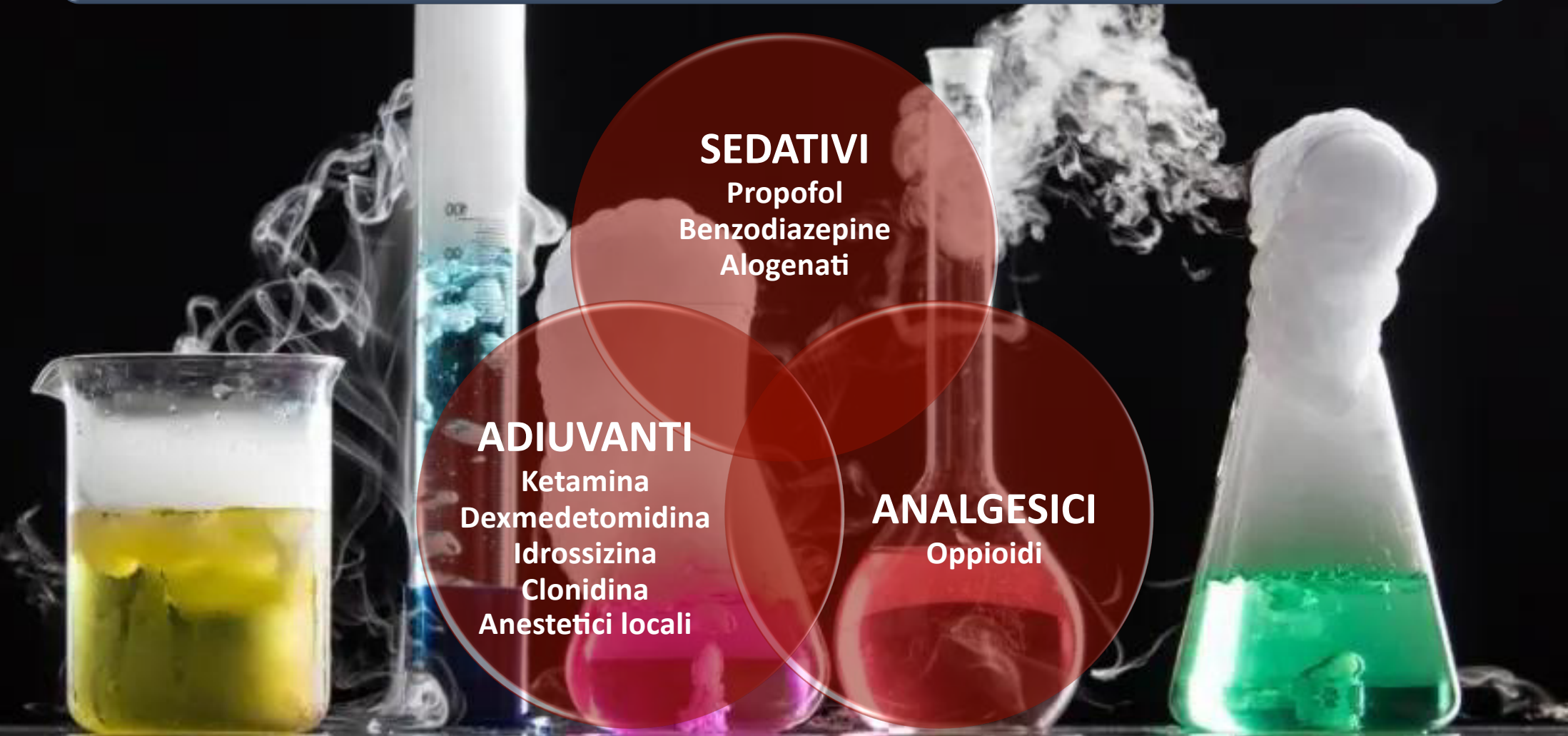
Propofol
Benzodiazepine
Alogenati

ADIUVANTI

Ketamina
Dexmedetomidina
Idrossizina
Clonidina
Anestetici locali

ANALGESICI

Oppioidi





INDUZIONE INALATORIA VS ENDOVENOSA

- INALATORIA più comune nei bambini piccoli.
 - AGENTI INALATORI:
 - SEVOFLORANE
 - DESFLORANE
 - PROTOSSIDO D'AZOTO
- ENDOVENOSA consente di somministrare farmaci con un effetto rapido, può essere preferita per i pazienti con le seguenti condizioni:
 - Obesità
 - Alto rischio di aspirazione (es. stenosi pilorica, acalasia, gastroparesi, recente assunzione di cibo per via orale, scarsa gestione delle secrezioni orali, nausea e vomito recenti, fratture di ossa lunghe)
 - Necessità di precauzioni per l'ipertermia maligna

PROTOCOLLO SEDATION ROOM



PREMEDICAZIONE

A group of six people, including five medical professionals and a young child, are posed together in what appears to be an operating room. The medical professionals are wearing green surgical scrubs and blue bouffant caps. One man in the foreground is wearing a white surgical mask and black-rimmed glasses. The child, a young boy with brown hair, is wearing a white hospital gown with a blue pattern. They are all smiling at the camera. In the background, there are medical monitors and equipment.

L'ansia durante l'induzione può essere associata a cambiamenti comportamentali post-procedura, tra cui incubi, ansia da separazione e aggressività verso l'autorità.



PREMEDICAZIONE

Riduce l'ansia

Migliora la compliance all'induzione

Può fornire amnesia per l'induzione

Può ridurre i cambiamenti comportamentali negativi post-operatori durante la prima settimana post-operatoria

E più efficace della presenza di genitori o dei tutori all'induzione o dei programmi di insegnamento preoperatori.

FARMACO	DOSAGGIO	MECCANISMO D'AZIONE	EFFETTO ANESTETICO
Midazolam	os: 0.5–1.0 mg/kg e.v.: 0.05–0.15 mg/kg i.n: 0.1–0.2 mg/kg i.m.: 0.1–0.2 mg/kg Rettale: 0.5–1.0 mg/kg	GABA agonista	Sedazione
Ketamina	os: 3–6 mg/kg e.v: 1–2 mg/kg i.m: 2–10 mg/kg Rettale: 5–10 mg/kg	Antagonista recettori NMDA	Amnesia dissociativa e analgesia
Propofol	e.v.: 1.5–2.5 mg/kg	Modulatore recettori GABA-A	Sedazione-> An.generale
Remifentanil	e.v.:0,025-0,1 mcg/kg/min	Agonista recettore μ degli oppioidi.	Analgesia
Dexmedetomidina	Bolo: 0.5–1.0 mcg/kg in 10 min Mantenimento: 0.2–0.6 mcg/kg/h i.m./intranasale: 1-4 mcg/kg	α 2-agonista	Sedazione, analgesia, ansiolisi, effetto simpaticolitico

COMPLICANZE #1

Embolia gassosa

European Review for Medical and Pharmacological Sciences

2018; 22: 7916-7919

Spontaneous pulmonary air embolism in a child undergoing procedural deep sedation: case report and review of the literature

F. TOSI¹, A. CHIARETTI², D. BUONSENSO², S. MENSÌ¹, O. GENOVESE¹,
M. PITTIRUTI³, G. CONTI¹

¹Department of Anesthesiology and Intensive Care, Fondazione Policlinico Universitario A. Gemelli – IRCCS, Università Cattolica del Sacro Cuore, Rome, Italy

²Department of Pediatrics, Fondazione Policlinico Universitario “A. Gemelli” – IRCCS, Università Cattolica del Sacro Cuore, Rome, Italy

³Department of Emergency Surgery, Fondazione Policlinico Universitario A. Gemelli – IRCCS, Università Cattolica del Sacro Cuore, Rome, Italy

LETTERS TO THE EDITOR

DOI: <https://doi.org/10.5114/ait.2019.89225>

Be on the alert again for the risk of pulmonary air embolisation in paediatric patients during the insertion of a central venous catheter under general anaesthesia with spontaneous respiration

Tomohiro Yamamoto, Yusuke Mitsuma, Hiroshi Baba

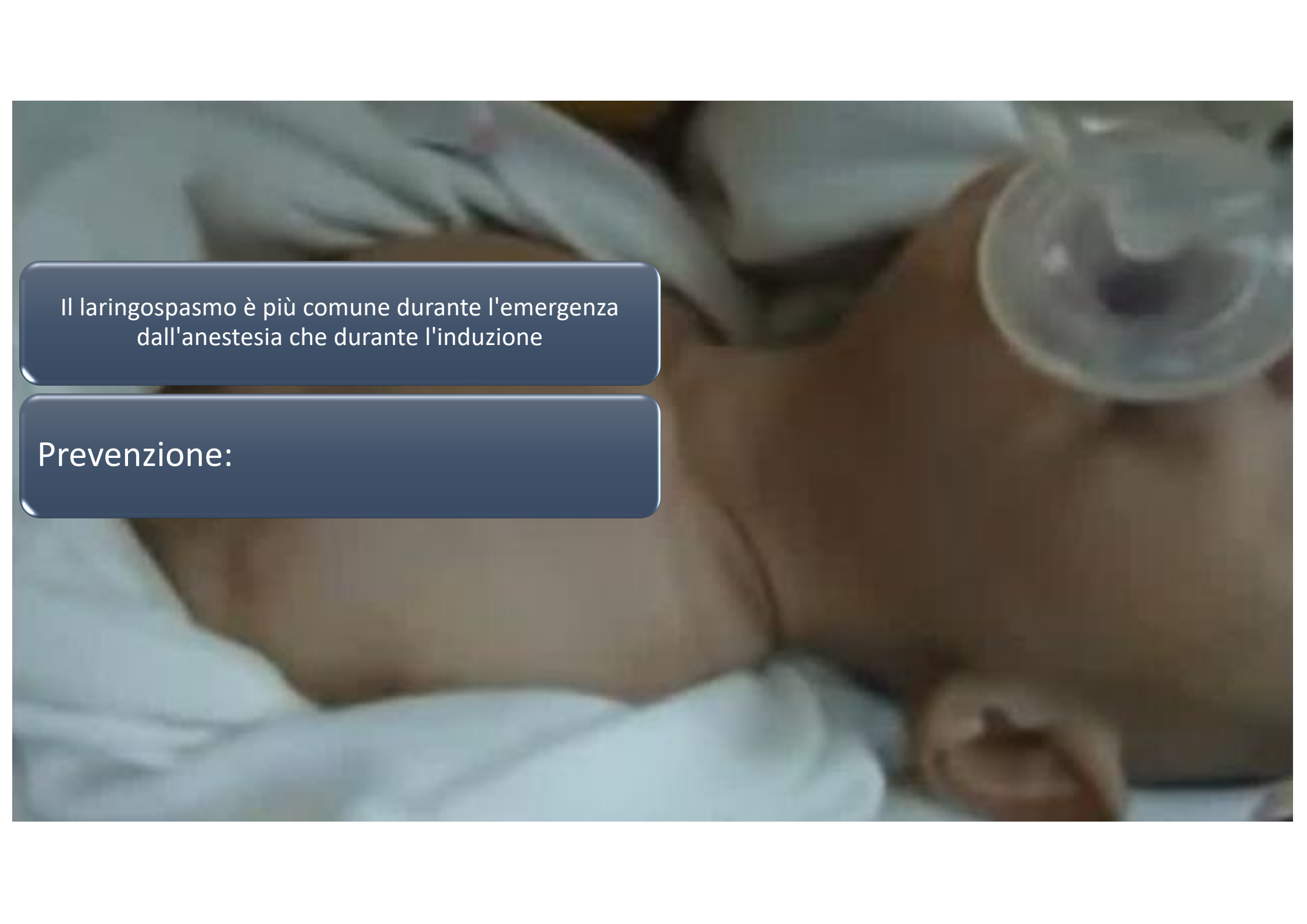
Division of Anaesthesiology, Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan

Reminder of important clinical lesson

CASE REPORT

Cerebral air embolism from a Central Venous Catheter: A timely reminder of the importance of rapid diagnosis

Muhammad Farhan Khaliq,¹ Maria Shoaib,² Syed Maaz Tariq,³
Muhammad Taimoor Khan⁴

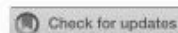


Il laringospasmo è più comune durante l'emergenza
dall'anestesia che durante l'induzione

Prevenzione:



RICETTE???



OPEN ACCESS

EDITED BY
Antonino Morabito,
University of Florence, Italy

REVIEWED BY
Vesna Colovic,
Royal Manchester Children's Hospital,
United Kingdom
Hamidreza Shetabi,
Isfahan University of Medical
Sciences, Iran

*CORRESPONDENCE
Wan Huang
huangwan@sysucc.org.cn
Handong Ouyang
ouyhd@sysucc.org.cn

[†]These authors have contributed
equally to this work

SPECIALTY SECTION
This article was submitted to
Pediatric Surgery,
a section of the journal
Frontiers in Pediatrics

RECEIVED 21 June 2022
ACCEPTED 21 July 2022
PUBLISHED 17 August 2022

Efficacy and safety of the combination of propofol and S(+)-ketamine for procedural sedation in pediatric patients undergoing totally implantable venous access port implantation: A prospective randomized controlled study

Yingjun Zhang^{1†}, Chaopeng Ou^{1†}, Xiaohui Bai², Jielan Lai¹,
Wan Huang^{1*} and Handong Ouyang^{1*}

¹State Key Laboratory of Oncology in Southern China, Collaborative Innovation Center for Cancer Medicine, Department of Anesthesiology, Sun Yat-sen University Cancer Center, Guangzhou, China,

²Guangdong Provincial Key Laboratory of Malignant Tumor Epigenetics and Gene Regulation, Department of Anesthesiology, Sun Yat-sen Memorial Hospital, Sun Yat-sen University, Guangzhou, China

Background: Totally implantable venous access port (TIVAP) implantation is usually performed under general anesthesia with endotracheal intubation in children. Procedural sedation without endotracheal intubation has been applied to minor pediatric surgeries like central venous catheter insertion. To explore a more efficient and less invasive anesthesia mode to implant TIVAPs for children, we aimed to evaluate the efficacy and safety of procedural sedation using propofol and S(+)-ketamine compared with general anesthesia.

Methods: Sixty-six patients aged 6 months to 10 years undergoing TIVAP implantation were randomly allocated to two groups. Patients under procedural sedation [S(+)-ketamine-propofol (sketofol) group] were given target-controlled infusion of propofol 4 µg/ml using the Paedfusor model and S(+)-ketamine 0.5 mg/kg as induction, and had target-controlled infusion of propofol 3–4 µg/ml as maintenance. Patients in sketofol group received medium-flow oxygen inhalation through facemasks during surgery. Patients under general anesthesia (control group) were given propofol 2 mg/kg, cisatracurium 0.2 mg/kg, fentanyl 3 µg/kg as induction, and sevoflurane 0.8 minimum alveolar concentration as maintenance after endotracheal intubation. Primary outcome was the postoperative emergence agitation evaluated 5 min after awakening.

Results: Postoperative emergence agitation evaluated 5 min after awakening was lower in sketofol group versus control group [1.0 (0.5, 1.0) vs. 3.0 (2.0, 4.0); median difference (95% CI): 2.0 (1.0, 2.0); $P < 0.001$]. Time to awakening was significantly lower in sketofol group versus control group [15.0 (5.0, 23.0) vs. 26.0 (20.5, 37.5); median difference (95% CI): 11.0 (7.0, 19.0); $P < 0.001$], as well as time to discharge from post anesthesia care unit [35.0 (24.0, 45.0) vs. 45.0 (37.5, 59.5); median difference (95% CI): 10.0 (10.0, 23.0); $P < 0.001$]. Postoperative complications or adverse events were not reported in sketofol group.

Conclusions: Compared to general anesthesia with endotracheal intubation, procedural sedation using propofol and S(+)-ketamine improves the postoperative emergence agitation right after the recovery of consciousness, and has advantage in shortening anesthetic recovery time for pediatric patients undergoing TIVAP implantation.

Prospettico-randomizzato-controllato

Efficacy and safety of the

66 pazienti (6 mesi-10 anni)

S(+)-ketamine for procedural

Sketofol: propofol TCI 4mcg/ml + ketamina 0,5 mg/ml

Controllo: propofol 2 mg/kg+cisatracurio 0,2 mg/kg+fentanyl 3 mcg/kg + sevo 0,8 MAC

Agitazione postop minore in sketofol

Tempi di risveglio e dimissione minori in sketofol

No complicanze in sketofol

Background: Totally implantable venous access port (TIVAP) implantation is usually performed under general anesthesia with endotracheal intubation in children. Procedural sedation without endotracheal intubation has been applied to minor pediatric surgeries like central venous catheter insertion. To explore a more efficient and less invasive anesthesia mode to implant

Methods: Sixty-six patients aged 6 months to 10 years undergoing TIVAP implantation were divided into two groups. Patients under sedation (sketofol group) were given propofol 4 mcg/ml (targeted infusion) and S(+)-ketamine 0.5 mg/kg as induction, and had target-controlled infusion of propofol 4 mcg/ml. Patients under general anesthesia (control group) were given propofol 2 mg/kg, cisatracurium 0.2 mg/kg, fentanyl 3 mcg/kg as induction, and sevoflurane 0.8 MAC for endotracheal intubation. Postoperative emergence agitation was evaluated 5 min after awakening.

After awakening, the emergence agitation score was significantly lower in the sketofol group (0.5, 1.0) vs. 3.0 (2.0, 4.0); median difference (95% CI): 2.0 (1.0, 2.0); $P < 0.001$. Time to discharge from post-anesthesia care unit was significantly shorter in the sketofol group (11.0 (7.0, 19.0); $P < 0.001$), as well as time to discharge from post-anesthesia care unit [35.0 (24.0, 45.0) vs. 45.0 (37.5, 59.5); median difference (95% CI): 10.0 (10.0, 23.0); $P < 0.001$]. No complications were reported.

Conclusions: Compared to general anesthesia with endotracheal intubation, procedural sedation using propofol and S(+)-ketamine improves the postoperative emergence agitation right after the recovery of consciousness, and has advantage in shortening anesthetic recovery time for pediatric patients undergoing TIVAP implantation.



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EDITED BY
Antonino Morabito,
University of Florence, Italy

REVIEWED BY
Vesna Colovic,
Royal Manchester Children's
Hospital, United Kingdom
Hamidreza Shetabi,
Isfahan University of Medical
Sciences, Iran

*CORRESPONDENCE
Wan Huang
huangwan@sysucc.org.cn
Handong Ouyang
ouyhd@sysucc.org.cn

[†]These authors have contributed
equally to this work

SPECIALTY SECTION
This article was submitted to
Pediatric Surgery,
a section of the journal
Frontiers in Pediatrics

RECEIVED 21 June 2022
ACCEPTED 21 July 2022
PUBLISHED 17 August 2022

Department of Anesthesiology, Sun Yat-sen Memorial Hospital, Sun Yat-sen University, Guangzhou, China

Procedural sedation for insertion of central venous catheters in children: comparison of midazolam/fentanyl with midazolam/ketamine

PAULO SÉRGIO LUCAS DA SILVA MD, SIMONE BRASIL OLIVEIRA IGLESIAS MD, FLÁVIA VANESCA FÉLIX LEÃO MD, VÂNIA EUZÉBIO AGUIAR MS AND WERTHER BRUNOW DE CARVALHO PhD

Pediatric Intensive Care Unit, Department of Pediatrics, Hospital do Servidor Público Municipal de São Paulo, São Paulo, Brazil

Summary

Background: There is a lack of studies evaluating procedural sedation for insertion of central venous catheters (CVC) in pediatric patients in emergency departments or pediatric intensive care units (PICU). This study was designed to evaluate whether there is a difference in the total sedation time for CVC insertion in nonintubated children receiving two sedation regimens.

Methods: Patients were prospectively randomized to receive either midazolam/fentanyl (M/F) or midazolam/ketamine (M/K) i.v. The Children's Hospital of Wiscosin Sedation Scale was used to score the sedation level.

Results: Fifty seven patients were studied (28 M/F and 29 M/K). Group M/F received midazolam ($0.24 \pm 0.11 \text{ mg}\cdot\text{kg}^{-1}$) and fentanyl ($1.68 \pm 0.83 \text{ }\mu\text{g}\cdot\text{kg}^{-1}$) and group M/K received midazolam ($0.26 \pm 0.09 \text{ mg}\cdot\text{kg}^{-1}$) and ketamine ($1.40 \pm 0.72 \text{ mg}\cdot\text{kg}^{-1}$). The groups were similar in age, weight, risk classification time and sedation level. Median total sedation times for M/F and M/K were 97 vs 105 min, respectively ($P = 0.67$). Minor complications occurred in 3.5% (M/F) vs 20.7% (M/K) ($P = 0.03$). M/F promoted a greater reduction in respiratory rate ($P = 0.005$).

Conclusions: In this study of nonventilated children in PICU undergoing central line placement, M/F and M/K provided a clinically comparable total sedation time. However, the M/K sedation regimen was associated with a higher rate of minor complications. A longer period of study is required to assess the efficacy and safety of these sedative agents for PICU procedures in nonintubated children.

Procedural sedation for insertion of central venous catheters in nonintubated children

Prospettico Randomizzato

M/F vs M/K

57 pazienti (omogenei in età, peso, classe di rischio, livello di sedazione – Children's Hospital Sedation Scale)

Non differenze nel tempo di sedazione totale

M/K minori complicanze

Summary

Background: There is a lack of studies evaluating procedural sedation for insertion of central venous catheters (CVC) in pediatric patients in emergency departments or pediatric intensive care units (PICU). This study was designed to evaluate whether there is a difference in the total sedation time for CVC insertion in nonintubated children receiving two sedation regimens.

Methods: A prospective randomized study was conducted in the PICU of Children's Hospital of Wisconsin. Sedation Scale was used to score the

Results: Fifty-seven patients were enrolled in the study. The M/F and M/K groups were comparable in age, weight, risk class, and level of sedation.

Conclusions: In this study of nonventilated children in PICU undergoing central line placement, M/F and M/K provided a clinically comparable total sedation time. However, the M/K sedation regimen was associated with a higher rate of minor complications. A longer period of study is required to assess the efficacy and safety of these sedative agents for PICU procedures in nonintubated children.

Keywords: procedural sedation, central venous catheter, pediatric intensive care unit, nonintubated children.

Abbreviations: PICU, pediatric intensive care unit; M/F, midazolam/fentanyl; M/K, midazolam/ketamine.

Introduction: The use of procedural sedation for the insertion of central venous catheters (CVC) in pediatric patients is a common practice in emergency departments and pediatric intensive care units (PICU).

The purpose of this study was to evaluate whether there is a difference in the total sedation time for CVC insertion in nonintubated children receiving two sedation regimens.

The study was designed as a prospective randomized trial. The patients were enrolled in the study after obtaining informed consent from the parents.

The study was conducted in the PICU of Children's Hospital of Wisconsin. The study was approved by the Institutional Review Board.

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D. K. L. Cheuk
W. H. S. Wong
E. Ma
T. L. Lee
S. Y. Ha
Y. L. Lau
G. C. F. Chan

Use of midazolam and ketamine as sedation for children undergoing minor operative procedures

Abstract *Objectives:* We used intravenous midazolam and ketamine for children undergoing minor operative procedures with satisfactory results. We aimed to further evaluate its efficacy and adverse effects in pediatric ward setting. *Methods:* This was a prospective study of all children undergoing minor operations with sedation in our pediatric general and oncology wards from July 1998 to June 1999. The procedures included lumbar puncture±intrathecal chemotherapy, bone marrow aspiration±trephine biopsy, central venous catheter removal, skin biopsy, or their combination. All sedation procedures were started with midazolam 0.1 mg/kg and ketamine 1 mg/kg; they were increased gradually to 0.4 and 4 mg/kg, respectively, if necessary. Heart rate and SaO₂ were continuously monitored. *Results:* Altogether, 369 minor operations were performed in 112 patients (male: female=2:1, median age 6 years, range 5 months–17 years). All achieved adequate sedation, with 96% within 30 s and 75% required just the starting dose. Younger children required a higher dosage ($p=0.003$ for midazolam, $p<0.001$ for ketamine). The median recovery time was 87 min, with no association with age, sex, or dosage of sedation, but was longer in patients having hallucination ($p=0.001$). Adverse effects included

tachycardia (27.9%), increased secretion (17.6%), agitation (13.6%), nausea and vomiting (9.2%), hallucination (8.7%), desaturation (8.4%), and cataleptic reaction (0.8%). All desaturation episodes were transient and responded to oxygen supplement alone. None developed bronchospasm or convulsion. Some adverse effects were dose-related. Half of the children who received 0.3 mg/kg midazolam developed desaturation. *Conclusions:* Intravenous midazolam–ketamine can provide rapid, effective, and safe sedation for children undergoing minor operations in ward setting. Adverse effects are mild. Midazolam above 0.3 mg/kg should be used with caution.

Keywords Sedation · Ketamine · Midazolam · Oncology · Children

Prospettico

Età 5 mesi – 17 anni

M 0,1 mg/kg fino a 0,4 mg/kg; K 1mg/kg fino a 4 mg/kg

Sedazione rapida, efficace e sicura per i bambini sottoposti a interventi minori in reparto. Gli effetti avversi sono lievi. Il Midazolam al di sopra di 0,3 mg/kg deve essere usato con cautela

Abstract Objectives: We used intravenous midazolam and ketamine for children undergoing minor operative procedures with satisfactory results. We aimed to further evaluate its efficacy and adverse effects in pediatric ward setting. **Methods:** This was a prospective study of all children undergoing minor operations with co-tachycardia (27.9%), increased secretion (17.6%), agitation (13.6%), nausea and vomiting (9.2%), hallucination (8.7%), desaturation (8.4%), and cataleptic reaction (0.8%). All desaturation episodes were transient and responded to oxygen supplement alone. None developed bronchospasm or

infrapine biopsy, central venous midazolam-ketamine can provide

4 mg/kg, respectively, if necessary.

5 months-17 years); All achieved

with no association with age, sex, or dosage of sedation, but was longer in patients having hallucination ($p=0.001$). Adverse effects included

Original Article

Sedation with intravenous ketamine and midazolam for painful procedures in children

BÜLENT KARAPINAR,¹ DENİZ YILMAZ,² KUBILAY DEMİRAG³ AND MEHMET KANTAR⁴

¹Pediatric Intensive Care Unit, ²Pediatric Hematology Department, ³Department of Anesthesiology and Reanimation, and ⁴Pediatric Oncology Department, Faculty of Medicine, Ege University, Izmir, Turkey

Abstract

Background: Children often require relief of pain and anxiety when undergoing painful procedures. The purpose of this study is to evaluate the effectiveness and safety of painful pediatric procedures performed by pediatric intensivist, using the combination of intravenous ketamine and midazolam for sedation and analgesia.

Methods: The records of the patients who received intravenous ketamine-midazolam combination for painful procedures in the pediatric sedation unit of a university hospital over a 3 year period were retrospectively reviewed to determine indications, dosing, assesment of the level of sedation, adverse events, and recovery time for each procedural sedation and analgesia.

Results: A total of 227 children aged 4 months to 18 years were admitted to the pediatric sedation unit for a total of 356 procedures. The indications for procedural sedation and analgesia included bone marrow aspiration or biopsy (50.8%), central venous catheter insertion (27%), and others (22%). A total of 46 adverse events (12.9%) were observed. These adverse events included SpO₂ below 85% without apnea ($n=14$), apnea ($n=3$), transient stridor ($n=2$), hypertension and tachycardia ($n=8$), hypersalivation ($n=6$), vomiting ($n=5$), hallucinatory emergence reaction ($n=4$), and rash ($n=4$). There were no adverse outcomes attributable to ketamine and midazolam combination.

Conclusion: Skilled pediatric intensivists can safely and effectively administer ketamine and midazolam to facilitate painful procedures outside the operating room setting.

Retrospettivo

determinare le indicazioni, il dosaggio, la valutazione del livello di sedazione, gli eventi avversi e i tempi di recupero per ogni sedazione e analgesia procedurale

227 bambini di età compresa tra 4 mesi e 18 anni

356 procedure

Un totale di 46 eventi avversi (12,9%)

SpO2 inferiore all'85% senza apnea (n = 14) Apnea (n = 3) Stridore transitorio (n = 2) Ipertensione e tachicardia (n = 8) Ipersalivazione (n = 6) Vomito (n = 5) Reazione allucinatoria di emergenza (n = 4) Rash (n = 4)

Nessun outcome negativo



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EDITED BY
Jean-Michel Roué,
Université de Bretagne Occidentale, FranceREVIEWED BY
Razuhiko Nakame,
University of Miyazaki, Japan
Robin Van Der Lee,
Radboud University Medical Centre,
Netherlands
Flaminia Persigilli,
Cliniques Universitaires Saint-Luc, Belgium*CORRESPONDENCE
Vito D'Andrea
✉ dandrea.vito@gmail.comSPECIALTY SECTION
This article was submitted to Neonatology, a
section of the journal Frontiers in PediatricsRECEIVED 31 August 2022
ACCEPTED 13 February 2023
PUBLISHED 24 February 2023CITATION
D'Andrea V, Prontera G, Barone G and Vento G
(2023) Combination of ketamine and fentanyl
(KetaFent) for safe insertion of ultrasound-
guided central venous catheters in infants.
Front. Pediatr. 11:1033793.
doi: 10.3389/fped.2023.1033793COPYRIGHT
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Combination of ketamine and fentanyl (KetaFent) for safe insertion of ultrasound-guided central venous catheters in infants

Vito D'Andrea^{1*}, Giorgia Prontera¹, Giovanni Barone²
and Giovanni Vento¹¹Department of Woman and Child Health and Public Health, Fondazione Policlinico Universitario Agostino Gemelli IRCCS, Rome, Italy; ²Neonatal Intensive Care Unit, Infermi Hospital, Rimini, Italy

Centrally inserted central catheters (CICCs) are placed by ultrasound guided puncture of the internal jugular or brachio-cephalic vein. It is crucial to achieve a good level of sedation and analgesia in order to keep the babies still thus reducing the risk of procedural failure. The aim of this study is to evaluate the efficacy of the combination of ketamine and fentanyl during the CICC placement procedure. We retrospectively collected data from 72 infants who underwent CICC insertion after sedation with KetaFent protocol. The primary outcome was to assess the success of the procedure defined as CICC placement. Secondary outcome was intubation during the procedure in non-ventilated infants (noninvasive ventilation or spontaneous respiration), need for repeat doses of study medications to complete the procedure, time to complete the procedure, the level of analgesia assessed using vital parameters. The procedure was completed in 100% of cases. There were no cases of hypotension during and at the end of the procedure. No intubation was performed on non-ventilated infants. The combination of ketamine and fentanyl for sedation and analgesia in infants requiring insertion of a CICC is 100% successful. It is associated with a low risk of side effect like apnea and intubation. Insertion of a central venous catheter is a painful procedure for infants. Adequate sedation is mandatory to keep the baby still thus reducing the risk of procedural failure.

KEYWORDS

procedural pain management, pain measurement, analgesia, infant, ultrasound-guided central venous catheters

Retrospettivo

72 pazienti (NICU – neonati a termine e pretermine)

Ketamina 0,5 mg/kg 10 minuti prima della venipuntura (fino a 2 mg/kg)

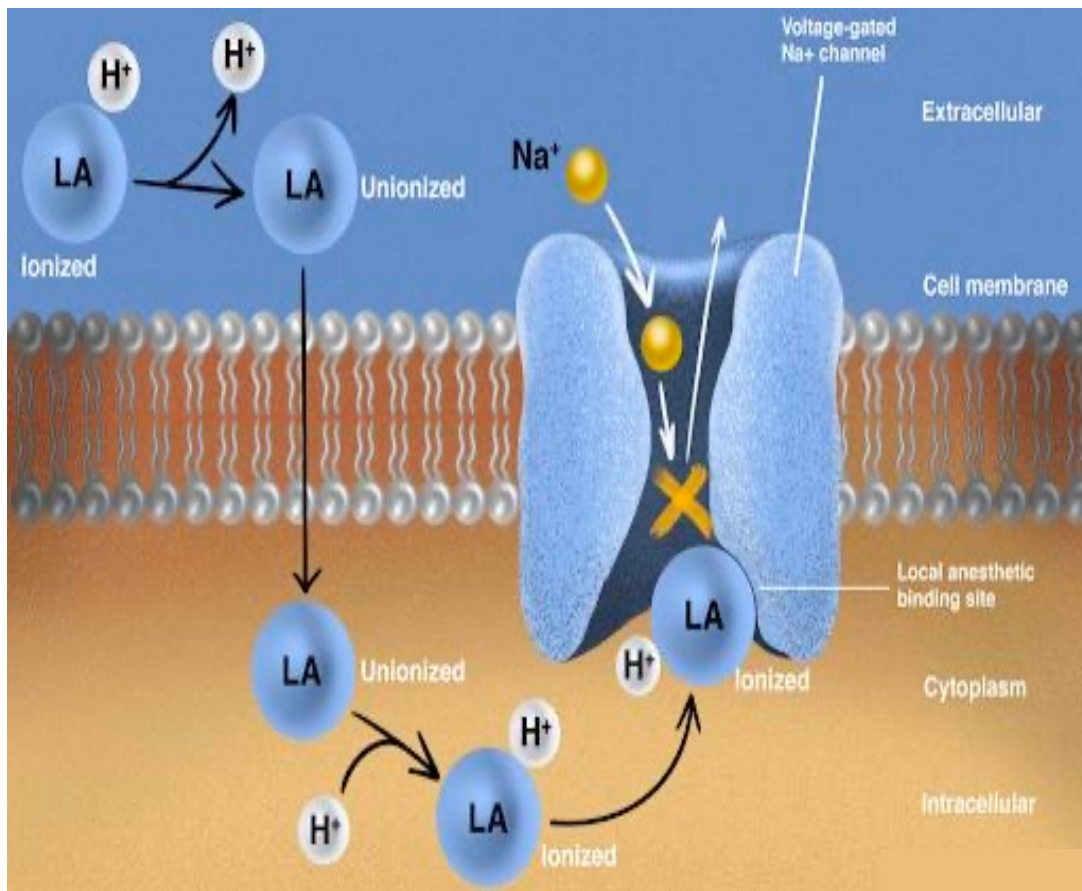
Fentanyl 2 mcg/kg 5 minuti prima della venipuntura

TABLE 2 Study outcomes of enrolled infants.

	Invasive ventilation 37	Non-invasive ventilation Spontaneous respiration 35
Primary outcome		
Success rate of CICC insertion	100%	100%
Duration of procedure minutes (min-max)	23 (17–32)	25 (20–41)
Secondary outcome		
Dose of Ketamine median (Q1–Q3)	2 (1–2)	3 (1–3)
Infants achieving maximum dose of ketamine <i>n</i> (%)	2 (5.4)	5 (14.2)
Δ HR mean (min-max)	4 (2–5)	5 (2–10)
Δ BT mean (min-max)	0.6 (0–1.1)	0.7 (0–1.2)
Need for supplemental oxygen <i>n</i>	6	5
Apnea <i>n</i>	–	2
Need for intubation	–	–

n, number; HR, heart rate; BT, body temperature.

ANESTETICI LOCALI



LIPOSOLUBILITA'

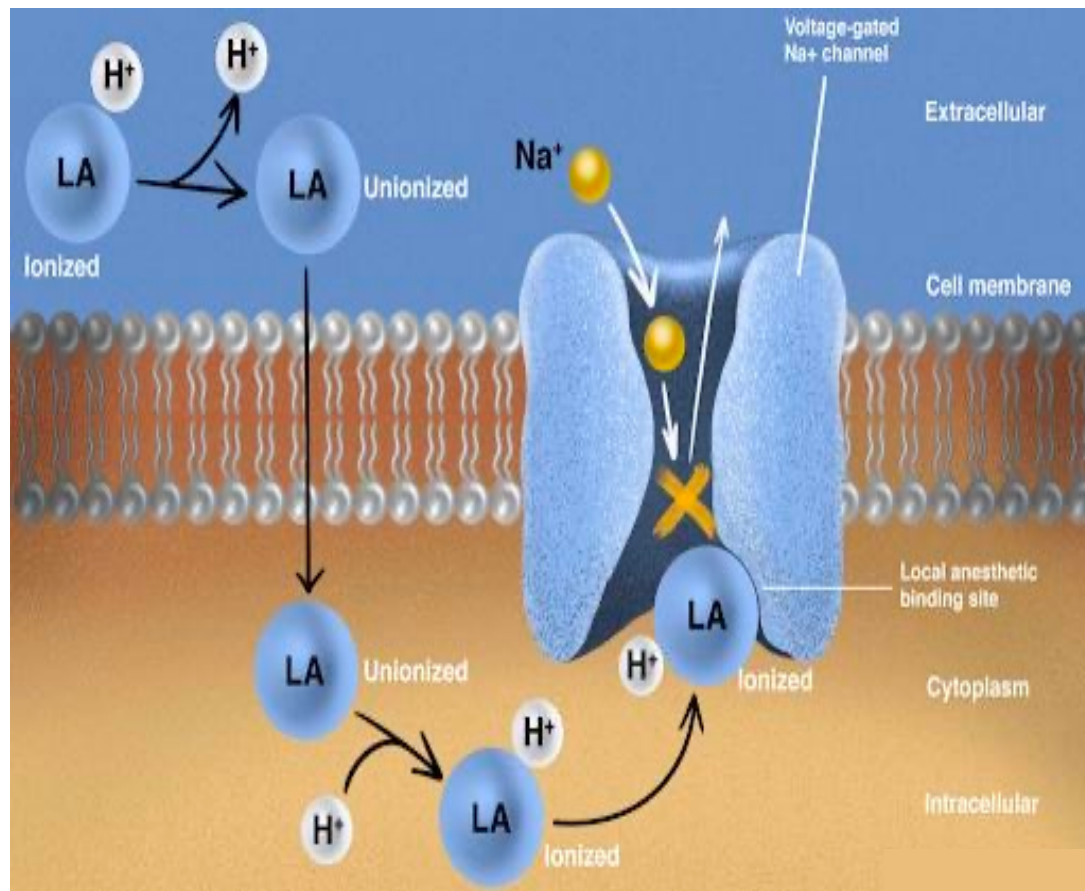
- I composti più liposolubili sono i più potenti, per la maggior diffusibilità tra le membrane biologiche.

COSTANTE DI DISSOCIAZIONE pKa

- Tanto più il pH è lontano dal pKa, tanto minore è il farmaco in forma neutra, quindi tanto maggiore sarà la latenza.

BINDING PROTEICO

ANESTETICI LOCALI



FATTORI CHE INFLUENZANO IL BLOCCO

Dose

TUNNELLIZZAZIONE

«... tecnica chirurgica di superficie che consiste nel trascinare nel tessuto sottocutaneo un tratto di un catetere...»

- Diminuzione infezione catetere correlata
- Diminuzione trombosi
- Gestione ottimale del dispositivo
- Aumento confort paziente
- Tecnica semplice
- Basso costo
- Tempo di esecuzione molto veloce
- Rare complicanze procedurali maggiori
- Facile Rimozione del catetere
- Facilità di gestione e miglior comfort
- Catetere a breve-medio termine diventa a lungo termine

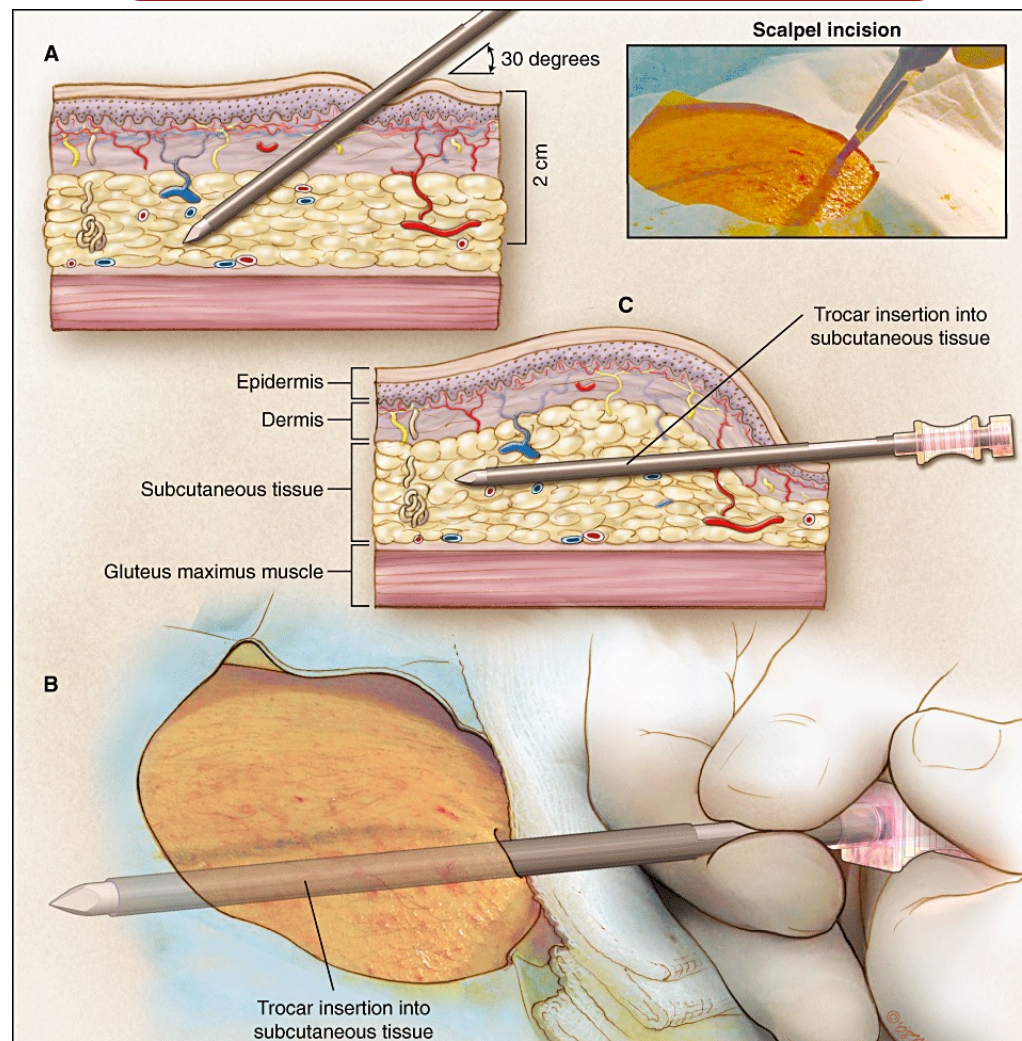
CENSORED

Allontanare sito di inserzione endovasale da sito di inserzione percutanea

IDRODISSEZIONE



TUNNELIZZAZIONE





CONCLUSIONI

TEAM

- (esperienza, competenza, attitudine)

AMBIENTE

- (sicurezza, presidi, costi)

INDICAZIONE

VALUTAZIONE DEL PAZIENTE

- (condizioni psico-fisico-sociali)

PREMEDICAZIONE

ANESTESIA

COMPLICANZE

CONTROLLO DEL DOLORE POST-PROCEDURALE

GRAZIE



aldo.mancino@policlinicogemelli.it