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A Survey of Caudal Anaesthesia practice in an academic anaesthesia unit

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A Survey of Caudal Anaesthesia practice in an academic anaesthesia unit

Sepheu Letshokge Julius

A research report submitted to the Faculty of Health Sciences,

University of the Witwatersrand, Johannesburg,

in the partial fulfilment of the requirements for the degree of

Master of Medicine in the branch of Anaesthesiology

Johannesburg, 2022

Declaration

I, Sepheu Letshokge, herewith declare that this research report is my own, unaided work. It is being submitted for the degree of Master of Medicine at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.

Sepheu Letshokge Julius

Signed on this 22nd day of September 2022.

Dedication

This dissertation is dedicated to memories of my late brothers Ntipu Gibson Sepheu and Amporo Victor ‘Tampae’ Sepheu.

Presentations and publications from this research project

1. A poster will be presented at the Paediatric Anaesthesia Community of South Africa Congress (PACSA).
2. A manuscript will be submitted to the South African Journal of Anaesthesia and Analgesia for publication (SAJAA).

Abstract

Background

Caudal blockade is a means of providing intra and postoperative analgesia and minimises the sympathetic stress response to abdominal and lower limb surgery. Clear anatomical landmarks and ease of performing the procedure make it one of the most commonly performed regional techniques in the paediatric population.

Methods

A prospective, contextual, descriptive study was conducted between 2020 and 2021 on anaesthetists working in an academic anaesthesia unit. Data was collected anonymously through a digital questionnaire and participation was voluntary.

Results

The study sample is made up of 40 consultants and career medical officers (27%), 87 registrars (61%), 15 medical officers (10.6%) and two community service medical officers (1.4%). Plain bupivacaine at 2.5mg/kg was found to be the local anaesthetic of choice. Most participants,90 (63.1%), did not use an adjunct in their caudal blocks, with the risk of excessive sedation and risk of postoperative apnoea being the most frequently cited reasons. Where an adjunct was used, the alpha-2 agonists; clonidine (64.5%) and dexmedetomidine (53.2%) were chosen. The majority,122 (85.1%), anaesthetists acquired consent specifically for caudal blocks. Potential complications of caudal blockade, the duration of analgesia and the technique of the caudal block were frequently discussed with patients and their caregivers when obtaining consent. Use of ultrasound is not in widespread practice, and block failure was reported by 91 (63.8%) participants. Paracetamol was the most regularly employed rescue analgesia.

Conclusion

This study found that the academic unit's caudal blockade practice compared well with local and international literature. The use of adjuncts, ultrasound and caudal catheters is not a widespread practice, and clear guidelines may be beneficial in this regard. Use of standardised informed consent protocols may improve the patient and caregiver experience.

Keywords: *paediatric, anaesthetic practise, analgesia, caudal block*

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My wife Lintle Ntlou for her midnight prayers, and steadfast faith.

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LIST OF ABBREVIATIONS

MMED	Master of Medicine
FCA (SA)	Fellowship of College of Anaesthetists of South Africa
WITS	University of the Witwatersrand
HPCSA	Health Professions Council of South Africa
LA	Local Anaesthetics
SASRA	The South African Society of Regional Anaesthesia
PACSA	The Paediatric Anaesthesia Community of South Africa
SAJAA	South African Journal of Anaesthesia and Analgesia
FRC	Functional residual capacity
TAP	Transversus abdominis plane block
II-IH	Ilioinguinal - iliohypogastric block

Draft Article

Title: **A Survey of Caudal Anaesthesia practice in an academic anaesthesia unit**

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Keywords: *paediatric, anaesthetic practise, analgesia, caudal block*

Introduction

Paediatric analgesia is a constantly developing field, with multiple studies proposing guidelines on the prevention and treatment of perioperative pain in children. Since 1933, when Campbell first described caudal blocks performed in 87 children undergoing urological procedures, caudal anaesthesia has grown to become the mainstay of postoperative analgesia in infra-umbilical surgical interventions in children.[1] Neuraxial anaesthesia is accepted as an indispensable component of post-operative analgesia in children.

Caudal anaesthesia has an attractive safety profile, as it provides analgesia restricted to the site of surgery [2] impacting the patient's haemodynamic status to a lesser degree than intravenous analgesia alone. It has been noted that neuraxial anaesthesia not only provides effective intraoperative and postoperative analgesia but is also beneficial in modifying the neuro-endocrine stress response to surgery, thus facilitating earlier extubation after major neonatal surgery [3] and by extrapolation, may result in shorter hospital stays. It is associated with a motor block in a dose dependent manner,[4] and this may affect the balance between chest wall recoil, lung recoil, and diaphragmatic tension. It has been proven to significantly improve functional residual capacity (FRC) and the distribution of ventilation in mechanically ventilated children.[5] It involves inserting a needle through the sacral hiatus to deliver medication into the epidural space to achieve anaesthesia or analgesia, providing pain relief for surgery below the umbilicus for around six-eight hours, according to the Paediatric Anaesthesia Community of South Africa (PACSA).[6]

Caudal blockade is one of the most commonly performed neuraxial anaesthetic techniques in children. It can be used as the sole method of anaesthesia but is often combined with general anaesthesia, especially in paediatric patients where it may be technically challenging and ethically difficult to justify when performed on an awake child.

In the early stages, local anaesthetics were used alone in caudal blocks to achieve the analgesic effect; however, over the years multiple agents have been trialled as adjuncts to augment the analgesic effect and prolong the duration of the block. [7]

The aim and objectives of this study were to describe current caudal block practice in the WITS Anaesthesia department with regards to technique; choice of local anaesthetics used; preferred adjuncts; aseptic precautions; types of needles employed; assessment of successful block; and complications of caudal blockade.

We then sought to determine if differences in practice were impacted by years of anaesthetic experience, professional category, and special training in paediatric and/or regional anaesthesia.

Methods

A prospective contextual, descriptive study was conducted between November 2020 and May 2021 in the University of the Witwatersrand (WITS) Anaesthesia department. The study was approved by the WITS Ethics committee (M200856). Data was collected anonymously through a digital questionnaire sent to all 226 members in the department and participation was voluntary. The results were extracted from a Google ™ form into a Microsoft Excel™ spreadsheet for statistical analysis.

The department consisted of 90 consultants, distributed as 80 anaesthetists with a Fellowship of the College of Anaesthetists of South Africa (FCA) and/ or Master of Medicine in Anaesthesia (MMED) and ten career medical officers who function in a consultant capacity. There were 114 registrars and 22 medical officers. Participants were based in the three main teaching hospitals in the WITS circuit, namely Chris Hani Baragwanath Academic hospital, Charlotte Maxeke Johannesburg Academic hospital and Helen Joseph and Rahima Moosa Mother and Child Hospital complex, and registrars rotate through the three hospitals during their training. The sample size was calculated using RaoSoft™.[8]

The questionnaire was developed by the researcher and supervisors based on the available literature, as there were no previous studies similar in nature to this one. To ensure face and content validity, the questionnaire was evaluated by four senior anaesthetists with a special interest in paediatric anaesthesia who were affiliated with the WITS Anaesthesia department prior to being finalised. It acquired descriptive data such as years of experience in anaesthesia, special training in paediatric anaesthesia as well as the number of paediatric lists and caudal blocks performed per month. The authors sought to determine how this data influenced the conduct of caudal blockade,

choice of local anaesthetic drug and dose used, adjuncts employed, maintenance of sterility and the acquisition of informed consent.

The data was analysed using IBM SPSS version 25. A 95% confidence level was used, and statistical significance was set at a p-value of <0.05. To describe our data, we used frequencies and percentages for categorical data, and for continuous data, we made use of medians and interquartile ranges (IQR) if the variables were not normally distributed according to the Shapiro-Wilk test.

For the association between categorical variables and professional category, we used the Fisher's exact test for years of anaesthetic experience, number of monthly paediatric lists performed, and duration of caudal blockade without the addition of an adjunct. The Chi-square test was used for the rest of the categorical variables. To compare the relationship between continuous variables and our outcomes, we used the Kruskal Wallis test except for age and weight cut-off values, where the ANOVA test was used as these were normally distributed.

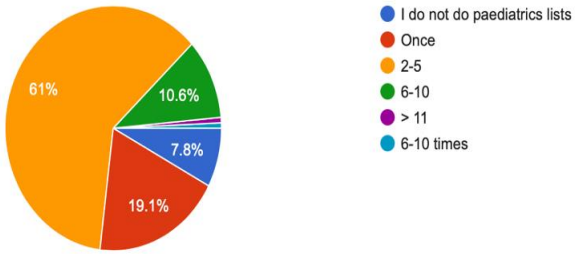
Results

A total of 143 people participated in the study, out of 226 departmental members, representing a 63.27% response rate. Two people were excluded in data analysis as they stated they have never conducted a caudal block in their anaesthetic practice. The sample consisted of 40 consultants and career medical officers (27%), 86 registrars (61%), 15 medical officers (10.6%) and two community service medical officers (1.4%). Forty three percent of anaesthetists had less than five years of anaesthetic experience, 34.8% had 6-10 years of experience, 9.2% had 11-15 years of experience and 12.8% had more than 16 years of anaesthetic experience, (Table 1). A statistically significant association was found between years of experience and the number of paediatric lists performed per month (p= 0.002), meaning that more senior anaesthetist were more likely to do paediatric lists than their junior colleagues, as demonstrated in table 1.

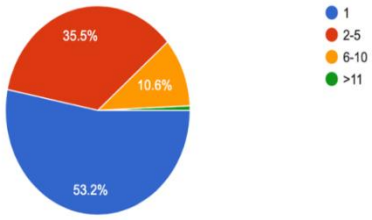
Table 1: Distribution of participants according to professional categories and number of paediatric lists versus years of experience

		Professional category			
Years of experience	Total numbers and percentages	Consultant and Career MO	Medical officers	Registrars	P value
	N =141	N = 40	N=15	N=86	
< 5 years	61(43.26%)	2 (5.00%)	13(86.67%)	46 (53.49%)	<0.001
6- 10 years	49(34.75%)	12(30.00%)	1(6.67%)	36 (41.86%)	
11-15years	13 (9.22%)	11(27.50%)	0(0.00)	2 (2.33%)	
>16 years	18(12.77%)	15(37.50%)	1(6.67%)	2(2.33%)	
	Number of years of experience				
Paediatric list	<5 years	6-10 years	11-15 years	>16years	P value
	n=61	n=49	n=13	n=18	0.002
none	7(11.48%)	0(0.00)	1(7.69%)	3(16.67%)	
once	18(29.51%)	5(10.42%)	3(23.08%)	1(5.56%)	
2-5	33(54.10%)	37(77.08%)	7(53.85%)	9(50.00%)	
6-10	3(4.92%)	6(12.50%)	8(15.38%)	5(27.78%)	

Despite 61% of respondents conducting 2-5 paediatric lists per month, 53.2% only performed one caudal block per month (Figure1). Paediatric lists are classed as theatre lists comprising patients under 18 years of age. These lists vary in nature: Neonatal, paediatric surgical, paediatric urological, paediatric neurosurgical, paediatric orthopaedic surgery and paediatric burns.



Number of paediatric lists performed per month



Number of caudal blocks performed per month

Figure 1. Number of paediatric lists per month vs number of caudal blocks performed per month

The majority of respondents (78.7%) have completed a paediatric anaesthesia rotation; 39% have completed a regional anaesthesia rotation; 21.3% have completed a dedicated ultrasound training course; 20.6% a regional anaesthesia training course or workshop; and 14.2% a paediatric anaesthesia regional training course or workshop (figure 2).

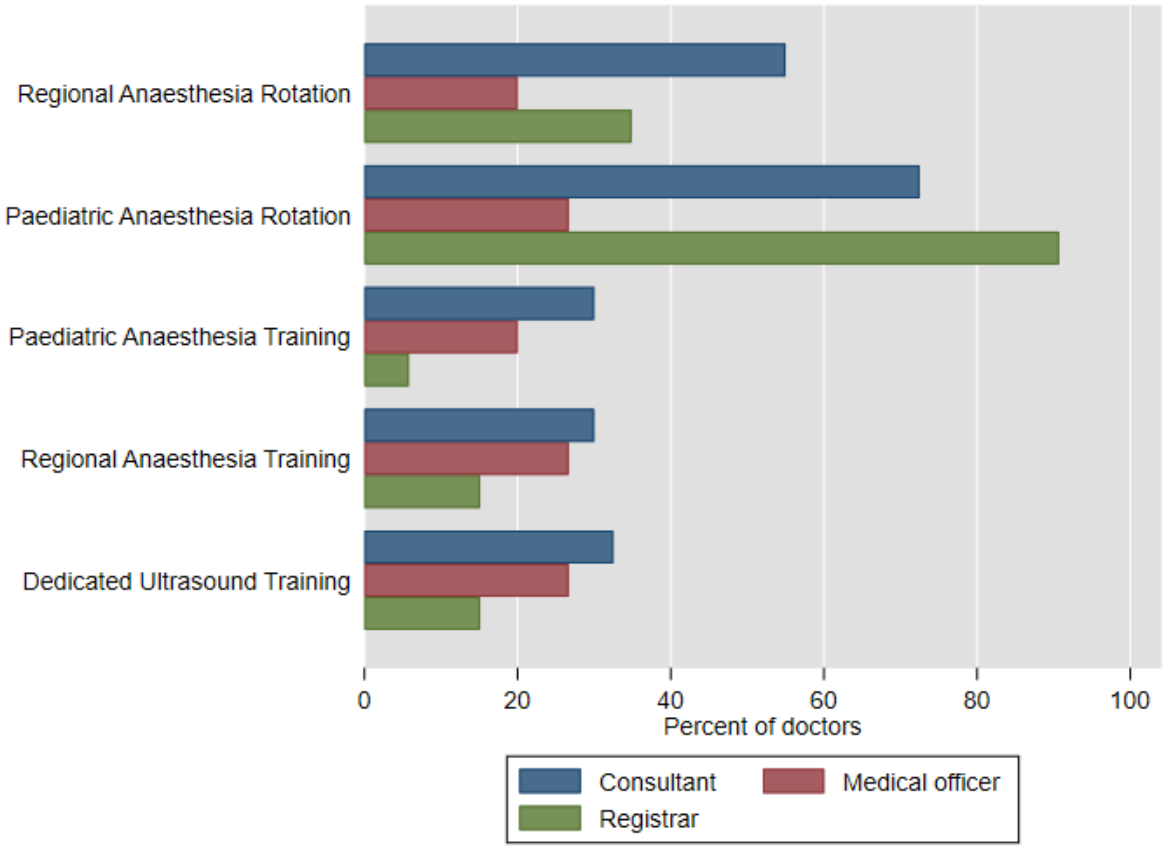


Figure 2. Distribution of professional category and special training relevant to caudal blockade

Most anaesthetists, 85.1%, acquired consent specifically for caudal blockade (figure 3). Consent regarding the technique of caudal blockade was discussed with the caregivers by 75.4% of those with less than 5 years of experience, 77.6% of those with 6-10 years of experience, all of those with 11-15 years of experience and half of those with more than 16 years of experience (p=0.014).

Discussion about level of expertise took place with parents or guardians by 27.5% of consultants, 10.7% of registrars and 26.7% of medical officers (p=0.035), while 97.5% of consultants, 79.1% of registrars and 73.3% of medical officers discussed possible complications of caudal blockade with the parents or legal guardians (p=0.017).

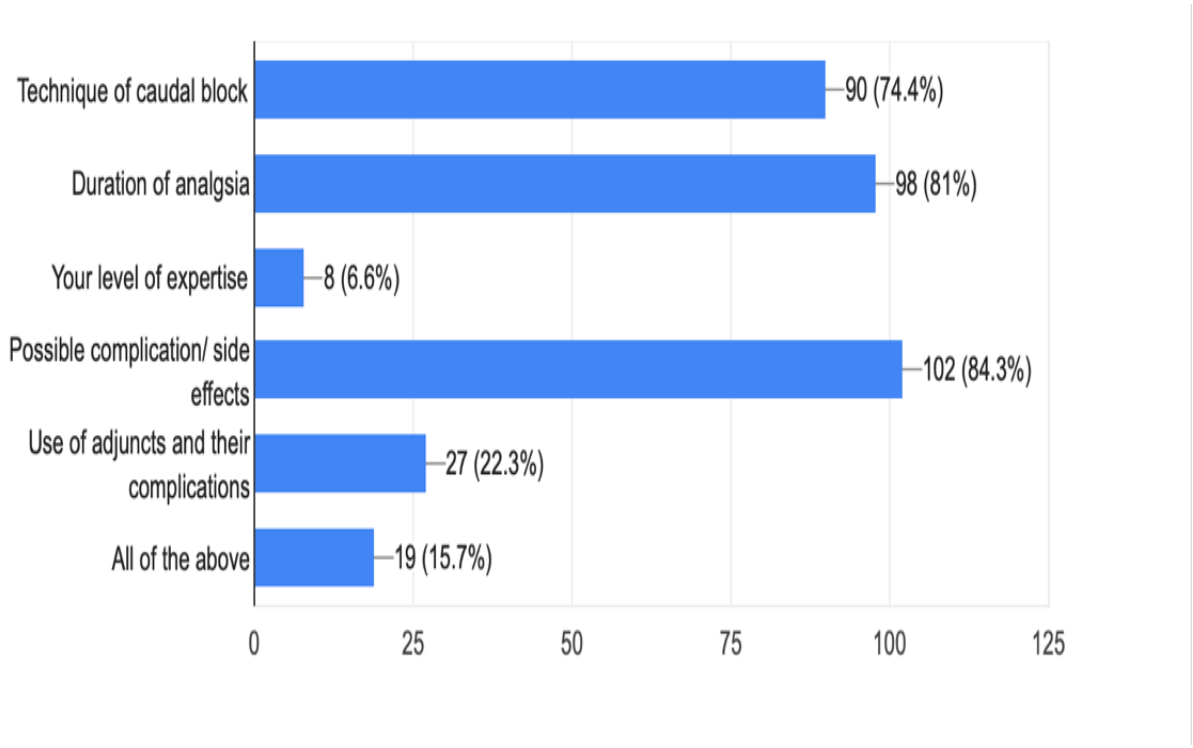


Figure 3. Components of consent discussed with parents/guardians

Regarding sterility, 76.8% of respondents made use of a strictly aseptic technique comprising of a sterile scrub, a mask, gloves, and gown, while 23.4% noted that they used sterile gloves and cotton balls soaked in alcohol. In particular, medical officers and registrars were more likely to adhere to a strict aseptic technique compared to their consultant counterparts. Ninety- three percent of medical officers and 82.6 % of registrars reported that they used a strict aseptic technique when performing caudal blockade compared to only 57.5% of consultants reporting the same (p=0.002). Forty two percent of consultants used sterile gloves and cotton balls soaked in alcohol to ensure sterility.

Plain bupivacaine was the most commonly used local anaesthetic. In this academic unit, a toxic dose of 2.5 mg/kg (IQR:2-2.5ml/kg) was used. The cut off age and weight chosen for caudal blockade was 7.43 years (+/-3.28) and 25 kilograms (+/-5), respectively. The median volume (IQR) guides to achieve sacral, lumbar, or thoracoabdominal caudal block were 0.5mL/kg (0.5-1.0); 1mL/kg (1.0-1.5) and 1.5mL/kg (1.25-1.5), respectively.

Just over half, 53.9%, of the study population employed caudal blockade for infra-umbilical surgery, while 46.1% noted that they employed caudal blockade for both supra and infra-umbilical

surgery. On further analysis, 70.5% of participants with less than five years of experience were likely to use caudal blockade for infraumbilical surgery only; compared to 42.8% of those with 6-10 years of experience; 38.5% of those with 11-15 years of experience; and 38.9% of those with more than 16 years of experience(p=0.007).

Regarding types of needles used to perform caudal bocks, 123 participants (86.5%) reported that they used caudal specific needles, 13 (9,2%) used cannulae and ten (7.1%) used hypodermic needles. Twenty percent anaesthetist with more than 16 years' experience report to use spinal needles. Caudal catheter usage was reported by 11.3 % of the sample population, who used the distance between the sacral hiatus and the desired dermatomal level of surgical incision to determine the depth of insertion of the catheter.

Nearly all the anaesthetists (99.3%) did not use an ultrasound to perform caudal blockade, citing inexperience in the use of ultrasound for caudal blockade (69.3%), preference for a landmark-based technique (41.4%), and ultrasound not being readily available (21.4%). The lack of availability of ultrasound affected decision-making in 18% of those with less than five years of experience, 32.7% of those with six to ten years of experience, 23.1% of those with 11-15 years of experience and 0% of those with more than 16 years of experience (p=0.029).

A considerable proportion of respondents (63.1%) did not use an adjunct in their caudal blocks, with the fear of excess sedation and risk of post- operative apnoea being the frequently cited reasons. Both clonidine and dexmedetomidine at one mcg/kg were commonly used by those who reported to use adjuncts in their practice (64.5% and 53.2% respectively). Seventy two percent of consultants noted that their caudal blocks had a duration of action of two to three hours without the addition of an adjunct, while 53.3% of medical officers and 48.8% of registrars thought it had a longer duration of action, four to six hours (p=0.013).

A combination of parameters were used to determine the success of the caudal block intraoperatively (figure 4). Ninety two percent of consultants, 80% of medical officers and 100% of registrars made use of a reduction in additional intraoperative analgesia requirements as a marker of caudal blockade success (p=0.001).

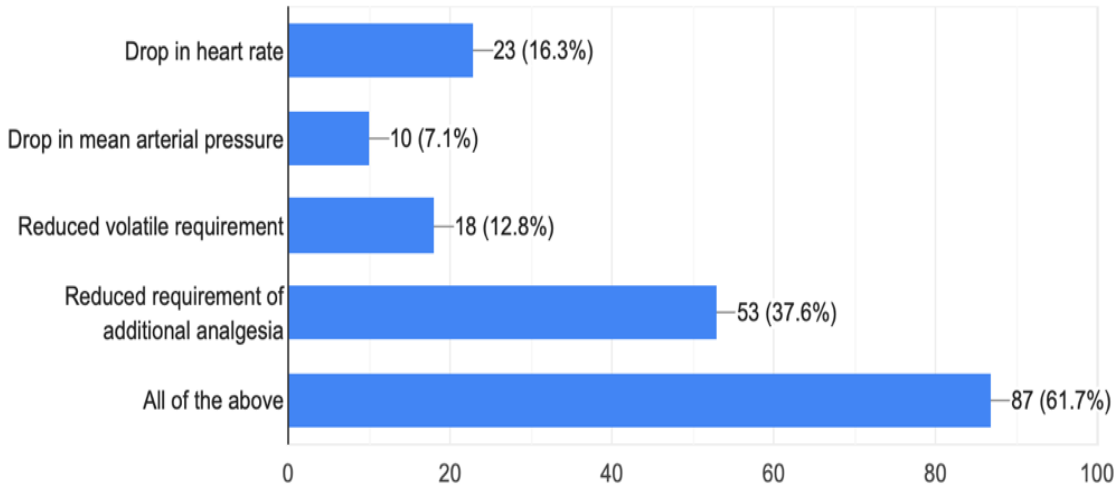


Figure 4: Determination of intraoperative success of a caudal block

The frequently reported complications of caudal blockade are depicted in figure 5. Block failure was a complication reported by 63.8% of respondents. Other commonly observed complications were hypotension, reported by 21.3% of respondents, and bradycardia, reported by 11.3%.

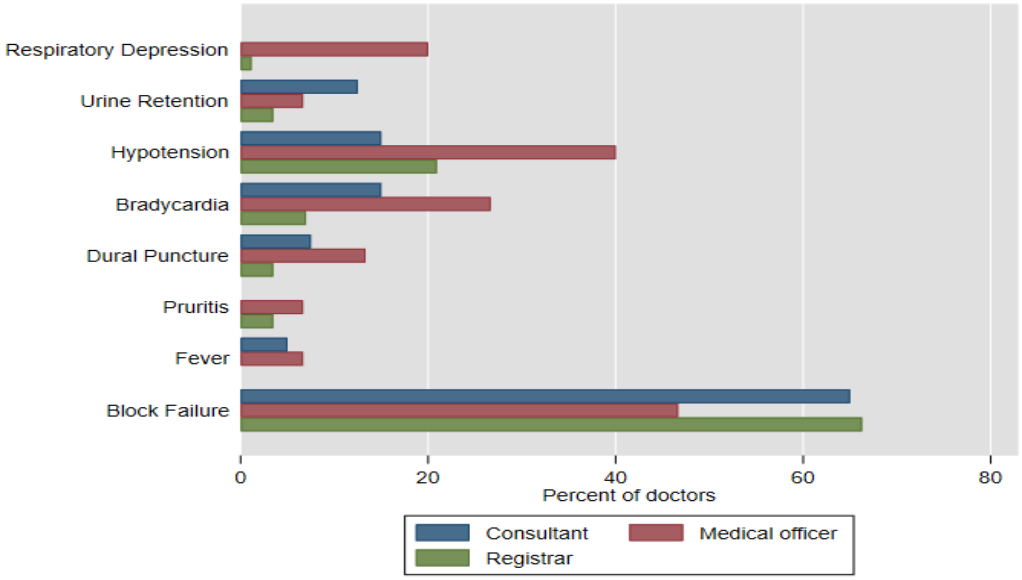


Figure 5: Complications of caudal blockade by professional category

Regarding safe discharge from the post anaesthesia care unit, 42.6% of respondents used time in recovery of greater than 30 minutes as their sole discharge criteria. The child moving lower limbs and passing urine were used by 32,6% and 16.3% of respondents respectively and 40.4% required all three criteria to be met before discharging the child to the ward.

Regarding postoperative monitoring, only 61.7 % of participants requested apnoea monitoring for infants of less than 60 weeks post conceptual age. There is no standardized routine regarding follow up of patients postoperatively, with only 22.9% of consultants, 6.98% of registrars and 13.3% of medical officers reporting that they followed up on patients post caudal blockade.

Most anaesthetists (75.2%) routinely employed intravenous analgesia intraoperatively, despite having performed a caudal block. Paracetamol was the preferred analgesic, used by 95.4% of respondents, followed by fentanyl (49.5%), ketamine (25.7%), non-steroidal anti-inflammatory (NSAIDS) (24.8%) and morphine (20.2%) (Figure 6). Clonidine was the least preferred intravenous analgesic. If a child who with a caudal block on board experienced breakthrough pain post operatively, paracetamol was the most commonly employed rescue analgesia, prescribed by 88.7% of respondents. NSAIDs were prescribed by 44% of respondents, morphine by 19.9% of respondents and fentanyl by 16.3% of respondents as rescue analgesics.

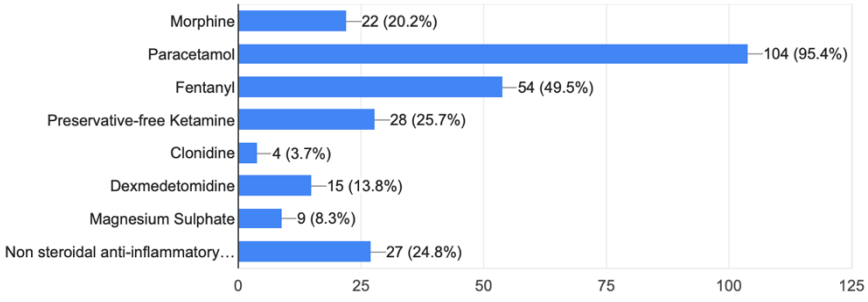


Figure 6. Intraoperative usage of additional intravenous analgesia

Discussion

This study found that years of experience correlated directly with the number of paediatric lists performed. Those with more than six years of experience, mainly consultants (60%) and registrars (68%) performed two or more paediatrics list every week compared to medical officers (20%). This may be attributed to the fact that registrars undergo six months of compulsory consultant -led paediatric anaesthesia rotations during their four years of anaesthesia training.

Specific components of informed consent were discussed preoperatively. Participant responses varied, with only 15% discussing all elements. Complete information should be disclosed with a discussion around material risk-benefit prior to surgery, as there is a clear shift from the reasonable doctor standard to the reasonable patient standards in medical law.[9] The South African Society of Regional Anaesthesia (SASRA) recommend that the anaesthetist should advise the patient on the most appropriate technique based on their personal experience and patient characteristics. They should discuss both the risks and benefits of the proposed technique and alternative options available, and where possible, direct the patient to additional information after the initial consultation to make an informed decision.[10]

Registrars (82.6 %) and medical officers (93.3%) were more likely to adhere to strict aseptic techniques compared to consultants (57.5%). Anecdotally, this may be because senior consultants, who are likely to be more acutely aware of resource limitations, may employ shortcuts to save time and money and in doing so 'break the rules' for the sake of their patients. Though this may not necessarily result in patient harm, but it can have a direct impact on junior staff, resulting in adoption of certain practices, and normalisation of the violation of certain standards[11].

A shortage of paediatric trained nursing staff to provide adequate monitoring of analgesia provided by caudal catheters postoperatively is one of the main reasons why caudal catheters are not as commonly employed by this anaesthetic unit. Risk of infection, limited resources to manage complications and financial constraints may be other contributing factors. A major contamination risk was found to be associated with the insertion of caudal catheters compared to single shot injections, due to the proximity of the sacral region with the perineum. In the literature, incidence rates of 25% and 16% have been reported for gram positive and negative colonisation respectively, despite use of an aseptic technique during insertion of caudal catheters.[12] The quoted incidence of infection due to epidural catheters is less than 0.1%, with a range of 0.1 to 0.2%. [13]

Bupivacaine 0.125%- 0.25% and ropivacaine 0.1%-0.375%, with volume ranges between 0.5ml/kg-1.25 ml/kg [14] are commonly used, depending on the desired dermatomal level, with a higher concentration increasing the risk of undesired effects, such as local anaesthetic systemic toxicity and urinary retention. While ropivacaine has a better side effect profile, bupivacaine is the most commonly used agent, because of its duration of action, commercial availability and research backing, with its benefits out-weighing its potentially toxic effects, [15] findings noted in this study too.

Caudal blockade can safely be administered to children from the neonatal period (0-28 days) onward, to an average age of six ± four years, with a mean weight of 21.1 ± 10.7 kg.[16] Similar age and weight ranges were reported in this study. Most anaesthetists consider there to be no minimum age for caudal anaesthesia [17] however, early ossification of the sacrococcygeal membrane and the substantial thickness of the cornua may make accessing the epidural space in older children difficult. Nonetheless, caudal blocks are said to be possible in children up to 50 kg in weight. [12]

Caudal specific needles are preferred because they traverse the sacrococcygeal ligament with less risk of dural or blood vessel puncture, are easier to advance and have reduced risk of displacement following insertion.[18] A notable percentage of consultants, (22%) particularly those with more than 16 years of experience used hypodermic needles, risking coring of superficial tissue which could be deposited in the epidural space, leading to complications such as epidermal tumours, where nucleated stratum basale cells proliferate.[19]

While ultrasound guidance confirms the position of the caudal needle with greater accuracy, and minimises the risk of dural sac puncture, it is still not widely used in this unit, and most senior anaesthetists prefer the traditional landmark-based technique. In the study by Park et al,[20] when compared to the landmark-based technique, ultrasound assistance resulted in less needling attempts and time taken to perform caudal blocks. However, ultrasound use is limited by the skill of the operator. Only a small percentage of participants in this study had special training in ultrasound use and access is also a limiting factor in our setting.

While this study found that adjuncts are not frequently used when performing caudal blocks, multiple randomised trials [21] [22] have shown that use of local anaesthetics without adjuncts provided analgesia for two to three hours compared to six to eight hours if adjuncts were added.

Lack of adequate postoperative monitoring in the wards and no routine postoperative follow up could be the reason most practitioners are reluctant to adopt this practice in our setting.

Caudal use of alpha-2 agonists, clonidine and dexmedetomidine are associated with less side effects when recommended doses are adhered to. They do not to cause or potentiate respiratory depression, but severe bradycardia may occur if higher high doses are used. [3] Currently there is no consensus regarding what the ideal doses should be, but most anaesthetists in various studies were found to use similar dose ranges: clonidine and dexmedetomidine at one to two mcg/kg, and morphine 10-30 mcg/kg, with fewer side effects. [3, 12-13] These are all used off label in South Africa. Absence of preservative- free ketamine limits its use as a caudal adjunct in this academic unit.

Block failure is the most significant complication associated with caudal blockade, reported by 68.3% of senior and junior participants combined, compared to the incidence of block failure in the literature which ranged between 1-2 %.[2] [23] This could be related to fewer blocks being performed in the department, or a preference for other novel blocks that are more specific than caudal blockade, both resulting in poorer expertise. Success rates of caudal blockade are as high as 96% in centres where they are performed on a regular basis.

While 61.7% of participants in this study used multiple factors as indicators of successful blockade particularly reduction in additional intraoperative analgesia requirements as a marker of caudal blockade success (p=0.001), a study by Dave and Garasia [24] found that the decrease in heart rate and laxity of anal sphincter tone had a positive predictor value of 98,48% and 99,5 % (95%CI) in determining successful needle placement and adequate caudal block respectively.

Caudal blockade is versatile, dependable, and easy to teach and perform. The introduction of less invasive regional blocks such as the Transversus Abdominis Plane block (TAP), ilioinguinal–iliohypogastric (II-IH) and paravertebral blocks have reduced the popularity of caudal blockade as a form of analgesia for certain surgical procedures. Multiple randomised controlled studies showed conflicting outcomes regarding superiority of one over the other regarding side effect profile, however there is consensus that caudal blocks provide similar analgesic benefit for postoperative pain in children.[25] [26] [27] [28] [29] However, TAP and II-IH block result in better parent satisfaction and earlier home discharge with fewer side effects when compared with caudal block.[27] Children who

had a preoperative caudal block received less intraoperative opioids than children with TAP blocks or no regional anaesthesia. [26]

This study relied on participants honestly answering the questions posed about their clinical practice.

The response rate of the study was 66 %. In order to avoid nonresponse bias, it would have been ideal to achieve 80 – 90% response rate to ensure that the study was more representative of the department as a whole, however due to time limitations and no further engagement following multiple reminders, conclusions were drawn based on the current response rate. The study was performed in one academic unit, and the results can therefore not be extrapolated to other units in the province or in the country.

Conclusion

Adequate knowledge and skill to perform caudal blockade is essential for the practising anaesthetist. Performing caudal blocks on a regular basis, employing ultrasound, and implementation of focused training programme on caudal block may be beneficial may to improve quality of caudal block and reduce failure rates. Use of bupivacaine and adjuncts such as alpha- 2 agonists, is a safe, recommended practice in paediatric patients for caudal blockade, is associated with fewer side effects, such as arrythmias, respiratory depression, or sedation. Use of standardised informed consent protocols may improve patient and caregiver experience/understanding. A training program with a focus on clear and standardised protocols for paediatric caudal blockade practice will be of great benefit to homogenise practice and therefore improve the safety and quality of caudal blocks performed, as well as their success rate. In doing so, it should reduce the rate of block failure and complications in this academic unit. The idea is to encourage caudal block practice by taking any ‘guesswork’ or varying practices out of the equation. This in turn will benefit patients greatly.

Conflict of interest

The authors declare no conflict of interest

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APPENDICES

Appendix 1: Proposal

A survey of caudal anaesthesia practice in an academic anaesthesia circuit

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Introduction

Regional anaesthesia is generally accepted as an indispensable part of post-operative analgesia in children. Research is required to establish guidelines on paediatric analgesia as this domain is still a developing field, both clinically and scientifically, as greater insight is gained into the perception and treatment of pain in children.

Regional anaesthesia has a good safety record as it provides analgesia restricted to the site of surgery [2, 30] thus impacting the patient's haemodynamic to a lesser degree. Other benefits include a reduction in the required minimum alveolar concentration (MAC) of the volatile agent being used, reduced need for muscle relaxants and for postoperative ventilatory support after major surgery, enhanced suppression of the metabolic stress response to surgery and a potentially reduced hospital stay. [31]

Since 1933 when Campbell first described caudal blocks performed in 87 children undergoing urological procedures, caudal anaesthesia has grown to become the mainstay of post-operative analgesia in infra-umbilical surgical interventions in the paediatric population. [1, 13]

Caudal blockade involves inserting a needle through the sacral hiatus to deliver medication into the epidural space to achieve anaesthesia and/or analgesia [4] in the supra and/or infraumbilical region. The Paediatric Anaesthesia Community of South Africa (PACSA) define a caudal block as a pain-relieving injection of local anaesthetic at the base of the back, performed under general anaesthetic, providing pain relief for surgery under the belly button for about 6-8 hours. [6]

Caudal blockade can be used as the sole method of anaesthesia, but is generally combined with general anaesthesia, especially in paediatric patients where it may be technically challenging and ethically difficult to justify when performed on an awake child. When choosing a regional technique, the risk-benefit ratio of caudal blockade must be weighed against that of other forms of analgesia. [31]

Sound knowledge of the relevant anatomy may improve the success rate of caudal epidural needle placement and minimise the risk of complications. [4, 32] Palpation of the sacral cornua is used to locate the sacral hiatus in the conventional landmark- based technique. [4]

Use of ultrasound and nerve stimulators are advised to improve the accuracy of regional anaesthesia and to reduce the risk of postoperative neuropathy. [10] However, since the use of ultrasound in the practice of regional anaesthesia requires prior training and the acquisition of specialised equipment, performing caudal blockade without ultrasound does not constitute poor or negligent practice in South Africa. [10]

Local anaesthetics (LA), such as bupivacaine, ropivacaine, levobupivacaine and lignocaine are used alone or with adjunct agents such as α -2 agonists, preservative- free ketamine and opioids in caudal blocks to achieve an enhanced analgesic effect. [3, 32] The South African Society of Regional Anaesthesia (SASRA) does not have any clear guidelines specific to caudal block practice, however, their regional anaesthesia guidelines endorse the use of adrenaline as an adjunct agent, particularly when lignocaine is used as the LA, to test for accidental intravascular injection and prolong the duration of the block. Other adjunct agents may include magnesium sulphate, clonidine, morphine and dexmedetomidine. Addition of agents such as ketamine and sodium bicarbonate is no longer recommended. [10] Opiate use is also not recommended as they provide minimal benefit and increase the incidence of side effects such as nausea and vomiting and respiratory depression.[10]

Current SASRA guidelines recommend that the dose for 0.5% bupivacaine is 2-3 mg/kg or 0.4-0.6 ml/kg for the paediatric population. SASRA advises the use of reduced doses in neonates. They advise a dose of 2 -3 mg/kg of 0.2% ropivacaine [10] diluted to the desired volume to achieve blockade of the intended dermatomal level. [16]

Studies by Beyaz et al [33] on 2200 children in Diyarbakir Children's Hospital in Turkey demonstrated that caudal blockade was safely administered to children from neonates (0-28 days) to an average age of six ± four years, with a mean weight of 21.1 ± 10.7 kg. Neither SASRA nor PACSA guidelines specify an age or weight limit to caudal blockade.

The left lateral decubitus position with the knees and hips flexed is preferred when performing caudal blockade as it allows for easy identification of the appropriate landmarks by palpation of the posterior superior iliac spines and the two sacral cornua, making it easy to localise the sacrococcygeal ligament, through which one may access the epidural space.[34]

Contraindications to caudal blockade are localised infection at the site, pilonidal cyst, spinal dysraphism, spinal or meningeal anomalies and bleeding diatheses. [12]

SASRA recommend that the anaesthetist is guided by The Children's Act No. 38 of 2005 when performing caudal blockade on paediatric patients. [35] It is the responsibility of the anaesthetist to advise the patient and their parents/guardians on material risk regarding the proposed procedure, the benefits of having a caudal block, the most appropriate technique based on the patient's characteristics, and alternative analgesic options available. The patient and their parents/guardians should also be provided with an information leaflet or directed to reputable additional information on the subject in order that they may make an informed decision.[10] PACSA is a provider of such information for parents that may be helpful. [6]

Caudal blockade is rarely associated with serious infections and abscess formation. However, SASRA considers the use of gloves, masks, and surgical caps as mandatory when performing caudal blockade, and a full sterile barrier technique is required if siting an indwelling caudal catheter as bacterial colonisation of nerve catheters occurs in 16-57% of patients who have caudal catheters sited. [10] Disinfection of the skin with chlorhexidine/alcohol should be systematic, surgical, and large enough to cover the field of the block. [10]

An appropriate appreciation of the potential adverse effects of a caudal block is important when conducting the procedure. Due to the devastating side effects of bupivacaine when injected intravascularly, efforts must be made to enable identification of correct needle placement.

When performing the test dose, an increase in the T wave amplitude of ≥ 25%, an increase in heart rate of more than ten beats per minute, development of a nodal rhythm or sinus bradycardia [36] are said to be reliable and sensitive methods of identifying inadvertent intravascular injection. SASRA guidelines indicate that an adrenaline test dose is only of value if positive i.e. an increase in heart rate is seen.[10]

Complications associated with performing caudal blockade include hematoma formation, block failure, seizures, cardiac arrest and accidental dural puncture. [23]

It is important that age-appropriate pain assessment tools such as the FLACC scale or the Wong - Baker Faces score are used to assess the child. This determines the effectiveness of caudal blockade and the requirement for additional analgesia.[32]

Studies such as Lundblad et al [3] discuss adjuncts to LA, Fahy et al [19] discuss aseptic technique and needle type , Lonngevist et al, [17] use of ultrasound. However, local, and international studies assessing caudal blockade practices holistically could not be identified.

2. Problem statement

The practice of anaesthesia continuously improves with ongoing research in the field. As anaesthetists, it is important that we regularly update our knowledge if we are to practice safe anaesthesia and maintain up to date practice. This study will assess the practice of anaesthetists working in the Department of Anaesthesia at the University of the Witwatersrand (WITS) regarding caudal blockade as the cornerstone of pain management in the paediatric population undergoing surgery as the current practice is unknown. This study may assist to make recommendations to establish clear guidelines regarding caudal blockade practice.

3. Aim

The aim of this study is to describe current caudal block practice in the WITS Anaesthesia department.

4. Objectives

The objectives of the study are:

1. To describe caudal blockade practice with regards to:

- Technique
- Choice of local anaesthetics used
- Preferred adjuncts to local anaesthetics
- Aseptic precautions and needle type used
- Successful blockade assessment
- Complications of caudal blockade

2. To determine differences in practice with

- Years of experience
- Professional category
- Special training in paediatric and/or regional anaesthesia

5. Research assumptions

The following definitions will be used:

Intern: a doctor who completed a university degree but is currently in training prior to registration as an independent medical officer by the Health Professions Council of South Africa (HPCSA).

Community service doctor: a practising doctor registered with the HPCSA. This is the first-year post internship.

Medical officer: a post community service doctor practising anaesthesia under specialist supervision.

Registrar: a doctor who is registered with the HPCSA as a trainee anaesthetist.

Consultant: a doctor registered with the HPCSA as specialist anaesthetist. Career Medical officers are doctors with more than 10 years of experience practising anaesthesia but not registered as a specialist anaesthetist with the HPCSA. They function in a consultant capacity in the anaesthesia department.

6. Demarcation

The study will be conducted in the Department of Anaesthesia affiliated with the Faculty of Health Sciences at WITS.

The following hospitals constitute the core academic and training platform.

- Charlotte Maxeke Johannesburg Academic Hospital
- Chris Hani Baragwanath Academic Hospital
- Helen Joseph Hospital
- Rahima Moosa Mother and Child Hospital
- WITS Donald Gordon Medical Centre

7. Ethical considerations

An ethical clearance application will be submitted to the WITS Human Research Ethics Committee (HREC). Permission will also be sought from the academic head of the WITS Anaesthesia department. The study will not and is not intended to assess anyone and will not be used as part of any disciplinary undertaking against any of the participants. The data will be saved in a password protected computer. The study will only commence after obtaining ethical clearance from HREC. Consent will be implied upon completion of questionnaire.

Anonymity and confidentiality of all participants will be ensured by not acquiring any identifying or personal information at any stage during the research, and only the researcher and supervisor will have access to the raw data.

All data collected will be kept and stored for six years after completion of the study as per HREC regulations.

The study will be conducted according to the principles of the Declaration of Helsinki [37] and the South African Guidelines for Good Clinical Practice. [38]

8. Research methodology

8.1 Study design

This study will be a prospective, contextual, descriptive study of anaesthetists working in the WITS Anaesthesia department.

Contextual: A simple analysis of text that helps us to assess text in context of its historical and cultural settings.

Descriptive: A quantitative analysis of data providing a simple summary about sample and measures.

The data will be collected at the time study takes place, targeting doctors providing anaesthesia services in the WITS Anaesthesia circuit.

8.2 Study population

The study will be conducted on anaesthetists working in the WITS Department of Anaesthesia

8.3. Study sample

8.3.1 Sample method

In this study, convenience sampling will be used. Convenience sampling is a non-probability sampling method, which is considered appropriate for a descriptive study of this nature. [39]

Convenience sampling involves selecting the most easily available persons as participants. [40] A sample of anaesthetists attending departmental academic meetings will be used.

8.3.2 Sample size

The staff complement of the department is 80 consultants, 114 registrars, 22 medical officers, and ten career medical officers.

The sample size was determined using Raosoft™. By accepting a margin of error of 5%, a 95% confidence interval, and a 50% response distribution, we determined the recommended population size to be 143 participants. [8]

Inclusion criteria

All doctors practising anaesthesia in the listed hospitals including consultants, career medical officers, registrars, and medical officers will be included.

Exclusion criteria

Interns will be excluded from the survey.

8.4 Data collection

The questionnaire was developed by the researcher and supervisors based on the available literature, as there were no previous studies similar in nature to this one.

A questionnaire will be issued to anaesthetists during departmental meetings with participation being voluntary to all those meeting the requirements. The researcher will be present to explain and assist with any queries that may arise and to prevent data contamination.

Following the introduction of the study, the objectives and aim of the study will be explained followed by issuing of the questionnaire and information letter. After completion of the survey, which should take approximately 10-15 minutes to complete, the participants will place the questionnaire into the collection box.

The data to be extracted includes the answers to all questions posed in the questionnaire (Appendix 2).

The demographic information to be acquired includes:

- Years of anaesthetic experience
- Special training in paediatric anaesthesia with specific reference to regionals
- Professional category

8.5. Data Analysis

All data will be transferred from the data sheet to a Microsoft Excel spreadsheet. Data will then be exported to Stata version 14 statistical software for analysis. Categorical data will be presented as frequencies and percentages. Data describing anaesthetic practice will be presented either as a mean (± standard deviation) if normally distributed, or median (± interquartile range) if not normally distributed.

Continuous variables will be compared using analysis of variance (ANOVA). The Kruskal Wallis' test will be used if the continuous variable is not normally distributed.

The association between categorical variables will be evaluated using the Pearson's Chi Square test. Fischer's exact test will be used if any expected cell value is less than five.

A 95% confidence interval will be used. The statistically significant level will be set at a p-value<0.05.

9. Significance of the study

WITS Anesthetists' practice with respect to caudal anaesthesia is unknown. No similar study has been previously conducted in the WITS academic circuit. This study will assess current practices of caudal blockade. This study aims to assist with creating guidelines and protocols for improved caudal blockade practice. The survey is not intended to assess knowledge thus there will be no pass mark.

10. Validity and Reliability

Reliability: is the degree of consistency or reproducibility of measurements[39].

Validity: is the measure of the truth or accuracy of the findings obtained from the study and indicates whether the conclusions of the study are reasonable based on the study design.

To ensure face and content validity, the questionnaire will be evaluated by four senior anaesthetists with a special interest in paediatric anaesthesia who are affiliated with the WITS department prior to being finalised.

The researcher will be present during the completion of questionnaire to answer any questions and prevent data contamination.

Participant anonymity is guaranteed as no personal identifying information will be acquired.

Every tenth data entry point on the spread sheet will be checked for accuracy.

Due to the current unprecedented Covid 19 crisis, departmental meetings are held via virtual means until congregational meetings are allowed by legislation. As a result, it may not be possible to distribute questionnaires in the manner we had initially planned on. To adapt to the current situation, the questionnaires may be distributed via digital means.

11. Limitations

The study depends on the voluntary participation of the participants.

The contextual nature of the study focuses on the doctors working in WITS anaesthesia department and findings may not be extrapolated to other anaesthetic departments.

As a percentage of the department at any given time is away on leave, pre- or post-call, the researcher will target as many of the available anaesthetists as possible.

If an online questionnaire is made use of, or alternatively, if questionnaires are distributed outside of academic meetings, this may affect the number and quality of the responses received.

12. Timeline

	February-April 2020	May -July 2020	August - December 2020	January -February 2021	March-May 2021
Literature Review					
Preparation of Protocol					
Ethics Application and Protocol Submission					
Data Collection					
Data analysis					
Write – Up					

13. Funding

All costs involved in this study will be incurred by the WITS Anaesthesia Department.

Table 4: Proposed budget

Item	Cost (Rand)
Printing of information sheets and questionnaires	R1.20/page x 10 = R12.00 200 copies = R240.00

Total	R240

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Appendix 2: Ethics approval for protocol amendments

To Whom It May Concern

RE: RESEARCH PROPOSAL CORRECTIONS – Mmed Dr Letshokge Sepheu (9904325m)

This is to certify that Dr H J Moutlana (PSG committee member) and the undersigned (chairperson of PSG committee) have read the corrected research proposal and are satisfied that the corrections recommended by the Post graduate Committee have been effected. He can now submit his revised research proposal with all other required documents.

Kind regards,

Dr M M A MASHININI

Head Clinical Unit

Department of Anaesthesia

University of the Witwatersrand

Appendix 3: Human research ethics committee clearance certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Dr LJ Sepheu

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M200856

NAME: (Principal Investigator)	Dr LJ Sepheu
DEPARTMENT:	School of Clinical Medicine Department of Anaesthesiology Medical School University
PROJECT TITLE:	A survey of caudal anaesthesia practice in an academic anaesthesia circuit
DATE CONSIDERED:	2020/08/28
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Drs A Mamoojee and P Mogane
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2020/10/19

This clearance certificate is valid for 5 years from the date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the 3rd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **August** and will therefore reports and re-certification will be due early in the month of **August** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____ Date _____

Appendix 4: Plagiarism/ Turnitin report cover page

Julius_Sepheu_MMed_caudal_block_practices_final_draft-1.docx

ORIGINALITY REPORT

10%	6%	6%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

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1	Submitted to Leiden University Student Paper	1%
2	Marion Wiegele, Peter Marhofer, Per-Arne Lönnqvist. "Caudal epidural blocks in paediatric patients: a review and practical considerations", British Journal of Anaesthesia, 2019 Publication	1%
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Appendix 5: Journal guidelines to authors

Author Guidelines for the South African Journal of Anaesthesia and Analgesia

Submitted manuscripts that are not in the correct format and without the required supporting documentation specified in these guidelines will be returned to the author(s) for correction and will delay publication.

AUTHORSHIP

Named authors must consent to publication by signing a covering letter which should be submitted as a supplementary file. Authorship should be based on substantial contribution to:

(i) conception, design, analysis and interpretation of data;

(ii) drafting or critical revision for important intellectual content; and

(iii) approval of the version to be published. These conditions must all be met (uniform requirements for manuscripts submitted to biomedical journals; refer to www.icmje.org); and

(iv) exact contribution of each author must be stated.

DECLARATION OF CONFLICT OF INTEREST

Authors must declare all sources of support for the research and any association with a product or subject that may constitute a conflict of interest. If there is no conflict of interest to declare please include the following statement: The authors declare no conflict of interest.

FUNDING SOURCE

All sources of funding should be declared. Also define the involvement of study sponsors in the study design, collection, analysis, and interpretation of data; the writing of the manuscript; the decision to submit the manuscript for publication. If the study sponsors had no such involvement, this should be stated as follows: No funding source to be declared.

RESEARCH ETHICS COMMITTEE APPROVAL

The submitting author must provide written confirmation of Research Ethics Committee approval for all studies including case reports. The ethics committee as well as the approval number should be included.

STATISTICAL ANALYSIS

Authors are advised to involve medical statisticians at the protocol stage of their research project: to plan sample size, and the selection of appropriate statistical tests for analysis and presentation.

PROTECTION OF PATIENT'S RIGHTS TO PRIVACY

Identifying information should not be published in written descriptions, photographs, and pedigrees unless the information is essential for scientific purposes and the patient (or parent or guardian) gives informed written consent for publication. The patient should be shown the manuscript to be published. Refer to www.icmje.org.

ETHNIC CLASSIFICATION

The rationale for analysis based on racio-ethnic-cultural categorisation should be indicated.

CATEGORIES OF SUBMISSIONS

Shorter items are more likely to be accepted for publication, owing to space constraints and reader preferences.

Original articles

Original articles on research relevant to anaesthesia and analgesia should not exceed 3 200 words, no more than 30 references, with up to 6 tables or figures. A structured abstract under the following headings, Background, Methods, Results, and Conclusions is a requirement and should not exceed 300 words.

Clinical Review articles

Review articles relevant to anaesthesia and analgesia should not exceed 2 400 words, with a maximum of 20 references and no more than 6 tables or figures. A summary of 300 words or less is required.

Case reports

Case reports should not exceed 1 800 words with no more than 10 references. Figures are limited to 2 figures and may include images or photographs. The case report should have three headings: Summary (not exceeding 100 words), Case report (with no introduction) and Discussion. Case reports will be published online only. The summary and the URL will appear in the printed version.

Scientific Letters

Scientific Letters should not exceed 2 400 words with a maximum of 10 references. Only one table or illustration is permissible. A structured abstract under the following headings, Background, Methods, Results, and Conclusions, is a requirement and should not exceed 250 words.

Letters to the editor

Letters to the editor should be 800 words or less with only one image or table.

MANUSCRIPT PREPARATION

Refer to articles in recent issues for the presentation of headings and subheadings. If in doubt, refer to 'uniform requirements' - www.icmje.org. Manuscripts must be provided in UK English.

Qualification, affiliation, and contact details

This information must be provided for ALL authors and must be submitted as a supplementary file.

Email addresses of all authors must be provided.

ORCID number of ALL authors must be provided - if authors do not have ORCID, please register at https://orcid.org/

Abbreviations

All abbreviations should be spelt out when first used and thereafter used consistently, e.g., 'intravenous (IV)' or 'Department of Health (DoH)'.

Scientific measurements

Scientific measurements must be expressed in SI units except blood pressure (mmHg) and haemoglobin (g/dl). Litres is denoted with a lowercase 'l' e.g. 'ml' for millilitres). Units should be preceded by a space (except for %), e.g. '40 kg' and '20 cm' but '50%'. Greater/smaller than signs (> and 40 years of age) should also be preceded by a space e.g. > 20 years. No spaces should precede ± and °, i.e. '35±6' and '19°C'.

Numbers should be written as grouped per thousand-units, i.e. 4 000, 22 160...

Quotes should be placed in single quotation marks: i.e. The respondent stated: '...' Round brackets (parentheses) should be used, as opposed to square brackets, which are reserved for denoting concentrations or insertions in direct quotes.

General formatting

The manuscript must be in Microsoft Word or RTF document format. Text must be 1,5-spaced, in 12-point Times New Roman font, and contain no unnecessary formatting (such as text in boxes, except for Tables). *The manuscript must be free of track changes.*

Disclaimers should follow the Conclusion and it should be in the following order: Acknowledgements, Declaration conflict of interest, Funding source, Ethics declaration and ORCID.

ILLUSTRATIONS AND TABLES

If tables or illustrations submitted have been published elsewhere, the author(s) should provide consent to republication obtained from the copyright holder.

Tables may be embedded in the manuscript file and provided as 'supplementary files'. They must be numbered in Arabic numerals (1,2,3...) and referred to consecutively in the text (e.g. 'Table 1'). Tables should be constructed carefully and simply for intelligible data representation. Unnecessarily complicated tables are strongly discouraged. Tables must be cell-based (i.e. not constructed with text boxes, tabs, or enters) and accompanied by a concise title and column

headings. Footnotes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || then ** †† ‡‡ etc.

Figures must be numbered in Arabic numerals and referred to in the text e.g. '(Figure 1)'. Figure legends: Figure 1: 'Title...'. All illustrations/figures/graphs must be of high resolution/quality: 300 dpi or more is preferable, but images must not be resized to increase resolution. Unformatted and uncompressed images must be attached as 'supplementary files' upon submission (not embedded in the accompanying manuscript). TIFF and PNG formats are preferable; JPEG and PDF formats are accepted, but authors must be wary of image compression. Illustrations and graphs prepared in Microsoft PowerPoint or Excel must be accompanied by the original workbook.

REFERENCES

Authors must verify references from the original sources. *Only complete, correctly formatted reference lists will be accepted.* Reference lists may be generated with the use of reference manager software, but the final document must be delinked from the reference database or otherwise generated manually. Citations should be inserted in the text as superscript, e.g. These regulations are endorsed by the World Health Organization,[2] and others.[3,4-6] The superscript reference number should come after the punctuation mark and should not be in brackets.

All references should be listed at the end of the article in numerical order of appearance in the Vancouver style (not alphabetical order). Approved abbreviations of journal titles must be used; see the List of Journals in Index Medicus. Names and initials of all authors should be given; if there are more than six authors, the first four names should be given followed by et al. First and last page, volume and issue numbers should be given. Wherever possible, references must be accompanied by a digital object identifier (DOI) link and PubMed ID (PMID)/PubMed Central ID (PMCID). Authors are encouraged to use the DOI lookup service offered by CrossRef. Crossref DOIs should always be displayed as a full URL link in the form https://doi.org/10.xxxx/xxxxx

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Other references (e.g. reports) should follow the same format: Author(s). Title. Publisher place: publisher name, year; pages. Cited manuscripts that have been accepted but not yet published can be included as references followed by '(in press)'. Unpublished observations and personal communications in the text must not appear in the reference list. The full name of the source person must be provided for personal communications e.g. '...(Prof. Michael Jones, personal communication)'.

COVERING LETTER

A covering letter to the editor is mandatory and must include statements that the manuscript has not been published previously and is not under review elsewhere. It should state details of any prior publication of the research in abstract form or in Congress proceedings. The letter must declare if any of the authors have a conflict of interest and that the requirements for submission, including ethics approval and patient permission for case reports have been fulfilled. All authors must sign the covering letter.

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(400-800 words) (1 page)

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(2800-3200 words) (4-5 pages)

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(1 800 words) (3 pages)

Clinical reviews

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Appendix 6: Survey questionnaire

INFORMATION SHEET

Dear Colleague

My name is Letshokge Julius Sepheu and I am a registrar in the Department of Anaesthesiology at the University of the Witwatersrand. I would like to invite you to participate in my MMED research survey.

My research seeks to describe current practices of caudal blocks performed by anaesthetists in the department. The results of this research may assist with the establishment of clear departmental guidelines and protocols pertaining to caudal blockade.

The study has been approved by Human Research Ethics Committee (Medical). The ethics approval number is M200856. A principal function of this committee is to safeguard the rights and dignity of all human subjects who agree to participate in research projects as well as the integrity of the research. If you have any concerns or queries, please contact the chairperson of the committee, Professor Clement Penny, on 011 717 2301 or clement.penny@wits.ac.za. Alternatively, the secretary of the committee can be contacted on 011 717 2700 or via email at zanele.ndlovu@wits.ac.za or rhulani.mukansi@wits.ac.za.

Participation in the study is voluntary and anonymous. There is no personal information included in the questionnaire. Consent is implied by the completion and return of the survey questionnaire. All information will remain confidential and only my supervisors and myself will have access to raw data. The are no penalties for not participating in the study.

No incentives will be provided for completing the survey. The questionnaire should not take longer than 20 minutes to complete. This survey is not intended to test your knowledge. Please do not communicate with anyone or use other resources of information while completing this survey. If you have any questions during completion of the survey, please feel free to ask me or my supervisors.

Thank you for your time. Your participation in my research is valued.

Kind regards

Letshokge Julius Sepheu (Researcher) 073 756 3276

Dr Anisah Ismail Mamoojee (Supervisor) 082 767 6747

Dr Palesa Mogane (Supervisor) 073 173 1440

October 2020

Questionnaire

1.1: Years of anaesthetic experience including community service medical officer time

☐ < 5 years

☐ 6-10 years

☐ 11-15 years

☐ >16 years

1.2: Professional Category:

☐ Consultant/career medical officer

☐ Registrar

☐ Medical Officer

☐ Community Service Medical Officer

1.3: Have you completed any of the following special training?

☐ Regional anaesthesia rotation

☐ Paediatric anaesthesia rotation

☐ Paediatric anaesthesia regional training course or workshop (e.g. at PACSA)

☐ Regional anaesthesia training course or workshop (e.g., at SASRA)

☐ Dedicated ultrasound training course

2: How many times per month do you have a paediatric list?

☐ I do not do paediatrics lists

☐ Once

☐ 2-5

☐ 6-10

☐ >11

3: How many caudal blocks do you estimate you perform per month?

☐ 1

☐ 2-5

☐ 6-10

☐ >11

4. 1: Regarding consent anaesthesia, do you acquire consent specifically for caudal blockade?

☐ yes

☐ no

4.2 If yes, which of the following do you discuss with the parent/guardian?

☐ Technique of caudal block

☐ Duration of analgesia

☐ Your level of expertise

☐ Possible complications/ side effects

☐ Use of adjuncts and their complications

☐ All of the above

5: What age cut-off do you use for caudal blockade? _____

6: What weight cut off do you use for caudal blockade? _____

7.0: Which local anaesthetic do you use most often?

☐ Plain bupivacaine

☐ Bupivacaine with adrenaline

☐ Ropivacaine

☐ Lignocaine

7.1: What toxic dose (in mg/kg) do you use for

☐ Bupivacaine

☐ Ropivacaine

8: What volume guide (in ml/kg) do you use for:

☐ Sacral blockade

☐ Lumbar blockade

☐ Low thoracic blockade

9: Do you regularly use an ultrasound guided caudal technique?

☐ Yes

☐ No

10: If no, why not?

☐ I am not experienced with ultrasound-guided caudal blockade

☐ I prefer a landmark – based technique

☐ Ultrasound is not readily available

11.1: Do you routinely use an adjunct in your caudal blocks?

☐ yes

☐ no

11.2: Please give a reason for your answer: _____

11.3: If yes, which of the following adjuncts do you use? (Tick all applicable)

☐ Fentanyl

☐ Clonidine

☐ Dexmedetomidine

☐ Preservative-free Ketamine

☐ Magnesium Sulphate

☐ Morphine

11.4: Please give reasons for your choices: _____

11.5: If you noted that you used any of the above adjuncts, at what dose (/kg) do you use them?

☐ Fentanyl _____

☐ Clonidine _____

☐ Dexmedetomidine _____

☐ Preservative-free Ketamine _____

☐ Magnesium Sulphate _____

☐ Morphine _____

12: Do you routinely give additional intravenous analgesia intraoperatively when you perform caudal blockade?

☐ Yes

☐ No

13: If you answered yes to the above question, which agent do you routinely use? (tick all applicable options)

☐ Morphine

☐ Paracetamol

☐ Fentanyl

☐ Preservative- free Ketamine

☐ Clonidine

☐ Dexmedetomidine

☐ Magnesium Sulphate

☐ Non-steroidal anti-inflammatory drugs

14: Which types of surgery do you mostly use caudal blockade for?

☐ Infra-umbilical

☐ Supraumbilical

☐ Both supra and infraumbilical surgery.

15: What type of needle do you most commonly use

☐ Hypodermic needle

☐ Caudal specific needle

☐ Spinal needle

☐ cannula

16.1: Do you use caudal catheters?

☐ Yes

☐ No

16.2: If you answered yes to above question, how do you determine the distance/length you advance catheter?

☐ External measurements

☐ Using ultrasound

☐ Age or weight cut off: ……kg or ……yrs.

17: Regarding sterility in your caudal block practice, which of the following applies?

☐ I use a strictly aseptic technique (mask, scrub, glove, gown)

☐ I use sterile gloves and paintballs soaked in alcohol

☐ I use non-sterile gloves and alcohol swabs

☐ None

18: Do you use bupivacaine with adrenaline to check for inadvertent intravascular injection?

☐ Yes

☐ No

19: How do you assess if your caudal block is working adequately intraoperatively?

☐ Drop in heart rate

☐ Drop in mean arterial pressure

☐ Reduced volatile requirement

☐ Reduced requirement for additional analgesia

☐ All of the above

20: How long do you think a caudal block without the addition of an adjuvant lasts (duration of analgesic effect)?

☐ 30 minutes-1 hours

☐ 2-3 hours

☐ 4-6 hours

☐ >7 hours

21: Which of the following complications have you personally experienced after performing a caudal block? (tick all applicable options)

☐ Respiratory depression

☐ Urine retention

☐ Hypotension

☐ Bradycardia

☐ Dural puncture

☐ Pruritis

☐ Fever

☐ Seizures

☐ Intravenous injection (positive test dose)

☐ Cardiac arrest

☐ Block failure

22.1: What recovery room discharge criteria do you use post caudal blockade?

☐ Time in recovery 30 minutes

☐ Moving lower limbs

☐ Passing urine

22.2: What post-operative monitoring do you routinely prescribe for patients who have received a caudal block (tick all applicable options)?

☐ Regular Pain score monitoring (FLACC or other validated score)

☐ Respiratory monitoring (including respiratory rate, pattern)

☐ Apnoea monitoring in a child of PCA <60 weeks (apnoea mat/oxygen saturation probe)

☐ Return of motor function monitoring

23: Do you routinely follow up patients in the ward post caudal anaesthesia?

☐ Yes

☐ No

24: What do you routinely prescribe as postoperative rescue analgesia for breakthrough pain in a child who has received a caudal block?

☐ Morphine

☐ Paracetamol

☐ Nonsteroidal anti-inflammatory drugs

☐ Fentanyl

Appendix 7: Checklist (PRISMA/STROBE/CONSORT)

STROBE checklist

	Item No	Recommendation
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract✓
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found✓
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported✓
Objectives	3	State specific objectives, including any prespecified hypotheses✓
Methods		
Study design	4	Present key elements of study design early in the paper✓
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection✓
Participants	6	Give the eligibility criteria, and the sources and methods of selection of participants✓
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable ✓
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group ✓

Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at ✓
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why✓
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding✓
		(*b*) Describe any methods used to examine subgroups and interactions✓
		(*c*) Explain how missing data were addressed✓
		(d) If applicable, describe analytical methods taking account of sampling strategy ✓
		(*e*) Describe any sensitivity analyses

Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed ✓
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders✓
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures✓
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included✓
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
Discussion		
Key results	18	Summarise key results with reference to study objectives✓
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias✓

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence✓
Generalisability	21	Discuss the generalisability (external validity) of the study results ✓
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based✓

Appendix 8: Letter from Head of Department of Anaesthesiology

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG | FACULTY OF HEALTH SCIENCES | WITS SCHOOL OF CLINICAL MEDICINE | DEPARTMENT OF ANAESTHESIOLOGY Tel:(011)488 4344

Department of Anaesthesiology
School of Clinical Medicine
Faculty of Health Sciences
University of the Witwatersrand

30th May 2022

To Whom It May Concern

RE: PERMISSION TO CIRCULATE QUESTIONNAIRE IN DEPARTMENT

This serves to confirm that Dr Julius Lettuce Sepheu, student number 9904325M, has been granted permission to circulate his questionnaire within the Department of Anaesthesiology at the University of the Witwatersrand. This is being performed in fulfilment of his MMed study titled: A SURVEY OF CAUDAL ANAESTHESIA PRACTICE IN AN ACADEMIC ANAESTHESIA UNIT

Kind regards.

Prof Palesa Mosthabi Chakane
Academic Head of Department
Department of Anaesthesiology
Palesa.Motshabi@wits.ac.za

Appendix 9: Permission letter from the Medical Advisory Committee

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

MEDICAL ADVISORY COMMITTEE

CHRIS HANI BARAGWANATH ACADEMIC HOSPITAL

PERMISSION TO CONDUCT RESEARCH

Date: 17th May 2022

TITLE OF PROJECT:

A survey of caudal anaesthesia practice in an academic anaesthesia circuit.

University: Witwatersrand

Principal Investigator: Dr L Sepheu

Department: Anaesthesia

Supervisor : Dr A I Mamoojee / Dr Palesa Mogane

Permission Head Department (where research conducted): Yes

NHRD No. GP_202205_043

The Medical Advisory Committee recommends that the said research be conducted at Chris Hani Baragwanath Academic Hospital. The CEO / management of Chris Hani Baragwanath Academic Hospital is accordingly informed and the study is subject to:-

- **Permission having been granted by the Committee for Research on Human Subjects of the University of the Witwatersrand.**
- The Hospital will not incur extra costs as a result of the research being conducted on its patients within the hospital
- The MAC will be informed of any serious adverse events as soon as they occur
- Permission is granted for the duration of the Ethics Committee Approval.

Recommended
(On behalf of the MAC)
Date: 17/05/2022

Approved/Not Approved
Hospital Management
Date: 27/05/2022