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SHORT REPORT

Procedural sedation and analgesia practices in the emergency centre

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ABSTRACT

Introduction: Procedural sedation and analgesia allows the clinician to safely and efficiently administer sedation, analgesia, anxiolysis and sometimes amnesia to facilitate the performance of various procedures in the emergency centre. The aim of this study is to determine current sedation practices, common indications and major obstacles in selected emergency centres across Southern Gauteng, South Africa, with a view to improving future standards and practices.

Methods: This was a prospective, questionnaire based, cross-sectional interview of emergency centre managers or their designee of selected private-sector and public-sector hospitals in Southern Gauteng.

Results: Overall, 17 hospitals completed the interview, nine (53%) public-sector and eight (47%) private-sector hospitals, with 36% of hospitals being aligned to an academic institute. All hospitals performed procedural sedation in their emergency centre. Forty seven percent of managers had between ten and 19 years of clinical experience post internship. Although eleven (64.7%) managers achieved a postgraduate qualification in emergency medicine, only seven (41%) were accredited with a Fellowship of the College of Emergency Medicine (FCEM) qualification and only three (17.7%) centres employed three or more specialists. The majority of centres (52.3%) performed between ten and 30 procedures per month requiring sedation. Staff training in the practice of procedural sedation was mostly obtained internally (52.9%), from in-house seniors. Essential drugs, procedure monitors, resuscitation equipment and protocols were all available in 70.6% of centres.

Conclusion: Although the safe practice and awareness of procedural sedation and analgesia in both public-sector and private-sector emergency centres in Southern Gauteng appears to be on the increase, there is still a need to enhance practitioner training and promote awareness of current local and international trends, protocols and recommendations.

African Relevance

- Widespread implementation of procedural sedation practices across Africa and other resource constrained environments may potentially reduce the burden on health care.
- The practice of procedural sedation may reduce operating theatre demands as well as reduce hospital admission rates.
- Awareness of the practice of procedural sedation and structured training programmes should be encouraged across Africa.

Introduction

Emergency medicine structures in South Africa were formally developed and first introduced in the late 1990's. The specialty was included in the list of recognised specialities in 2003 [1]. The first procedural sedation and analgesia guideline aimed at the emergency physician was published in 2009 by the Emergency Medicine Society of South Africa [2]. Procedural sedation is directed to facilitate the performance of various procedures whilst avoiding wide fluctuations in cardio-respiratory physiologic parameters and simultaneously maintaining protective airway reflexes. It allows the clinician to safely and efficiently administer sedation, analgesia, anxiolysis and sometimes amnesia [3–5].

The use of procedural sedation has been associated with a reduction in hospital cost as well hospital length of stay [6]. Due to the risks associated with the loss of airway control and other potential adverse events, the practice of procedural sedation was previously restricted to the operating room [7]. However, studies have demonstrated that procedural sedation can be safely and effectively performed by trained emergency physicians in the emergency centre (EC) with success rates

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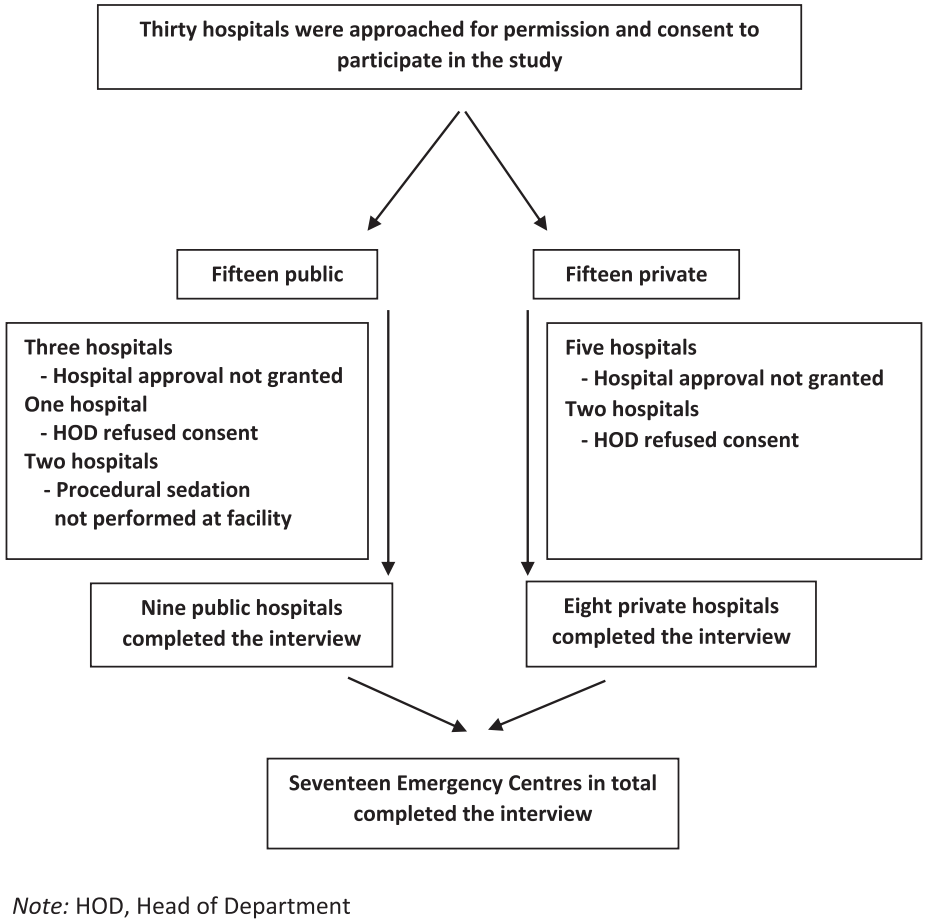


Fig. 1. Flow diagram illustrating the final study sample.

of up to 98.6% [8,9]. Emergency physicians have also expressed acceptance and satisfaction with regards to the practice of procedural sedation in the EC [5].

Various local and international guidelines provide clear objectives and indications as well as describe the preparation and method of procedural sedation in both adults and children [2,7,10–14]. Basic requirement for procedural sedation include; a high flow oxygen source, suction apparatus, airway management equipment, three-lead electrocardiography (ECG), pulse oximetry, non-invasive blood pressure (NIBP) monitoring, intravenous (IV) access, a defibrillator, appropriate drugs for resuscitation (including reversal agents) and adequate staffing [15]. Although capnography is useful [16,17], its current use is not routine [18,19].

Selection of the appropriate choice of drugs for procedural sedation is dependent on the type of procedure (non-painful procedures requiring immobilization, low-pain high anxiety procedures or highly painful procedures) as well as current patient physiology [5,15,20]. Commonly used drugs include: opioids (fentanyl and morphine), benzodiazepine (midazolam), ketamine, etomidate, propofol and nitrous oxide [21]. Due to their complementary synergistic activity, combination regimens are commonly used [22]. Patients must be closely monitored during the recovery period and should only be discharged to the care of a responsible adult once baseline cognitive and motor functions have returned back to normal [23].

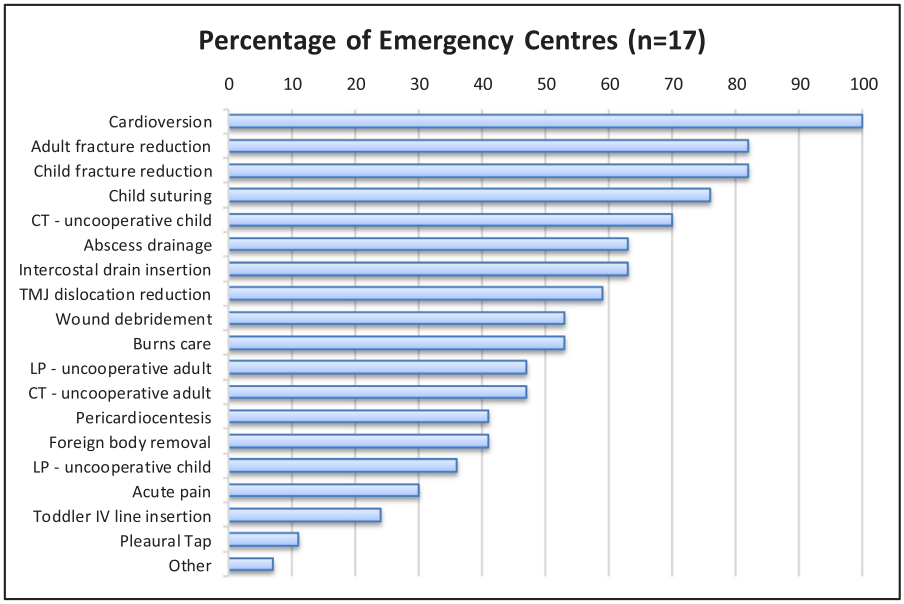
In South Africa, the specialty of emergency medicine is now an established discipline, with ECs being staffed with personnel that have endured extended training. Since procedural sedation is now likely practiced across many centres in South Africa, there is a need to ascertain whether practices are in keeping with current evidence based guidelines. This study was therefore aimed at determining current practices, common indications and major obstacles with regards to the practice of procedural sedation and analgesia in selected ECs based in Southern Gauteng. It is hoped that results from this study will improve and enhance the practice of procedural sedation in the EC.

Methods

This researcher-administered, questionnaire based, cross sectional study was conducted in 2015 during the month of March. It was structured to include at least 25% of the 32 public-sector and 32 private-sector hospitals situated in Southern Gauteng. Based on convenience and proximity to the study institute, 15 public and 15 private hospitals were approached for permission and consent to participate in the study.

The primary researcher, a medical doctor who had previously undertaken informal web based training on the methods of conducting a research interview, interviewed the EC manager or designee of all participating hospitals. Based on preference and availability of the unit manager/designee, interviews were either conducted face-to-face or telephonically. None of the interviews were subject to voice recording.

The questionnaire (Supplementary file), which had been adapted from a previous similar study [23], was based on the knowledge, attitudes and practice (KAP) model. It assessed the qualifications and experience of the EC manager, the experience of other clinical staff, the average number of patients that had required procedural sedation monthly, availability and awareness of a sedation protocol, training of staff, common indications, availability of an assistant, availability of a resuscitation room and the availability of a resuscitation trolley as well as essential drugs, items, consumables and various monitoring equipment.



Note: CT, Computed tomography; TMJ, Temporomandibular Joint; LP, Lumbar puncture

Fig. 2. Most common procedures performed under procedural sedation and analgesia in the emergency centres surveyed.

Ethical approval for this study was obtained from the Human Research Ethics Committee (medical) of the University of the Witwatersrand (clearance certificate no. M150406). Permission to conduct the study was obtained from the management of relevant hospitals. Informed consent was obtained in writing once the information sheet was read and the participating EC's manager/ physician representative agreed to complete the questionnaire by interview. Each centre was assigned an identification number that was only known to the researcher. Confidentiality was maintained at all times.

Data was entered into an electronic data spread sheet (Microsoft® Excel®) and exported to STATA 14 (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP) for analysis. A descriptive analysis of the data is presented in the results section. Frequency distributions have been described in the text and tabulated or presented in graphic format where appropriate.

Results

A total of 17 hospitals completed the interview. This comprised nine public-sector (52.9%) and eight private-sector (47.1%) hospitals (Fig. 1). Fourteen (82.4%) interviews were conducted face-to-face whilst three (17.6%) were conducted telephonically.

Two out of the 30 (6.7%) hospitals that were initially approached for permission were excluded from the interview process as procedural sedation was not performed in their EC. Both hospitals were non-academic public-sector facilities. Almost two-thirds (64.7%, n = 11) of EC managers had one or more postgraduate qualification in the field of emergency medicine. Qualifications included three managers (17.6%) with a Diploma in Primary Emergency Care (DipPEC), seven (41.2%) with a Fellowship in Emergency Medicine (FCEM) and three (17.6%) with a Master of Science (MSc) in Emergency Medicine. Amongst the managers, 76.5% (n = 13) had over ten years of experience post internship, but most of them (70.6%, n = 12) had less than five years of experience as an EC manager. The various grades of clinical staff employed at the various ECs included: emergency medicine specialist employed at eleven (64.7%), emergency medicine registrars at ten (58.8%), medical officers at all 17 (100%) and medical interns at 13 (76.5%) of the participating hospitals. Six out of the nine public-sector and one out of the eight private-sector hospitals that participated in the interviewed were designated academic hospitals aligned to the University of the Witwatersrand.

Most of the ECs that participated in the survey provided care to priority one patients (88.2%, n = 15) and had managed more than 2000 patients per month (64.7%, n = 11). Just over half the ECs (52.9%, n = 9) were staffed with three or more doctors per shift. Participating ECs performed procedural sedation more often in adults (ten out of 17 hospitals) than in children (six out of 17 hospitals). The ratio of adult to paediatric attendees at the various ECs was not determined.

Approximately four-fifths of ECs (82.3%, n = 14) performed procedural sedation on more than ten occasions per month, whilst almost as many centres (76.7%, n = 13) possessed a written unit protocol. In the majority of ECs (52.9%, n = 9), informal training with regards to the practice of procedural sedation was rendered by senior clinical staff, whilst only three ECs (17.7%) had arranged a formal training course for their staff.

In the majority (88.2%, n = 15) of hospitals, a dedicated health care practitioner was the assistant during procedural sedation. Also, 88.2% (n = 15) of units performed procedural sedation in a resuscitation area with immediate access to resuscitation drugs and equipment. In the remaining two hospitals, these procedures were carried out in a routine examination cubicle.

All units that completed the questionnaire had the availability of a resuscitation trolley during procedural sedation. The availability of various items and monitoring devices included; intravenous fluids and drip sets, a bag valve mask resuscitator, oxygen supply, 3-lead electrocardiography, non-invasive blood pressure monitoring and pulse oximeter at all centres. Resuscitation drugs, a suction apparatus, endotracheal tubes and at least one laryngoscopy set was available at 94.1% (n = 16) of ECs while 88% (n = 15) of ECs possessed a dedicated defibrillator device. Capnography was not available in the majority (n = 9, 53%) of the hospitals studied. Amongst the unavailable equipment, capnography (29%) and a mechanical ventilator (12%) were the most desired pieces of equipment.

Fig. 2 describes common procedures requiring procedural sedation in the ECs surveyed. Cardioversion (100%) and reduction of fractures (82%) were performed under procedural sedation in most of the ECs, whereas toddler intravenous line insertions and pleural taps (< 30%)

Table 1
Drugs used and route of administration during procedural sedation.

Drug	Route (n = 17)						
	IV	IM	PO	Rectal	Inhalation	Topical	Infiltration
Lignocaine							14 (82.3%)
Lignocaine/Prilocaine cream						10 (58.8%)	
Bupivacaine							2 (11.8%)
Ketamine	15 (88.2%)	13 (76.7%)	3 (17.6%)				
Propofol	14 (82.3%)						
Combination Ketamine/Propofol	4 (23.5%)						
Etomidate	10 (58.8%)						
Midazolam	16 (94.1%)	5 (29.4%)	5 (29.4%)	4 (23.5%)			
Clonazepam	1 (5.9%)	1 (5.9%)					
Lorazepam	2 (11.8%)	2 (11.8%)					
Diazepam	3 (17.6%)						
Morphine	12 (70.6%)	3 (17.6%)					
Fentanyl	9 (52.9%)	1 (5.9%)					
Tilidine			9 (52.9%)				
Tramadol	6 (35.3%)	6 (35.3%)	5 (29.4%)				
Paracetamol	7 (41.2%)		10 (58.8%)				
Ketorolac	1 (5.9%)	1 (5.9%)	3 (17.6%)				
Entonox					1 (5.9%)		
Methoxyflurane					1 (5.9%)		

IV, Intravenous; IM, Intramuscular; PO, Per Os (oral).

were not performed under procedural sedation in most of the ECs.

Seventy one percent (n = 12) of ECs routinely administered oxygen to patients undergoing procedural sedation. Where oxygen was not routinely administered, the decision was based on various factors that included: the level of oxygen saturation (17.6%, n = 3), the sedating agent used (17.6%, n = 3), the clinical condition of the patient (11.8%, n = 2) and the age of the patient (5.9%, n = 1).

Amongst the intravenous sedation drugs, midazolam was most widely available (94.1%, n = 16). The availability of other drugs included ketamine (88.2%, n = 15), propofol (82.3%, n = 14), morphine (70.5%, n = 12) and etomidate (58.8%, n = 10). With regard to intramuscular agents, ketamine (76.7%, n = 13) and tramadol (35.3%, n = 6) were the most widely available agents and paracetamol (58.8%, n = 10) and tilidine (52.9%, n = 9) were the most widely available oral agents. Lignocaine was the most widely utilised local anaesthetic agent (82.3%, n = 14) (Table 1).

With regard to the preferred sedating agent, ketamine was reported as the drug of choice in children in all the 15 hospitals where it was available. In haemodynamically stable adults propofol was the choice drug in eight (47.1%) of the ECs whereas, in potentially haemodynamically unstable patients (e.g. burns, cardioversion) etomidate was the agent of choice (58.8%, n = 10). Four (23.5%) ECs reported a combination of ketamine/propofol as their agent of choice. Eight (47.1%) ECs reported the use of various benzodiazepines for pre-sedation while the opioid class of drugs was used by twelve (70.2%) ECs for pain control. With regards to the choice of sedation agent, this was mostly influenced by clinician familiarity with the drug (n = 7, 47.1%), the presenting clinical scenario (29.4%), safety of the agent (17.6%) and cost (11.8%).

Discussion

There has been a reported increase in the awareness and practice of procedural sedation in the EC [24,25]. Although only 41% of ECs were managed by a specialist and a further 35.3% of EC managers had no postgraduate qualification, procedural sedation was performed in more than 90% of hospitals surveyed in this study. With appropriate training, studies have shown that procedural sedation can be safely and effectively administered by family physicians based in community hospital ECs [3] as well as by trained nurses [26]. In a study that surveyed 13 ECs in Cape Town, South Africa, procedural sedation was predominantly (95.8%) performed by junior to middle grade doctors [5]. Both doctors and nurses in this study predominantly received informal in-house training from their seniors. However, considering the possibility of adverse events and the potential medico-legal risk, structured formal training and credentialing in the practice of procedural sedation is recommended.

The current study also showed no obvious differences in the practice of procedural sedation between the various hospital types (private vs government, academic vs non-academic), which suggest an improvement from findings of the study by Hodkinson et al, where procedural sedation facilities were generally good in the private-sector, but poor in the public-sector. The difference was attributed to a lack of equipment, staff and protocols in public-sector facilities [5].

Possible reasons as to why procedural sedation was performed more frequently in adults than children amongst the centres surveyed may be because a) clinicians in those centres were less comfortable with the practice of procedural sedation in the paediatric population or b) those centres managed more adults that required procedural sedation.

Interestingly, written procedural sedation protocols were available in 70.6% of the ECs. In the study by Hodkinson et al, only 15.3% of ECs had written protocols [5], whilst another similar but later study that was also conducted in Cape Town, reported that 87.5% of private-sector and 37.5% of public-sector emergency centres had written protocols [27]. In a Korean study, institutional guidelines and protocols were only available in 20% of centres [28].

With regard to the availability of an assistant during procedural sedation, an assistant was available during more than 98% of the 51 cases that were included (compared to 88.2% of centres in our study) in a single centre study conducted at an EC based in Pretoria, South Africa. However, in 73% of cases, the individual responsible for post procedure monitoring had to also attend to multiple other tasks [29].

It is commendable that most types of resuscitation equipment and monitoring devices were present in the majority of hospitals. However, the non-availability of a dedicated defibrillator device in one centre and endotracheal tubes/laryngoscopy set in two centres is concerning, rendering these facilities unsafe for the practice of procedural sedation. The absence of capnography in 53% of centres in this study may also appear worrisome. Although capnography is an essential monitoring tool in the operating room for the early identification of respiratory depression [16,17], routine use of capnography during procedural sedation is debatable and is not an essential requirement in most guidelines [18,30]. Based on inconsistent or limited-quality patient-oriented evidence, capnography has been accorded a level B recommendation [23,31]. Barriers to the routine use of capnography during procedural

sedation include; lack of knowledge or comfort with the use of the device, lack of availability of devices and consumables, lack of inclusion in checklists and lack of a written policy [19]. However, a study reported that capnography more frequently identified the presence of respiratory depression that was missed by the treating physician during procedural sedation [32]. Since capnography is an expensive adjunct and is unlikely to be widely available in low-resource settings, monitoring of related parameters such as respiratory rate and pulse oximetry is an acceptable alternative [29].

Similar to the findings of Green and colleagues [33], cardioversion was the most widely performed procedure requiring procedural sedation. Since the harms and toxic effects of high concentrations of oxygen are well known [34], the routine administration of supplemental oxygen during procedural sedation (70.6% of ECs in this study) may be controversial. In two separate randomised controlled studies that included patients who underwent procedural sedation with the administration of either propofol [32] or midazolam and fentanyl [35], the routine use of supplemental oxygen was not associated with significant reductions in the number of hypoxic episodes.

Surprisingly, the combination of ketamine and propofol (Ketofol), was reported as the agent of choice at 23.5% of hospitals. A study concluded that Ketofol provided comparable sedation and superior analgesia (significantly lower perceived pain as measured by the visual analogue scale) when compared to the combination of midazolam/fentanyl [36]. There has been recent renewed interest, proving the safety and efficacy of inhaled methoxyflurane for pain control in the adult and paediatric age groups [37,38]. However, this was only available at one centre in this study.

Limitations of our study relate to the small study sample. To ensure an optimal response rate, interviews were conducted in person or telephonically. Recall bias could however not be avoided as some of the survey questions were likely subject to recollection of events by managers or their designee. Another limitation relates to the potential of reporting bias, as the opinion of unit managers and senior doctors may not have been an accurate reflection of doctors administering procedural sedation. Furthermore, interviews were not voice recorded and data relating to various quality markers such as pre-procedure consent, documentation of observations, post-procedure care, discharge criteria, overall outcomes or adverse event rates were not obtained.

It would be of interest to note the impact of procedural sedation on theatre case load, length of hospital stay and overall patient satisfaction. Widespread training and implementation of procedural sedation practices across Africa and other resource limited environments is likely to be of great value in this regard. It is hoped that results of this study will encourage other similar studies as well as improve procedural sedation practices across varying clinical settings.

Conclusion

Local practices of procedural sedation seem to be satisfactory but nevertheless still requires conscientious improvement to align with current international trends and recommendations. Hence, there is an ongoing need to enhance practitioners training, awareness of protocols and current indications for procedural sedation.

Authors' contributions

DW and AL conceived the original idea. DW collected the data. DW, AL and CE analysed the data, drafted the manuscript, reviewed the content and approved the final submitted version.

Conflicts of interest

The authors declared no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.afjem.2018.09.003.

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