Safe Procedural Sedation

Course

Candidate's Manual

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TABLE OF CONTENTS

Introduction

The use of sedation by non-anaesthetists has grown exponentially over the last few decades. It is used for treatment or diagnostic purposes in many clinical settings like the Emergency Department, Endoscopy unit, radiology and dental clinics.

The purpose of this course is to allow clinicians to adopt a safe, effective and systematic approach to sedation through team based education and communication. The course should serve as a good governance tool towards the practice of safe sedation, and puts emphasis on the need for a standardised approach to help minimise the likelihood of adverse events.

This pdf is to accompany the Safe Procedural Sedation (SPS) course run through AWSEM. The course has been designed to provide guidance when providing safe procedural sedation in a myriad of clinical situations. All procedural sedation carries a risk. The SPS course will cover decision making related to monitoring and appropriate agents required to achieve safe procedural sedation.

Our key objectives are to:

1) Help with the necessary relevant knowledge required to perform safe procedural sedation
2) Draw your attention to the importance of thorough systemic preparation and practice
3) Highlight the potential complications and management associated with practicing sedation
4) To provide an understanding of the importance of having a governance framework for safe procedural sedation

Throughout this simulation based course we will reinforce and support these ideas and ultimately give you a system that can be employed for all your future procedural sedations.

Definition of Procedural Sedation

The American College of Emergency Physicians (ACEP) defines procedural sedation as "*a technique of administering sedatives or dissociative agents with or without analgesics to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardiorespiratory function.*"

Levels / States of Sedation

There are different definitions for the levels of sedation. We recommend the ASA (American Society of Anaesthesiologists) definition, which uses four defined states of non-dissociated sedation:

	MInimal Sedation	Moderate Sedation	Deep Sedation	General anaesthesia
Resposiveness	Patients respond normally to verbal commands	Purposeful Response to Verbal/Tactile Stimulation	Purposeful Response to repeated or painful stimulation	Unrousable even with painful stimulation
Airway & Ventilation	No Airway Intervention Required	No Airway Intervention Required	Airway Intervention May Be Required	Airway Intervention Usually Required
Ventilation	Normal Ventilation	Adequate Ventilation	Ventilation May Be Inadequate	Ventilation Frequently Inadequate
Cardiovascular function	Maintained	Usually maintained	Usually maintained	May be impaired

Putting this into context:

Minimal sedation describes a patient with a near baseline level of alertness. A clinical example would be giving small doses of an anxiolytic agent. For example, giving 1-3 mg of midazolam for a lumbar puncture.

Moderate sedation means that the patient will have some level of awareness. The patient will be able to maintain his or her ventilatory and cardiovascular function. He or she will be able to perform purposeful responses to verbal or tactile simulation. This depth of sedation is used in endoscopic procedures.

Deep sedation, the patient is not easily aroused but may still respond purposefully to repeated or painful simulation. This level of sedation obviously can lead to increased risks to ventilatory and cardiovascular function.

Sedation and analgesia should be titrated to achieve a safe and comfortable, (anxiety free and pain free) procedure. Individuals differ in their response to sedation, so patients may require different levels of sedation depth for the same procedure.

Sedation is a continuum, it is not always possible to predict how an individual patient will respond. The patient may drift into general anaesthesia therefore it is important to match your agent with the length of the procedure being performed. This is quite a fine line, and it must be fully appreciated by the “sedationist”.

Practitioners intending to produce a given level of sedation should always anticipate complications and be prepared to rescue and resuscitate patients whose level of sedation becomes deeper than initially intended.

There is a thin line between general anaesthesia and deep sedation. The sedationalist must endeavour to avoid this state whenever possible. General anaesthesia is an unwanted consequence of procedural sedation and the sedationist must be prepared to appropriately deal with the potential consequences at all times.

SAFE PROCEDURAL SEDATION PROCESS

Safe approach and structure are important components to the process. The SPS process recommends the following points and actions are taken during the procedure:

A) Assessment and Preparation:
- Assessment of the patient environment
- Assessment of the patient

B) Continuous Monitoring and frequent clinical observation of the patient during the procedure

C) After care
- Post procedure observations and appropriate monitoring
- Discharge criteria and instructions

A) Assessment and Preparation

An assessment of the area and people performing the procedure as well as the patient's condition is an essential initial part of the process. Consider the following:

Area assessment and staff credentials

- Check for availability of the appropriate equipment, area and state of the department. A minimum of two experienced providers is recommended.
- Confirm the level of experience (yours and your assistants): The primary practitioner performing the sedation must be qualified and credentialed to administer the drugs. They must have minimal or no involvement in the procedure to be performed. They should be trained in the use of the drugs and have adequate knowledge of their side effects and have the skills to manage the complications that may arise as well as understand the role of the reversal agents.
- Keep in mind the duration of the procedure. This should link in with the type of drugs to be used as well as the type of patient.
- Ask yourself, is this an emergent, urgent, semi-urgent or elective procedure?
- ALS competency or availability of such individuals.
- Anticipate what can go wrong.

Patient Factors

Many important guidelines have been written in the last decade relating to safe procedural sedation. The design of this course is based on best evidence and practice guidelines. The SPS course uses the following approach system for teaching safe sedation. It is merely a suggestion to provide a framework for decision making and provides the structure for this booklet.

H: Background history of the patient with special considerations for the elderly, pregnancy, obesity and children, as well as those who are intoxicated.

A: ASA and comorbidities. Will you need to call for help early?

S: Starved state. How important is fasting? the urgency of the procedure versus patient's condition and the level of sedation.

C: Consent.

C: Safety Check list is performed. Including Airway assessment. Ask yourself, should the patient require airway intervention and ventilation, would I face any difficulties?

C: Sedation choice made

History

A thorough pre-procedure evaluation is essential for a safe procedural sedation. Pre-existing chronic medical illnesses and the use of medications can influence the practice and the outcome of sedation. Therefore, it is essential to obtain history of past and current medical illness, medications, allergies and history of any previous procedures done under sedation.

A medical examination of the patient's heart and lungs should be performed in all cases. An ECG should be obtained if there is any potential risk for heart problems. If the patient has pertinent blood results these should also be reviewed.

ASA

The physical status of the patient is assessed via the ASA classification. It serves as a screening tool to assess the risk and determine the administration of moderate versus deep sedation. It is often used to ascribe a arbitrary mortality figure to patients requiring anaesthesia.

It should be determined by the physician who will be performing the sedation.
It is recommended that an anaesthetist or a senior experienced clinician is consulted for patients with ASA 3,4 & 5. The exception to this rule is often the patient who requires a potentially lifesaving intervention, for example patients requiring emergency cardioversion.

ASA grade	Status	Absolute mortality (%)
1	Normal healthy patient	0.05
2	Mild systemic disease or patient over 80 years old	0.1
3	Systemic disease that causes definite systemic functional limitation on life	0.2
4	Severe systemic disease that is a constant threat to life	1.8
5	Moribund patient unlikely to survive 24 hours without surgery	7.8

Starving/Fasting status

There should be an appropriate interval of fasting before sedation. The ED is a unique setting in that patients present on an unscheduled basis, usually requiring emergent and complex procedures that will require sedation.

There are no absolute guidelines as to the timing of cessation of oral intake before administration of sedation. This is because of the absence of supporting data with regard to showing a direct relationship between duration of fasting and the risk of pulmonary aspiration.

However, the ASA guidelines state that patients should fast a minimum of 2 hours after consuming clear fluids and 6 hours after consuming light meals before the administration of sedation.

The American College of Emergency Physicians (ACEP) states, "*Recent food intake is not contraindicated for administering procedural sedation and analgesia but should be considered in choosing the timing and target of sedation.*"

The American Academy of Paediatrics (AAP) states that " *When proper fasting has not been assured, the increased risks of sedation must be carefully weighed against its benefits, and the lightest effective sedation should be used.*"

For urgent or emergent situations there is not always the opportunity to ensure complete gastric emptying so the risks and benefits have to be balanced. This means taking into consideration the type and duration of the last intake of food or fluids. This will ultimately help to determine the following:

(1) The target level of sedation
(2) Whether the procedure should be delayed
(3) Whether the airway should be protected by intubation.

Special considerations in relation to gastric emptying:

There are several key points to consider when sedating a pregnant woman. There is no absolute contraindication to the mother or fetus to administering procedural sedation, however it is the physiological changes that occur during pregnancy that make the patient higher risk.

Patients who have had gastric binding or sleeve procedures:
Please follow your local unit/facility policy/protocol/pathway for further guidance.

Consent

This is an essential part of the process. Occasionally, emergency consent will be required. Consent must be taken for both the procedure and sedation. The patient should be made aware of the risks, complications and serious possible damage to vital organs.

The sedationist should also discuss other possible alternative forms of treatment including non-treatment. In all cases, familiarise yourself with your organisation's policy on consent.

Choice of Agent

There are different choices of drugs when considering safe procedural sedation. The selection is determined by having a good understanding of the agent used, the intervals between increments and potential reversal drugs as well as the patient, clinical and situational factors.

Alternate strategies should always be considered and discussed with patients. If a safer strategy is available it should be employed.

These agents will be explored in more detail in the pharmacology section.

Checklist

A safety checklist in preparation for procedural sedation is essential. It is important to have oxygen, suction, reversal agents and advanced life support drugs available. We suggest the use of the SOAPME mnemonic.

SOAPME	
Suction	This should be checked and ready to use
Oxygen	Always available. Deep sedation will require pre-oxygenation and oxygenation during the procedure.
Airway equipment	An airway trolley should be available with airway equipment required to perform an emergency RSI if required.
Pharmacology equipment	The chosen medication should be ready and labeled. In addition drugs to counteract the chosen sedating agents should be available and ready to deliver.
Monitoring	Heart monitor, BP, SaO2
ETCO2	End Tidal CO2 monitoring should be in place. This is especially important with deep sedation.

Airway Assessment

Airway evaluation is an essential part of procedural sedation as it ensures that there is appropriate consideration of any potential airway issues. It also focuses the sedationist on the potential consequences of a failed sedation such as the need for tracheal intubation. Evaluation and documentation will note if the airway is adequate or at risk. The HAVNO mnemonic which is used in the TEAM course and the BOOTS mnemonic for difficult Bag Valve Mask (BVM) ventilation are shown here (recommended).

HAVNO mnemonic

	Difficult Airway Assessment
History	Including previous airway problems
Anatomy	Features of the face, mouth or teeth that may suggest difficulty
Visual clues	Obesity, facial hair, age. A mallampati inspection can be useful here
Neck	Check mobility
Opening	Opening of the mouth less than 3 fingers
	Table 1

An assessment of the difficulty of ventilation is also possible. For this we can use the BOOTS mneumonic. As described by Kovacs and Law in their 2011 book, airway management in emergencies. This is a very crude system, However, it does focus the mind on potentially important issues.

BOOTS mnemonic

	Ventilation difficulty	
Beard		Two or more elements are suggestive of difficult mask ventiliation
Obesity	**(BMI > 26)**	
Old age	**(>55y)**	
Toothless		
Snores		

Summary:

- **History**: obtain history of past and current medical illness, medications, allergies and history of any previous procedures done under sedation.
- **A**SA: A screening tool. Anaesthesia consulted for patients with ASA 3, 4 & 5
- **S**tarve status ? Fasting
- **C**onsent
- **C**hoices: The choice selection is determined by having a good understanding of the agents used and the patient for sedation
- **C**hecklist: a checklist to reduce the chances of forgetting important equipment this must include an airway assessment

B) Sedation Procedures

It is very important the person performing the sedation has minimal or no involvement in the procedure to be performed. This is of particular importance with deep sedations. The sedationist should have no potential distractions from monitoring the procedure.

The people performing the procedure should have been trained in the use of the drugs. Using drugs without full knowledge of their effects could be very detrimental. The SPS course is designed to allow you to practice within your competencies within a safe environment. It cannot give years of experiential learning.

In addition the practice of procedural sedation should be understood to be an event involving doctors and nurses. Human factors theory suggests these skills should be practiced and simulated as a collective group.

The ACEP clinical policy recommends that moderate and deep sedation should always be a two person technique.

Monitoring

Practitioners must be skilled/proficient in:

- ➢ Providing procedural sedation,
- ➢ Airway management and cardiovascular support,
- ➢ The ability to rescue a patient from sedation deeper than intended.

Continually evaluating and monitoring respiratory and circulatory parameters prior to, during, and following the procedure is essential. Note the following:

- Monitor vital signs before, during, and after the procedure.
- Monitor airway patency.
- Observe and monitor the patient's appearance and ability to respond to verbal stimuli during and after the procedure.
- ECG monitoring should be continuous for high-risk patients, during prolonged procedures, or during deep sedation.
- Consider continuous pulse oximetry for patients with increased risks of hypoxemia. The literature suggests that if the level of sedation is minimal and verbal communication can be assessed throughout the procedure then pulse oximetry may not be necessary.
- Capnography should be manditory. (See below for more information on this)

Pre-oxygenation

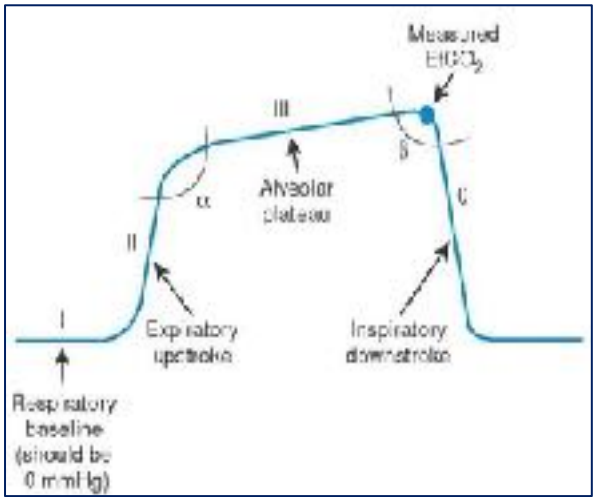
The incidence of oxygen desaturation during ED procedural sedation ranges from 6% to 40% without supplemental oxygen. Supplemental oxygen reduces the incidence of hypoxemia, and has no adverse clinical effects.

However, the administration of supplemental oxygen can delay the recognition of respiratory suppression, because oxygen saturation is maintained despite rising carbon dioxide noted by capnography. However many experts now feel that giving the patient oxygen for all deep sedations gives a practitioners a buffer zone. When used with quantitative ETCO2 it allows the sedationist to monitor the respiratory pattern and detect apnoea early.

In morbidly obese patients, bi-level positive airway pressure may be useful to facilitate adequate sedation while averting hypoventilation.

Capnography:

Capnography is the non-invasive measurement of the partial pressure of carbon dioxide (CO2) in exhaled breath. It can frequently identify respiratory depression and airway complications before clinical observation by providing real time breath to breath feedback on the baseline ventilatory status of the patient. In addition it allows these changes to be tracked over time. Waveform capnography represents the amount of carbon dioxide in exhaled air, which is normally 35-45 mmHg.



Normal Capnograph.

Phase I: At the start of exhalation, carbon dioxide concentration in the exhaled gas is essentially zero, representing gas from the anatomic dead space that does not participate in gas exchange.

Picture from http://what-wehn-how.wm/wp-content/uploads/2012/04/.

Phase II: As the anatomic dead space is exhaled, carbon dioxide concentration rises as alveolar gas exits the airway.

Phase III: For most of exhalation, carbon dioxide concentration is constant and reflects the concentrate of carbon dioxide in alveolar gas.

Phase IV: During inhalation, carbon dioxide concentration decreases to zero as atmospheric air enters the airway.

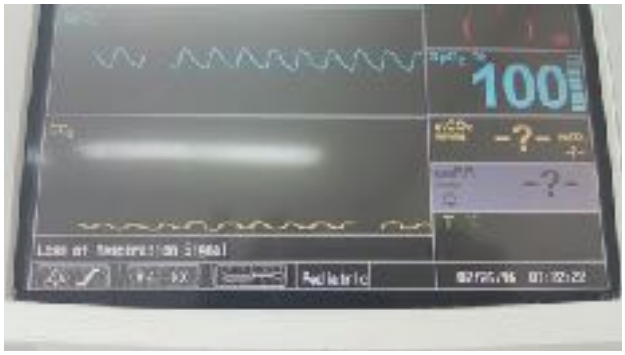
Two sensors can be used to measure capnography. In patients who are breathing, nasal prongs can be applied that capture exhaled air. In patients who require assisted ventilation, another adapter can be attached to a BVM and advanced airway device.

Pulse oximetry helps determine how much oxygen should be administered, and capnography helps determine when ventilation should be assisted with a bag valve mask

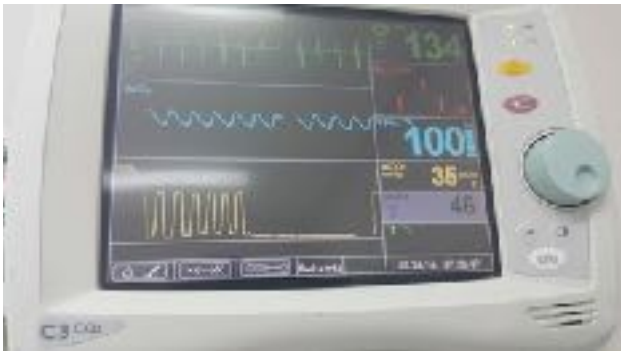
Importantly, vital signs and pulse oximetry respond late to hypoventilation. ET CO2 will detect hypoventilation before changes in the vital signs, SaO2 ? or clinical observation.

Oxygenation should be titrated to achieve minimum SaO2 of 92%, and ventilation should be titrated to achieve ET CO2 between 35 and 45 mmHg.

ETCO2 in a spontaneously breathing patient



Loss of ETCO2 Tracing



ETCO2 Showing apnoea/Airway obstruction in a spontaneously breathing patient

Resumption of breating/ open airway showing return of ETCO2

C) Post Sedation (Recovery) Care

In all settings, during the recovery phase, patients may continue to be at significant risk of developing complications after their procedure is completed. Additionally, when sedation or analgesia is administered to patients as an outpatient procedure, or in an ED, it is likely that there will be no medical supervision once the patient leaves the medical facility.

In order to decrease the likelihood of adverse outcomes, it is recommended that the recovery phase should include:

- documented continued observation
- monitoring
- handover process
- pre-determined discharge criteria
- discharge instructions.

1. Post Procedure Observation

Patients may continue to be at risk of developing complications after their procedure, hence the patient should be continuously monitored after the procedure and vital signs recorded at regular intervals. Post-sedation care involves documentation of the following components:

- Vital signs monitoring including oxygen saturation
- Neurological assessment such as AVPU or GCS

The duration of recovery may vary and should be based on the patient's response, return to baseline health status and, when no longer at risk, for cardiopulmonary depression.

Note: *Patients receiving Naloxone or Flumazenil should be observed for a longer period of time to ensure that re-sedation does not occur.*

2. Documentation

The sedationist is required to document and record the pre-procedure, intra-procedure and post –procedure events. All medications administered, including any undesired events, must be recorded in the patients file.

3. Time out:

Time out is a stopped period when all members of the procedure team participate in the positive identification of the patient, with agreement on the intended procedure to be done. The team members will conduct/complete a "time-out" form/checklist prior to the procedure in accordance with the organisation's relevant policy.

***Remember**: correct patient, correct procedure, and correct site*

4. Handover

Not uncommonly, it may be necessary to transfer the professional responsibility and accountability for some or all aspects of care for a post-sedation patient, to another person or professional group. When carried out improperly, handover of clinical information carries significant risks for individual clinicians, their organisations and for their patients.

Effective communication lies at the very heart of good patient care. For safe sedation practice, organisations, departments and members of clinical teams must use a documented and structured system for transfer of care. Staff involved in sedation must be familiar and comply with the handover system in their organisation/department.

5. Patient discharge criteria

Follow your hospital/unit post-sedation discharge criteria guidelines.
The following serve as a guide to safe post-sedation discharge criteria:

- Patient should be alert and oriented to time, place and person.
- Vital signs must be stable or a return to baseline noted.
- Swallow and cough reflex should be present.
- Patient is able to ambulate.
    - The presence of a responsible adult to transport the patient home.
    - Sufficient time (up to 2hours) should have elapsed after the last administration of the agents.
    - The use of scoring systems may assist in making discharge decisions. Examples include the Aldrete score.
- Patients/relatives have been given post-procedure instructions.

6. Post Sedation Discharge Instructions

Discharge planning is most effective if begun in the pre-procedure period and reinforced with written instructional material. As a guide, discharge instructions should include:

1. <u>Sedation related instructions (to be observed during the first 24 hours):</u>
    - Not to engage in other activities requiring judgment or coordination, eg driving
    - Not to consume any alcoholic beverages
    - Not to sign any legal documents
    - Have a responsible person available to assist you until you are fully awake
    - Conditions under which immediate emergency care should be sought
    - Dependent patients such as children must be accompanied by a responsible adult (parent or legal guardian)

2. <u>Additional discharge instructions dependent upon the procedure might include information about</u>:
    - Activity restrictions/resumption
    - Pain control/symptom relief
    - Diet
    - Follow-up visit
    - Emergency contact of physicians

SPS GOVERNANCE

Clinical governance is “a system through which NHS organisations are accountable for continuously improving the quality of their services and safeguarding high standards of care by creating an environment in which excellence in clinical care will flourish." (Scally and Donaldson 1998, p.61)

Health care organisations have a duty to the population they serve for maintaining the quality and safety of care. Whatever structures, systems and processes an organisation puts in place, it must be able to show evidence on how standards are achieved and maintained.

It is vital that staff caring for sedated patients have the necessary knowledge and skills to provide high-quality care. Additionally, SPS course emphasizes the importance of staff working in an efficient team and in a well supported environment.

Scally G and Donaldson LJ (1998) Clinical governance and the drive for quality improvement in the new NHS in England. British Medical Journal 317(7150) 4 July pp.61-65.

Pharmacology

Aims of Conscious Sedation techniques

To render uncomfortable diagnostic and therapeutic procedures acceptable for patients by:

- Relieving anxiety
- Reducing pain
- Providing amnesia

Whilst also maintaining:

- Consciousness and patient cooperation
- Control of airway, ventilation and other physiological parameters

Choice of drugs and techniques

Understanding the efficacy and safe administration of the drugs used in sedation is essential to the practitioner performing interventional procedures. When choosing a drug, the practitioner should:

- Choose an agent that carries a margin of safety wide enough to render total loss of consciousness unlikely
- Consider whether the procedure is painful
- For non-painful procedures – sedation alone is enough
- For painful procedures – need the addition of specific analgesic agent

General considerations

When choosing a drug, consider:

- Type of procedure
- Duration of procedure
- Age of patient
- Underlying medical conditions
- Patient's level of anxiety

Elderly patients:

- are more sensitive to most drugs
- have slower onset times
- doses required are usually half or less than those for younger adults

Titrate to effect (incremental doses):

- Initial dose should be determined by careful pre-assessment and any relevant medical history
- Wait for the initial dose to take full effect before considering additional doses
- The use of fixed doses or boluses is unacceptable
- Titrate subsequent doses to achieve desired effect

- It is therefore important to know the drug's time of onset, peak effect and duration of action

1.

Synergistic effects:

- Drugs used in combination have a total greater effect than the sum of the individual effects
- Safety margins are narrowed
- Increases the risk of overdose, loss of consciousness, respiratory depression and loss of airway control

Multiple drugs:

- As a general rule, single drugs are easier to titrate and safer than concurrent administration of two or more drugs
- When combining opioids and benzodiazepines, **the opioid should be given first**, and the benzodiazepine added only once the desired effect of the opioid is observed
- Benzodiazepines may be up to eight times more potent when given following opioid administration, so must be titrated with care

Use of antagonists:

- Must be readily available during all procedures under sedation
- Should be reserved for emergency use
- Antagonists have potential side effects too
- Have shorter half-lives than their corresponding agonists, this could lead to residual re-sedation

Drugs commonly used for Conscious Sedation and their known reversal agents/measures:

Sedation Agents	Reversal agents
Opiates	Naloxone
Midazolam	Flumazenil
Propofol	Time, IV fluids, Push dose pressors,
Etomidate	Time, Fentanyl for myclonic jerks
Ketamine	Glycopyrolate or Atropine for hypersalivation (Glycopyrolate doesn't cross BBB, hence less muscarinic effects) Midazolam for agitation or emergence effect

MIDAZOLAM	
Mechanism of action	Binds to GABA receptors resulting in CNS depression
Effects	Anxiolysis Sedation Amnesia Anticonvulsant No analgesic effect
Dosing guidelines	<u>General dosing</u> 0.05mg/kg repeated every 2-3 minutes up to a maximum of 0.2mg/kg (Small incremental doses of 1-3mg every 2-3 minutes, up to a maximum of 5mg) <u>In the elderly</u> 0.02mg/kg repeated every 2-3 minutes up to a maximum of 0.2mg/kg (Small incremental doses of 0.5 - 1mg every 2-3 minutes)
Pharmacokinetics	Onset time: 1-3 min Peak effect time: 5-7 min Duration of action: 20-30 min (repeated doses or larger doses prolong duration) Metabolisation: hepatic Active metabolites: Yes, excreted via kidney Reversal agent: yes - flumazenil
Adverse effects	CNS: ataxia, dizziness, paradoxical agitation (especially children) CVS: (only in higher doses) – bradycardia, hypotension RS: (only in higher doses) – depressed alveolar ventilation GIT: nil significant
Special considerations	When combining with opioids, give after the opioid and reduce dose by 25-50%

FENTANYL	
Mechanism of action	Binds to opioid receptors in CNS and PNS
Effects	Analgesia Sedation Cough suppression
Dosing guidelines	General dosing 0.5 - 1 mcg/kg given in small increments every 2-3 min up to a max dose of 250 mcg (Small incremental doses of 25-50 mcg every 2-3 minutes up to max 250 mcg) In the elderly 0.25 - 0.5 mcg/kg given in small increments every 2-3 min up to a max dose of 100 mcg (Small incremental doses of 25 mcg every 2-3 minutes up to max 100 mcg)
Pharmacokinetics	Onset time: 1-2 min Peak effect time: 10-15 min Duration of action: 30-60 min Metabolisation: hepatic Active metabolites: no Reversal agent: Naloxone
Adverse effects	CNS: muscle rigidity especially thoracic wall at higher doses, meiosis CVS: (with higher doses) bradycardia, hypotension (histamine release) RS: respiratory depression – hypoventilation- Apnoea GIT: nausea, vomiting Others: pruritus, urticaria
Special considerations	Has synergistic effects when combined with benzodiazepines

MORPHINE	
Mechanism of action	Binds to opioid receptors
Effects	Analgesia Sedation Cough suppression
Dosing guidelines	<u>General dosing</u> 2-4mg given in increments every 5 min up to a max dose of 10-20mg <u>In the elderly</u> 1-2 mg given in small increments every 5 min up to a max dose of 10mg
Pharmacokinetics	Onset time: 2-3 min Peak effect time: 20 min Duration of action: 2-4 hrs Metabolisation: mainly hepatic, metabolites excreted by kidney Active metabolites: Yes Reversal agent: Naloxone
Adverse effects	**CNS**: Euphoria, Meiosis **CVS**: Hypotension, bradycardia, vasodilatation due to histamine release **RS**: respiratory depressant, Apnoea **GIT**: Nausea, vomiting, constipation **Others**: pruritus, rash, anaphylactoid reactions
Special considerations	Has synergistic effects when combined with benzodiazepines

PROPOFOL	
Mechanism of action	Unclear
Effects	Sedation---> Anesthesia
Dosing guidelines	10-20mg incremental doses given every 5 min up to a max dose of 100 mg In the elderly 10 mg incremental doses given every 5 min up to a max dose of 50 mg
Pharmacokinetics	Onset time: 30-40 sec Peak effect time: unknown Duration of action: 10-15 min Metabolisation: hepatic Active metabolites: No Reversal agent: No
Adverse effects	**CNS:** Involuntary muscle movements **CVS:** Hypotension, bradycardia **RS:** Respiratory depression, Apnoea **GIT:** nil of significance **Others:** pain on injection, allergic reactions in patients with egg and Soiaallergy
Special considerations	More pronounced cardiovascular effects in the elderly, hypovolemic, and ? debilitated, patients on beta blockers, ACE inhibitors and calcium channel blockers. In combination with opioids produces profound respiratory depression Has no analgesic properties It is an anaesthetic agent

ETOMIDATE	
Mechanism of action	Unclear
Effects	Sedation
Dosing guidelines	0.2 mg/kg up to a max dose of 20mg
Pharmacokinetics	Onset time: 30-60 sec Peak effect time: unknown Duration of action: 3-5 min Metabolisation: hepatic and renal Active metabolites: No Reversal agent: No
Adverse effects	**CNS**: Myoclonus **CVS**: largely unchanged **RS**: respiratory depression **GIT**: nausea and vomiting **Others**: temporary adrenal suppression, pain on injection
Special considerations	Useful for patients with trauma and hypotension It is an anaesthetic agent

KETAMINE	
Mechanism of action	Antagonist at NMDA receptors Analgesic at low doses Causes dissociative effect – a state of sensory isolation
Effects	Analgesia Sedation Amnesia
Dosing guidelines	0.2 – 1.0 mg/kg May repeat as necessary every 5-10 min up to a max dose of 2mg/kg In the elderly 0.2 – 0.75mg/kg May repeat as necessary every 5-10min up to a max dose of 2mg/kg
Pharmacokinetics	Onset time: 1-2 min Peak effect time: unknown Duration of action: 10-15 min Metabolisation: hepatic Active metabolites: Yes (less potent) Reversal agent: No
Adverse effects	**CNS**: Emergence delirium, hallucinations, raised ICP **CVS**: hypertension, tachycardia **RS**: respiratory depression only at high doses **GIT**: hyper-salivation, nausea and vomiting
Special considerations	Emergence delirium can be reduced by the use of benzodiazepines It is an anaesthetic agent
Ketamine Contraindications	
Absolute	Age < 3 months Known or suspected schizophrenia
Relative	Posterior larynx stimulation eg. Endoscopy Active pulmonary infection or disease (increased risk of laryngospasm) Known or suspected cardiovascular disease (Angina, HF, CAD, HTN) CNS masses, abnormalities or hydrocephalus (raised intracranial pressure) Glaucoma or acute globe injury (increased intra-ocular pressure) Porphyria, thyroid disorder or thyroid medication (sympathomimetic)

NALOXONE	
Mechanism of action	Opioid receptor antagonist
Effects	Reverses the respiratory depression and sedation and analgesia due to opioids
Dosing guidelines	40mcg increments every 2-3 min up to max 800mcg
Pharmacokinetics	Onset time: 1-2 min Peak effect time: 5- 15 min Duration of action: 20-60 min Metabolisation: hepatic Active metabolites: No
Adverse effects	**CNS**: Reverses analgesia effects, withdrawal symptoms in those dependant on opioids **CVS**: tachycardia, hypertension, pulmonary edema **RS**: nil significant **GIT**: nausea and vomiting
Special considerations	Since the half life is shorter than that of the opioid, repeated doses may be necessary, or even an infusion

FLUMAZENIL	
Mechanism of action	Benzodiazepine antagonist
Effects	Reversal of sedation Reversal of paradoxical agitation with benzodiazepines
Dosing guidelines	0.1 mg increments every 1min up to max 1mg
Pharmacokinetics	Onset time: 1-3 min Peak effect time: 6-10 min Duration of action: 40-60min Metabolisation: hepatic Active metabolites: No
Adverse effects	**CNS**: Anxiety, tremors, may precipitate seizures in those dependent on benzodiazepines **CVS**: nil significant **RS**: nil significant **GIT**: nausea
Special considerations	Since the half-life is shorter than that of the benzodiazepine, repeated doses may be necessary, or even an infusion

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All the information contained in this booklet accompanying the SPS course is from the references below which have been categorised to allow ease of use.

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