

Emergency Centre-based paediatric procedural sedation: current practice and challenges in Cape Town

A Burger^{a*} , PW Hodkinson^b and LA Wallis^c 

^aDepartment of Anaesthesia and Perioperative Medicine, University of Cape Town, Cape Town, South Africa

^bDepartment of Surgery, Division of Emergency Medicine, University of Cape Town, Cape Town, South Africa

^cJoint Division of Emergency Medicine, University of Cape Town, Cape Town, South Africa

*Corresponding author, email: docmail@mweb.co.za



Background: The aims and objectives of this survey of the current practice of doctors working in Emergency Centres (ECs) in the Cape Town metropole was to assess clinical practice and attempt to identify obstacles to the practice of paediatric procedural sedation and analgesia (PPSA). This was considered essential to establish a baseline for quality assurance purposes and improvement.

Methods: After institutional ethics approval, a cross-sectional descriptive study was performed in 25 ECs in both private and government sectors in Cape Town. Specific aspects of PPSA practice were analysed after the anonymous completion of a specifically designed questionnaire, by full-time doctors working at each EC. The doctors' grade and training, practice preferences, medication and use of monitoring, and any perceived challenges to performing PPSA were assessed.

Results: Sixteen ECs agreed to be part of the study and 62 questionnaires were completed (a 64% response rate). Procedural sedation and analgesia was performed at all the participating ECs, by medical practitioners of varying experience. Doctors' awareness of unit protocols was inconsistent. Common indications were orthopaedic interventions, radiological investigations and surgical procedures. Medications used were similar in the responding units, but dosages varied. Monitoring was poor compared with local and international standards. The obstacles reported predominantly related to a lack of training and formal protocols.

Conclusions: This study was the first to evaluate the practice of Emergency Centre paediatric procedural sedation and analgesia practice in a South African setting. The lack of a formal system of training and accreditation, for both doctors and facilities, and the need for institutional and nationwide PPSA guidelines were highlighted.

Keywords: Cape Town, paediatric, procedural sedation analgesia

Introduction

Children often present to the Emergency Centre (EC) with injuries or conditions that require interventions for diagnosis or treatment which are potentially painful or unpleasant for a child. Procedural sedation and analgesia (PSA) is the technique of administering sedatives or dissociative agents, with or without analgesics, to induce a state that allows the patient to tolerate unpleasant procedures whilst maintaining cardiorespiratory function.¹

Paediatric procedural sedation and analgesia (PPSA) in the EC is internationally recognised as a safe and effective means to facilitate early appropriate medical care,^{2–5} and can alleviate waiting times for the definitive care of many conditions. With the establishment of Emergency Medicine as a specialty in South Africa in 2008,⁶ procedural interventions are increasingly being performed in ECs.⁷ There are no published articles surveying South African EC-based PPSA practice.^{2,7} The findings of adult-based studies might not be relevant to PPSA, as children differ anatomically, physiologically and emotionally from adults.⁸

Many ECs in South Africa are staffed by non-specialist doctors who practice PSA in children and adults.^{2,7} It was considered essential to evaluate the practice of a spectrum of doctors in ECs, to establish their training levels, their use of protocols, the indications for PPSA, the techniques used and whether there were any challenges to safe practice. With the baseline

practice established, areas of improvement could be addressed. A study was therefore undertaken to survey the current practice of PPSA of a spectrum of doctors in state and private ECs in Cape Town.

Methods

In the absence of any standard validated questionnaire in the literature, a questionnaire was specifically designed for the purpose of this survey, which reflected the various aspects of the local practice of PPSA (see Supplementary Data). Fifteen private and 10 state ECs were identified that accept paediatric patients routinely, 24 hours a day, and always have a doctor on site. The staff numbers were provided by the lead clinician of each EC. Doctors were graded as senior (Specialists or Heads of Unit), middle (Registrars, Medical Officers and General Practitioners), and junior grade (Community Service Doctors and Interns). Approval was obtained from the Human Research Ethics Committee of the University of Cape Town (UCT HREC 176/2010), before questionnaires were distributed. The study was conducted in 2011–2012. Anonymity was maintained as regards the data. The doctors' grade and training, practice preferences, medication and use of monitoring, and any perceived challenges to performing PPSA were assessed.

Data were captured on a Microsoft Excel (Microsoft Corp, Redmond, WA, USA) database and analysed by descriptive statistics. The frequency and percentage of each variable addressed in the questionnaire was calculated. The proportions of doctors

performing PPSA in state and private practice were compared. In addition, the influence of the grade and experience of doctors on whether PPSA was employed was examined. For these comparisons, Fisher's exact test was used. Statistical significance was defined at $p < 0.05$.

Results

Respondents

Full results were obtained from 16 of 25 (64%) ECs, of which 8 of 15 (53%) were private and 8 of 10 (80%) state hospital practice. There was no difference in the proportion of respondents in the state and private sector (47 of 98 [46%] versus 15 of 32 [47%] respectively). The majority of respondents (54 [87%]) reported performing adult PSA. A larger number (60 [97%]) reported performing PPSA. Of the respondents who perform PPSA, only 33% do this on a regular basis, as defined in the questionnaire (four or more times per month). Two provider factors were assessed: the grade of the doctor, and their sector of work (state or private hospital). There was no difference in the proportion of respondents in the three grades of clinician ($p = 0.051$), or in the proportion practising PPSA in the two sectors ($p = 0.572$).

Training and protocols

The majority (51 [82%]) of doctors had had no formal training; the balance had attended a sedation course. The majority (53 [85%]) reported what they regarded as acceptable competency in PPSA. Respondents were not all aware of the presence of a unit protocol for PPSA. A clear protocol existed in seven of eight private ECs, and in only three of eight state ECs. Most (83%) respondents reported that they would adhere to a protocol if it were available.

Specific indications for PPSA

Orthopaedic interventions (fracture manipulation and joint reduction) were the largest category, followed by sedation for radiological studies, surgical procedures (laceration repair, incision and drainage of abscess, insertion of chest drain, and burn care) and medical cases (general pain and anxiety, establishment of central venous access, lumbar puncture). [Figure 1](#)

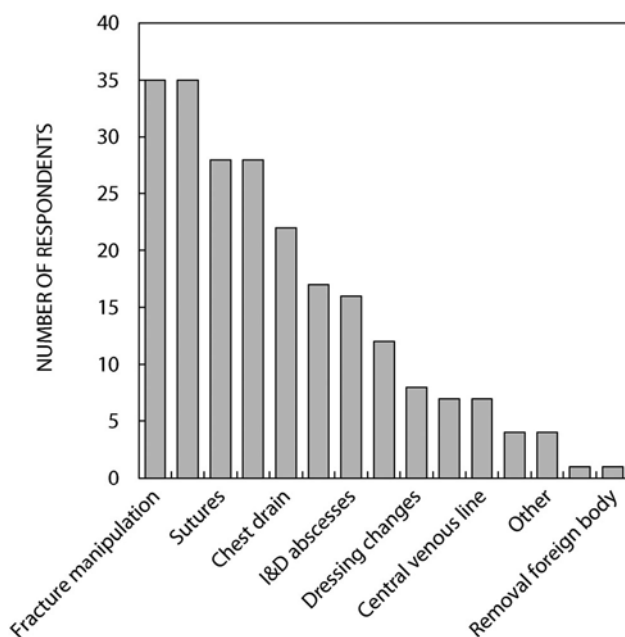


Figure 1: Specific indications for PPSA.

shows the specific indications and the number of respondents performing sedation for each indication.

Medication technique

The medications used were similar across all ECs, and are shown in [Figure 2](#). Nitrous oxide was not used in the ECs studied. The route of administration was dependent on the class of medication being used. Some 75% of respondents preferred the intravenous route for PPSA. The dosages of the medications varied widely, with many doctors using standard fixed doses rather than a weight-based dose. This led to a large variation in the medication dosages per kilogram. The pattern of usage followed convenience: doctors were comfortable using those medications with which they were familiar (77%), perceived as safe (60%), were readily available (52%) and easy to use (36%).

Details of doses used, administered as mg/kg by all but five practitioners, appear in [Table 1](#).

Patient monitoring and resuscitation equipment

The majority (59 [95%]) of respondents described the use of some form of monitoring during PPSA. Three clinicians (5%) did not monitor the effects of sedation. [Figure 3](#) demonstrates the variation in the use of monitoring. Nineteen (31%) monitored patients at a level considered adequate by national and international standards.^{1,9-12} Supplemental oxygen was routinely used by 41 (66%) doctors.

There was a similarity between state and private practice ECs with regard to staff available to monitor patients. In total, 50% of respondents employed a nurse as an assistant. No private practice EC doctors routinely employed an additional doctor to monitor the patient, compared with 8 (17%) in state practice. A similar number of doctors in the state and private sectors (12 and 16% respectively) employed either a nurse or a doctor, or both. Single practitioner PPSA was performed by six (12%) and two (16%) in the state and private sectors respectively. All respondents reported the immediate availability of a resuscitation trolley when performing PPSA. The contents of the trolley varied, but resuscitation equipment necessary for airway, breathing, circulation and advanced life support resuscitation was present in 86% of cases.

Fasting

Thirty respondents (48%) applied a 4–6 hour rule of fasting prior to commencing PPSA. Twenty-one (34%) did not have an established fasting rule.

Challenges and obstacles

The greatest hindrances to performing PPSA, as perceived by the doctors, were the operator-dependent factors (training and ability), following by equipment and staffing ([Figure 4](#)).

Discussion

Emergency Medicine training produces emergency physicians who have acquired the skills of airway management and critical care, and who have achieved familiarity with the use of a variety of sedative and analgesic medications. These are the core skills required for the practice of PSA, and are considered an important component of the day-to-day practice of emergency medicine.¹³ Internationally, an increasing number of procedures are being performed outside the operating theatre, commonly in the EC.¹⁴ The PSA administered is often reported as being sub-optimal with respect to guidelines, documentation and training,^{15,16} and there is a lack of data on patient satisfaction.¹⁶

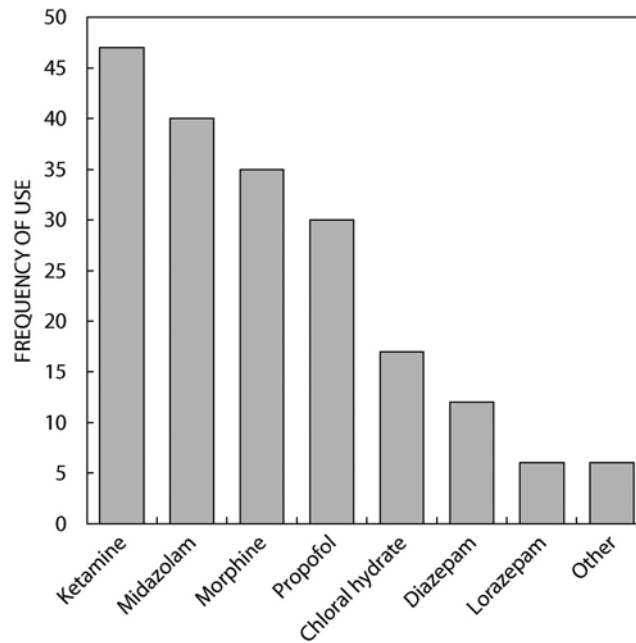


Figure 2: Frequency of use of preferred medications.

There are established international guidelines, as well as an increasing body of literature examining PPSA.^{8,14} In South Africa there are two current PSA guidelines: the Emergency Medicine Society of South Africa (EMSSA) 2009 guideline,¹² which is not paediatrics-specific, and the South African Society of Anaesthesiologists (SASA) 2010 paediatrics-specific guideline,¹⁰ which was updated in 2015.¹¹ Although paediatric dental chair sedation has been audited in South Africa,¹⁷ there has been no formal audit of doctors performing Emergency Centre-based PPSA. Our study has exposed inadequate utilisation of available training and protocols in EC-based PPSA in South Africa, and highlighted some obstacles to practice.

Training and protocols

Training in paediatric sedation was started at the University of Stellenbosch (US) in the year 2000, continued at University of the Western Cape (UWC) in 2004, and has been offered at the Department of Anaesthesia of the University of the Free State (UOFS) from 2017. A formal, accredited system of training has been available since 2000. A Postgraduate Diploma and a Master's Degree in Sedation and Pain Control are available at US and UWC respectively. There is a formal system for voluntary accreditation for both facilities and doctors, approved by SASA and SOSPOSA (Society of Sedation Practitioners of South Africa), which is a special interest group of SOSPOSA.

This study showed that all the respondents in the private sector perform both adult and paediatric PSA, whilst in state ECs only 72% of the doctors practise adult PSA, and 83% PPSA. This differs slightly from an earlier study on adult patients,⁷ which reported that 60% of doctors practice PSA in state ECs and 88% in the private sector. This difference may be due to the evolution of the speciality of EM, as well as subtle differences in study design.

Although most respondents indicated a willingness to follow PPSA guidelines, very few protocols or care guidelines were in place at the surveyed ECs. These data are similar to those from the previous study on adult practice,⁷ and indicate little progress

in this regard. Minimum standards for those performing PPSA are that they should be trained in the practice of sedation, be familiar with the medication and monitors used, and at least one participant in each case should be certified in Advanced Life Support.^{1,9-13,18} Few respondents had had any formal training in sedation, and a minority had recent certification in Advanced Life Support courses. Credentialing and training of doctors for PPSA was infrequent, but the reasons were not explored in this study. The high level of self-assessed competency by the respondents was subjective, and a matter of concern, especially in view of clear guidelines on training by SASA.

The lack of formalised assistance protocols is a concern, since it is regarded as standard of care for all but the lightest sedation to have one doctor administer sedation and monitor the patient, while another performs the procedure.^{8-13,15,19} We did not assess the level of nurse training in this survey, but one South African study found that the majority of nurses in their survey had no Basic Life Support qualification.²⁰

Indications for specific procedures

The majority of respondents indicated performing PPSA for orthopaedic and surgical procedures, such as fracture reduction and laceration repair. This is in line with international data, where trauma procedures dominate.^{3,21} Whilst PPSA is required for these obviously painful procedures, frequently performed minor painful interventions such as heel pricks, intravenous catheter placement and injections were not reported in the present study. These have been noted as mostly being performed without analgesia,¹⁵ and there is a need for further studies in this regard to evaluate practice and guidelines in South Africa. Patients who are anxious or those with special needs might be under-recognised and therefore under-treated, in keeping with international evidence.¹⁵

Medication technique

It is important to establish a specific individualised care approach with PPSA, so that an appropriate drug or combination can be selected. The choice of sedation technique depends on

Table 1: Drug dosage ranges used by respondents

Drug	Respondents/62	Mean dose mg/kg	SD	Range	
Ketamine					
IV	40	1.58	0.75	0.50	3.00
IM	10	3.28	2.09	0.75	8.00
PO	1	5.00	–	5.00	5.00
Midazolam					
IV	33	1.02	2.52	0.04	10.00
IM	1	0.50	–	0.50	0.50
PO	5	0.31	0.23	0.10	0.60
I/N	4	0.54	0.32	0.30	1.00
Morphine					
IV	31	2.87	4.08	0.08	15.00
I/N	1	0.30	–	0.30	0.30
IM	1	10.00	–	10.00	10.00
Propofol	21	1.93	1.98	0.50	10.00
Chloral hydrate	16	53.75	11.73	25.00	75.00
Diazepam	10	3.38	4.32	0.10	10.00
Lorazepam					
IV	3	0.06	0.01	0.05	0.08
IM	1	2.50	–	2.50	2.50
PO	2	0.55	0.64	0.10	1.00
Other	6	1.00	0.00	1.00	1.00

the target level of sedation, the exact nature of the procedure, any contraindications or side effects, and patient preference.¹⁹ In this study, the nature of the procedure was seldom a factor in deciding which medication was used, and yet this is an integral part of planning for PPSA and reducing risk. This may reflect the widely varying level of training and specialty education within the ECs surveyed. Formalised training and credentialing for PPSA would mitigate this by entrenching more appropriate assessment and planning. Our respondents reported using mostly ketamine, midazolam, morphine and propofol for PPSA, which is similar to international practice.^{3,8,13,18,19,21} Aspects of

local practice that appear deficient include limited use of short-acting opioids, nitrous oxide and sevoflurane.

Knowledge of the different medications available for PPSA seemed limited, as many doctors chose the same drug or combinations for all procedures. There is a measure of safety associated with this practice, in that doctors rely on their familiarity with only one or two different medications. However, these medications might not always be appropriate for all cases, and a protocol could prove helpful. Dosages of medications, usually administered in mg/kg, varied considerably. This might

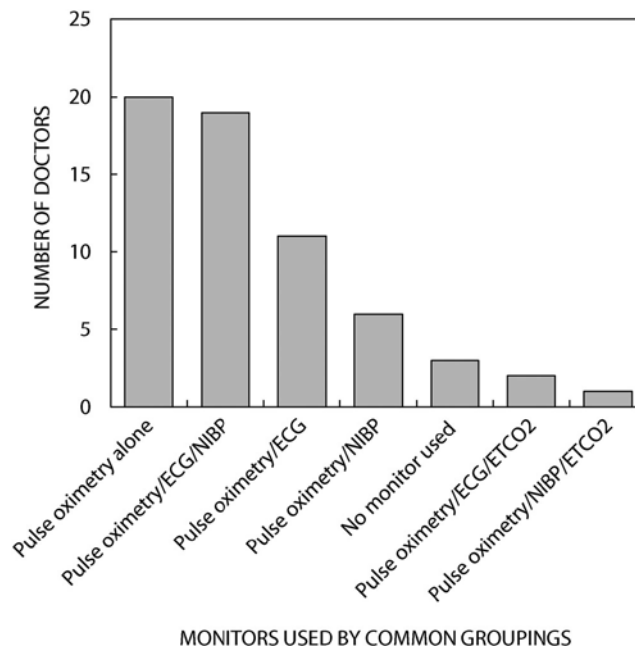


Figure 3: Patient monitoring.

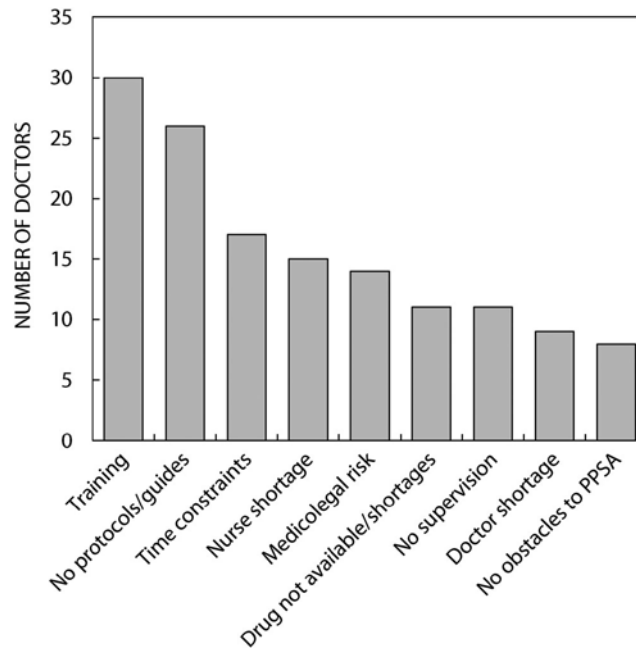


Figure 4: Obstacles to performing PPSA.

reflect the self-reported lack of training and awareness of established protocols.

Patient monitoring and resuscitation equipment

The common risks of PSA are inadvertent deep sedation with loss of protective airway reflexes, respiratory depression and cardiovascular depression.⁹ These risks are higher in paediatric patients, where there are different anatomical, physiological, pharmacokinetic and pharmacodynamic considerations.⁹ There should be appropriate staffing, equipment and monitoring to detect and manage these events. International standards of PPSA require a suitable area, complete with resuscitation equipment and vital signs monitors.^{9-12,19} The majority of doctors used monitors, with only 3% of respondents not using any monitoring during PPSA. The most commonly utilised monitoring equipment was pulse oximetry, but this alone is inadequate, as it is associated with a delayed detection of hypoventilation, apnoea or airway obstruction. A low rate of respondents reported using capnography in this study. Nasal capnography is widely recommended for early detection of hypoventilation, in addition to clinical observation and oxygen saturation, during PPSA.^{1,10-12} Cost is a factor requiring consideration in resource-poor environments, where capnography may not be readily available.

A concern was that a resuscitation trolley was absent in 10% of cases during PPSA. The equipment listed as being present on the trolley was sufficient to deal with any immediate life-threatening event. A further negative finding was the lack of immediate availability of flumazenil, while access to naloxone was generally unrestricted.

Mandatory accreditation of facilities and practitioners, as has been suggested by SASA Guidelines, could circumvent the problem of inadequate monitoring.

Fasting

Despite some suggestions for a strict "2-4-6" fasting rule for PPSA,⁹ there is a move towards more leniency in fasting

requirements for PPSA in emergency medicine guidelines.^{1,12,19} This move is supported by studies^{15,17,22,23} which suggest that the fasting status should to some extent be based upon the sedation method planned and the urgency of the case. Most of our surveyed group were conservative and preferred applying a six-hour fasting period.

Challenges and obstacles

The major pitfall in the practice of PPSA was identified by the respondents as their own lack of training. The other major deficiency was the lack of PPSA protocols. Time constraints were an important factor in private practice ECs, while limited capacity with respect to nurses and doctors were emphasised in state practice. The minor obstacles were related to equipment being outdated or broken, but only in the state ECs. Only 13% of respondents felt that there were no obstacles to PPSA in their EC. Only 3% were of the opinion that there was no need for PPSA in their EC. Medicolegal concerns were related to limited capacity in trained staff and equipment. PPSA was permitted in all ECs surveyed.

Limitations

This was a small study with a limited response rate. We did not control for reporting bias, and may not have had a fully representative sample. However, we believe that the results are likely to adequately reflect current practice.

We could not control for recall bias, and doctors may have misreported their training and expertise. In addition, this study was not designed to determine the adverse event rate; this should be the subject of a prospective audit in this field.

Conclusions

This study was the first to evaluate EC-based PPSA practice in a South African setting, using a specifically designed questionnaire. The level of formal training and accreditation of the doctors in PPSA was found to be inadequate, the use of sedation protocols was minimal, staffing numbers were inadequate and there was conservative application of fasting times. Classes of

medication varied and were deficient, dosing was inconsistent, and monitoring did not adhere to local and international standards. The challenges identified by the respondents should inform constructive changes in practice that will improve patient safety and comfort in PPSA.

The development of a nationwide EM-focused consensus PPSA guideline is a priority, to complement the recent paediatric sedation guideline for the non-emergency environment. The development of formal training and accreditation should be encouraged. Regular auditing processes, based on standardised sedation documentation and adverse event reporting, should guide protocol revision as further challenges are identified.

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ORCID

A Burger  <http://orcid.org/0000-0003-0523-2727>

LA Wallis  <http://orcid.org/0000-0003-2711-3139>

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