GUIDELINES FOR THE ADMINISTRATION OF SEDATION AND ANALGESIA IN MECHANICALLY VENTILATED CHILDREN

PURPOSE:
To outline the management of sedation and analgesia in critically ill children receiving mechanical ventilation.

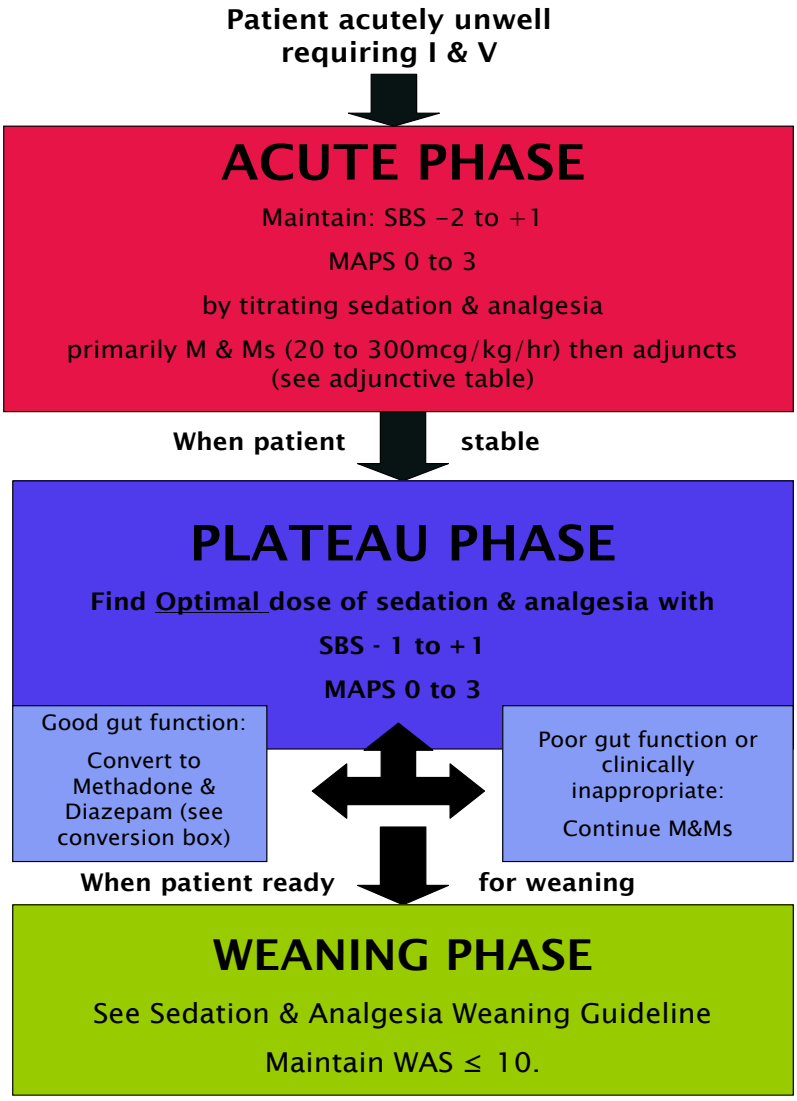
BACKGROUND / SUPPORTIVE DATA:
Sedation and analgesia are necessary components of the care of all critically ill children, especially those requiring mechanical ventilation. The main indications for the use of sedation and analgesia include: to reduce pain and discomfort, to reduce anxiety and agitation, to induce amnesia, to facilitate mechanical ventilation, to prevent the displacement of endotracheal tubes, and to decrease cellular metabolism. The consequences of prolonged use of sedative and analgesic agents in the PICU patient include central nervous system activation, gastrointestinal disturbances, and sympathetic hyperactivity. These signs and symptoms have been related to tolerance and withdrawal phenomena and hold implications for the patient's physical and psychological well being as well as health care costs.

Tolerance is one of the major reported adverse effects associated with continuous benzodiazepine infusions. Tolerance may be defined as a decrease in the effectiveness of a drug after prolonged use or as the requirement of larger doses to achieve the same effect. This phenomenon is due to an adaptation of neuronal cells and not a change of metabolism of the drug. One method of addressing this adverse effect, drug tolerance, is to recognise its occurrence and introduce alternative sedation agents titrated to an accepted sedation level.

A second adverse effect of the prolonged use of analgesic and sedation agents is withdrawal or abstinence syndrome. In paediatric patients, withdrawal syndrome is due to the development of tolerance to sedation and analgesic drugs not dependence or addiction. Studies have shown a strong positive correlation between large total doses of midazolam and the occurrence of withdrawal symptoms. Local, national and international audits have all shown that drug tapering is conducted in very few patients and that most patients have their sedation and analgesic agents abruptly discontinued. Thus, the incidence of withdrawal symptoms may be related to the infrequent tapering of sedation and analgesic agents.

There exists a plethora of literature discussing the adverse effects of sedation and analgesia in the critical care environment, particularly its prolonged use. There appears to be a consensus about the need and benefits of a systematic and coordinated approach to sedation administration, tapering and titration in the PICU.

SUMMARY OF SEDATION ALGORITHM:



EVIDENTIARY TABLE:

Strategy	Evidence
Use of protocol	The use of protocol directed sedation can reduce the duration of mechanical ventilation, ICU and hospital stay and can result in safe, cost-effective improvements.[1-5]
SBS – Sedation Scale	Reliable and valid scale for use in paediatric critical care.[6-8]
PICU MAPS – Pain Scale	Reliable and valid scale for use in paediatric critical care, particularly pre-verbal children.[9-12]
Withdrawal Assessment Scale	Combination of validated tool and Great Ormond Street Hospital protocol[13-18]
Accumulative dose	Up to 300 mcg/kg/hr for Midazolam
Weaning timeframes	[13, 19]
Mandatory review	[20]
Conversion to oral drugs	Diazepam, Methadone [24-26]

SUGGESTED PHARMACOLOGICAL TREATMENT OF PROCEDURAL PAIN AND DISCOMFORT:

Drug Group	Drug	Indications	Evidence
Topical Local Anaesthetic	Angel Cream EMLA	PIV/IAL insertion Venepuncture Arterial Stab Portacath access Lumbar puncture* CVL/ICC insertion*	[1-5]
	Lignocaine 2% & Chlorhexidine 0.05%	IDC insertion	[6, 7]
	Lignocaine 4%	Bronchoscopy*	[8, 9]
Sub-cutaneous injection	Lignocaine 1%	ICC/CVL insertion*	[2]
Disassociative Agent	Ketamine	CVL/ICC insertion Gastroenterology procedure Bronchoscopy Bone marrow aspiration Wound management procedure	[10, 11]
Short acting anaesthetic agent	Propofol	CVL/ICC insertion Gastroenterology procedure Bronchoscopy Bone marrow aspiration	[10, 12]
Short acting sedative & analgesic agent	Morphine & Midazolam	ETT Suctioning Movement/Position change	[30]

* used in conjunction with other drugs

SUGGESTED NON-PHARMACOLOGICAL MEASURES FOR OPTIMISING PATIENT COMFORT

Treatment	Evidence
Positioning & body support	[13-16]
Reassurance by staff and/or parents	[14]
Minimise discomfort of invasive devices (e.g. ETT, CVLs, and drainage tubes).	[14]
Optimise hydration, nutrition, essential cares (e.g. mouth, eye).	[17-19]
Massage, or rocking	[20, 21]
Swaddling	[22-24]
Non-nutritive sucking	[25-27]
Decrease external stimuli (noise, light, movement or handling)	[15, 28, 29]
Music therapy	[20]

SUGGESTED ADJUNCTIVE PHARMACOLOGICAL THERAPIES FOR MAXIMISING PATIENT COMFORT

Drug	Approach	Evidence
Propofol	2.5-3.5mg/kg stat then 7.5-15mg/kg/hr[30] ; 4-6mg/kg/hr[31]	[30-34]
Morphine	20mcg/kg prn	[30]
Midazolam	20mcg/kg prn	[30]
Ketamine	1mg/kg/hr	[30, 32, 33, 35]
Chloral Hydrate	25mg/kg q6h[36] maximum 5g	[35, 36]
Fentanyl	If allergic or renal failure 5-10mcg/kg/hrl	[30, 34, 35]
Promethazine	Oral 0.5mg/kg q6h Maximum 1mg/kg	[37]
Chlorpromazine	0.25-1mg/kg/q6-8h	
Clonidine	3-5mcg/kg q8h	[30, 35, 36, 38]
Haloperidol	0.1mg/kg- 0.1mg/kg q12h	[39]
Phenobarb	5mg/kg/day	[36]
Paracetamol	90mg/kg/24hrs- accumulation in hepatotoxic in pts with impaired LF-	[30]
Codeine	Max 1mg/kg/dose	[30]
Ibuprofen	10mg/kg q6h Precautions- asthma, renal impairment, under 6mths	[30]

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