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The occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital

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The Occurrence and Management of Postoperative Pain in Paediatric Patients on Discharge from the Recovery room of the Charlotte Maxeke Johannesburg Academic Hospital

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A thesis submitted to the Faculty of Health Sciences, University of the Witwatersrand, in the fulfilment of the requirements for the degree

of

Masters of Medicine in the branch of Anaesthesiology

Johannesburg, 2016

Declaration

I, Nozipho Philominah Hlatshwayo, declare that this research report is my own work. It is being submitted for the degree of Master of Medicine in the branch of Anaesthesiology in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

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Candidate's signature

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Date

Abstract

Background

Postoperative pain in children remains high despite an improvement in assessment and management. Assessment is done using developmentally appropriate tools including the Wong and Baker FACES® Scale (WBS). Management of immediate postoperative pain is done using intravenous or regional analgesic techniques. The aim of this study was to describe the occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Hospital operating theatres using the WBS.

Methods

A prospective, descriptive and contextual study was conducted over a three month period. Convenience sampling was used and 124 participants from various surgical disciplines aged 4 to 12 years were included in the study. Pain scores were assessed using the WBS in the recovery room immediately postoperatively.

Results

Of the 124 participants, 113 (91%) had adequate pain control. Fifteen percent (6/40) of general surgery and 9% (3/35) of orthopaedic patients that had pain 67% (4/6 and 2/3 respectively) had intravenous analgesia only whilst 33% (2/6 and 1/3 respectively) had a combination of intravenous and regional analgesic technique. One participant each from the ENT and ophthalmology groups had inadequate pain control and had received intravenous only analgesia. There was no statistically significant difference between those that had received intravenous only and combined intravenous and regional analgesic techniques (p= 0.199) or between males and females with regards to WBS score reported (p=0.511).

Conclusion

The assessment of pain scores in the recovery room show adequate pain control in the immediate postoperative period. A large percentage of those with inadequate pain control had undergone a general surgery or orthopaedic procedure. In addition a greater number of these participants had an intravenous only analgesic technique although the difference was not statistically different to those that had a combination of analgesic techniques.

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Table of contents

Contents

Declaration ..... **ii**

Abstract ..... **iii**

Acknowledgements ..... **iv**

List of figures ..... **vii**

List of tables ..... **viii**

List of abbreviations ..... **ix**

Section 1 ..... **1**

Literature Review **1**

1.1 Introduction 1

1.2 Patient satisfaction 1

1.3 Pain definition and classification 2

1.4 Pain physiology 2

1.5 Incidence of perioperative pain 5

1.6 Adverse effects of pain 8

1.7 Pain assessment tools 10

1.8 Pain management guidelines 15

1.9 Effective pain management 17

1.10 Summary 19

1.11 References 19

Section 2 ..... **24**

South African Journal of Anaesthesia and Analgesia: guidelines to authors **24**

Section 3 ..... **28**

Draft article **28**

Section 4 ..... **40**

Appendices **40**

Appendix 1: Human Research Ethics Committee (Medical) approval 41

Appendix 2: Postgraduate approval 42
Appendix 3: Parent or guardian information letter 43
Appendix 4: Parent or guardian consent form 45
Appendix 5: Children's information letter 46
Appendix 6: Children's assent form 47
Appendix 7: Data collection sheet 48
Section 5 49
Proposal 49

List of figures

1 Literature review

Figure 1. Wong-Baker FACES ® scale……..12

Figure 2. Adapted WHO analgesic ladder……15

2 Draft article

Figure 1. Wong-Baker FACES ® scale……..30

Figure 2. The WBS of participants……31

List of tables

Table 1. Demographics of participants…….….32

Table 2. WBS in various disciplines…….……..…32

Table 3. Types of analgesic technique by disciplines…….…....33

List of abbreviations

ACTH: adrenocorticotropic hormone

WBS: Wong and Baker faces scale

FPS-R: Faces pain scale- revised

VAS: Visual analogue scale

CHEOPS: Children's hospital of Eastern Ontario pain scale

FLACC: Face, legs, activity, cry, consolability

WHO: World Health Organisation

NICE: National institute of health and clinical excellence

APA: Association of paediatric anaesthetists

PCA: Patient controlled analgesia

Section 1

Literature Review

1.1 Introduction

In this section the literature review will be presented. It will highlight patient satisfaction, pain definition and classification, pain physiology and the adverse effects amongst other topics.

1.2 Patient satisfaction

The patients' perspective about their experience with health care services has become an important tool to evaluate the standards of health care. By measuring patient satisfaction the quality of health services, patient compliance to treatment and general perception of health services by the public can be improved. (1)

To measure the effectiveness of pain management interventions, it is necessary to evaluate patient satisfaction. In adults this is done frequently and the factors that influence how a patient would experience pain and the measures used to relieve their pain have been investigated. (2, 3).

Due to the complex nature of pain, pain relief is not the only factor that affects patient satisfaction. Factors contributing to improved satisfaction are preoperative information and education about pain control. The number of interruptions by nurses at night, empathy shown by health care workers as well as the level of pain and communication on pain expectations between the health care provider and patient also contribute to patient satisfaction. (3)

In children, a qualitative study by Kortesluoma et al (4) revealed that the degree of pain experienced by a child is influenced by care and attention given by significant others. A study by Polkki et al (5) looking at the experience of children aged 8 to 12 years old with postoperative pain, found that the comfort of an environment, assistance received to relieve

pain and perform daily activities were factors that children believed to improve their experience of pain. The implementation of cognitive-behavioural as well as physical methods of pain management, are suggested to improve patient satisfaction in children. (5) Preoperative education for the child and their parents has also been shown to reduce emotional distress in both. (6, 7)

1.3 Pain definition and classification

Pain is defined as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (8). There are several dimensions to pain including affective, behavioural and cognitive, beliefs and spiritual and cultural attitudes (9). The causes of pain are vast but for the purpose of this study the focus will be on surgical procedures as the cause.

Acute pain is usually brief and resolving around the time of healing of an injury or the termination of stretching, contraction or impingement of the involved part of the body. On the other hand, chronic pain can persist long after an initial injury has healed. It may be symptomatic of underlying, on-going tissue damage or chronic disease. Chronic pain is often refractory to common analgesic agents including non-steroidal anti-inflammatories and opiates. (9, 10)

Pain can trigger a biochemical and physiological stress response and cause impairment in pulmonary, cardiovascular, neuroendocrine, gastrointestinal, immunological and metabolic functions. (11) A discussion on the effects will follow.

1.4 Pain physiology

1.4.1 General physiology

The purpose of pain is to provide a protective mechanism which occurs in the presence of tissue damage and allows an individual to withdraw from a harmful stimulus. Pain and temperature sensations arise from unmyelinated dendrites of sensory neurones located around

hair follicles throughout the skin as well as deep tissue. Nociceptors respond to mechanical, chemical or thermal sensation. (8)

Impulses from nociceptors are transmitted via two types of fibre namely, fast Aδ and slow C fibres. The fast Aδ are thinly myelinated (2 to 5 µm in diameter), conducting at rates of 12 to 30 m/s while the C fibres are unmyelinated (0.4 to 1.2 µm in diameter) and conduct at slow rates of 0.5 to 2 m/s. Generally, fast pain is elicited by the mechanical and thermal types of nociceptors whereas slow pain can be elicited by all three. (8, 10) As a result of these two transmission velocities, pain can be classified as fast acute pain or slow chronic pain.

Chemicals such as potassium released from damaged cells at the site of injury, can further activate nociceptors by depolarising nerve terminals. Cells also release bradykinin and substance P which can further sensitise nociceptive terminals. Histamine is released from mast cells, serotonin from platelets, and prostaglandins from cell membranes which all contribute to the inflammatory process and pain. Some released substances act by releasing other substances, for example bradykinin activates both the A δ and C fibres and increases synthesis and release of prostaglandins. (8, 10)

Fibres from nociceptors and thermo receptors synapse on neurones in the dorsal horn. Aδ fibres terminate primarily on the neurones in laminae I and V whereas the dorsal root C fibres terminate on neurones in laminae I and II. The synaptic transmitter secreted by afferent fibres for fast mild pain is glutamate and the transmitter for slow severe pain is substance P. (10)

Axons from these neurones cross the midline and ascend in the ventrolateral quadrant of the spinal cord where they form the ventrolateral spinothalamic tract. Other dorsal horn neurones that receive nociceptive input synapse in the reticular formation of the brain stem (spinoreticular pathway) and then project to the contralateral nucleus of the thalamus. (8)

Pain shown through positron emission tomography and functional magnetic resonance imaging in normal humans indicate that pain activates cortical areas and the cingulate gyrus on the side opposite to the stimulus. In addition, the mediofrontal cortex, the insular cortex and the cerebellum are activated. (10)

During surgery when pain is inflicted on a patient through a surgical stimulus the stress response is activated. This leads to a variety of profound physiological alterations characterised by changes in haemodynamic, haematological, endocrine and immune functions. (12, 13) The stress response in surgery is characterised by increased secretion of pituitary hormones and activation of the sympathetic nervous system. The changes in pituitary secretion have secondary effects on hormone secretion from target organs. Vasopressin is secreted from the posterior pituitary and exerts its effects on the kidneys. From the pancreas glucagon is released while insulin secretion is suppressed. The metabolic effect is increased catabolism which mobilizes substrates (carbohydrates, fat and proteins) to provide energy sources, and a mechanism to retain salt and water and maintain fluid volume and cardiovascular homeostasis. (13)

Cortisol secretion from the adrenal cortex increases rapidly following the start of surgery, as a result of stimulation by ACTH. How high the level of cortisol rise depends on the severity of the surgical trauma. There is a negative feedback mechanism that serves to inhibit further ACTH secretion when cortisol levels are high. This control mechanism is ineffective after surgery resulting in levels of both hormones remaining high. Cortisol has complex metabolic effects on carbohydrate, fat and protein. It promotes protein breakdown and gluconeogenesis in the liver. Glucose use by cells is inhibited, so that blood glucose concentrations are increased. Cortisol promotes lipolysis, which increases the production of gluconeogenic precursors from the breakdown of triglycerides into glycerol and fatty acids. It has other corticoid effects, notably those associated with anti-inflammatory activity. Corticosteroids inhibit the accumulation of macrophages and neutrophils into areas of inflammation and can interfere with the synthesis of inflammatory mediators, particularly prostaglandins. (13)

1.4.2 Paediatric physiology

The nervous pathways and neurochemical systems involved in pain perception are well developed at about 25 weeks of gestation and the endogenous descending inhibitory pathways are not fully developed until mid-infancy. Opioid receptors are more widely distributed in foetuses and neonates than adults. (14)

Human foetuses mount a hormonal stress response during intrauterine needling and exchange transfusion, indicating that the human foetus feels pain in utero. (14, 15)

From birth, all the neural pathways required for nociception are present. However, the neurotransmitters and receptor-mediated systems are variably depressed depending upon developmental age. C-fibres release low levels of substance P and other neuropeptides in the early postnatal period. Therefore, a noxious stimulus may provoke different patterns of activity dependant on the stage of maturity of the paediatric central nervous system. (16, 17)

In the peripheral nervous system, C-fibres are mature in neonates although their cortical connections at the level of the dorsal horn are immature. At the same stage A-β fibres show extended connections within the spinal cord that can produce nociceptive signalling from lower intensity stimuli. These A-β fibres only recede once C-fibres have matured. This results in less discrimination between the perception of noxious and non-noxious stimuli in the paediatric patient. Inhibitory pathways are also not fully developed in the spinal cord in early life. (17)

An experimental study by Torsney et al (16) done in new born rats suggest that injury causing local tissue damage results in changes in skin sensitivity due to the elasticity of developing peripheral and central sensory connections, this can last into adulthood. Thus the combination of widened receptive fields, poor sensory discrimination and reduced inhibitory pathways results in the immature nervous system experiencing more pain in response to noxious stimuli (17).

1.5 Incidence of perioperative pain

This section will demonstrate that the magnitude of postoperative pain in children is comparable to that in adults.

1.5.1 Adults

In adults, pain is described as a common experience interfering with quality of life and is costly for the individual and for health services(18). Multiple studies assessing the incidence are

presented; however the groups are not homogeneous therefore it is difficult make conclusive comparisons.

In 1983, Cohen (19) found the incidence of moderate to severe postoperative pain, in five various hospitals in Illinois to be 75% on the third day after surgery. Owen et al (20) in 1990, demonstrated a similar prevalence.

A 1994 study by Oates et al (21) showed a decrease in prevalence to 34% for patients who had various surgical procedures. A 2002 review of the incidence of moderate to severe pain within the first 24 hours was 30%. However, in 2008 a study by Sommer et al (22) showed no improvement with 40% of patients reporting moderate to severe pain postoperatively.

Pain management programmes and strategies have improved since the 1980s. This may explain the decrease in the prevalence since Cohen's (19) study. Nonetheless, there remains a discrepancy between patient reporting of pain and the provision of analgesia. (19, 21, 23, 24)

1.5.2 Children

For children, there is limited data on the incidence, intensity, duration and costs associated with postoperative pain. This is because children were previously thought to not feel pain, nor respond to, or remember a painful experience to the same degree as adults. (11, 25) Nevertheless, is it now known that children not only experience pain but the incidence thereof is high.

In 1981, Mather and Mackie (26) conducted a survey amongst 170 children undergoing surgery with a mean age of 8 years in two large hospitals in Australia. They determined the incidence of pain postoperatively as well as the effectiveness of medication to treat postoperative pain. It was found that approximately 40% of the children experienced moderate to severe pain, 40% of those experiencing pain were not given the prescribed analgesia and for 16% analgesic treatment was not prescribed.

In 1992, a similar survey done in Canada in children aged 4 to 14 years by Johnston et al (27) showed more disappointing results. In this study 57% of children reported moderate to severe

pain and 46% of these had received no analgesia in the past 24 hours. The findings of a high incidence of pain in hospitalised children was supported in 1995 by Cummings et al (28) in an epidemiological study in Canada. The authors included a total of 200 paediatric inpatients at a tertiary hospital. It was demonstrated that up to 49% of the participants experienced severe pain in the past 24 hours of hospital admission. Children with significant pain were given less medication than what was prescribed.

In 1996 a Swedish nationwide survey to evaluate the prevalence of acute and postoperative pain in all children undergoing surgery, revealed that 23% of children experienced moderate to severe pain despite treatment (29). In 2006, research in Iceland including children aged 3 to 7 years old having tonsillectomies showed that 59% had significant pain less than four hours after surgery. (30) More recent studies include that by Taylor et al (31) in 2008 where 77% of hospitalised children with a mean age of 6 years, in two Canadian hospitals, were shown to have some pain during admission to hospital. Up to 64% had mild to moderate pain in the previous 24 hours of admission. A 2012 study in The United States of America (USA) showed a prevalence of moderate to severe pain of 27% with the highest prevalence amongst surgical patient (32) .

A USA study published in 2009, including children aged 2 to 12 years for tonsillectomy and adenoidectomy surgery showed that of the 41% of children reported by nurses to have significant pain on admission to the ward from theatre, 24% were not given analgesia. (33) These studies also showed that pain was under-recognised and under-treated in hospitalised children. (29, 31, 33, 34)

A more recent prospective Canadian study in 2015 by Wong et al (35) to determine the prevalence, severity and duration of post-operative pain in children having dental procedures under general anaesthetic showed that 29% reported moderate to severe pain at two hours after discharge from hospital. (35)

It is clear from the literature that the incidence of pain following surgery in both adults and children is unacceptably high. There is also concern about the under treatment of pain especially in children, where a high percentage do not receive any analgesia.

Pain assessment tools used in these studies varied according to the participants' age groups, therefore results may vary according to type of tool used. The groups, like in adult studies, are not homogeneous (did not have similar type of surgeries) thus the variation in the prevalence of pain over the years may not be conclusive.

There are various reports on the differences in reaction to pain between paediatric males and females. Groenewald et al (32) found no gender difference in pain prevalence in their study which included children between one month to 18 years old (mean age 8.1 years) in 2012. Blackenburg et al (36) showed nociceptive and non-nociceptive somatosensory perception was the same in boys and girls aged 7 years old. A systematic review and meta-analysis of 80 articles by Boerner et al (37) concluded that the majority of studies do not have significant differences in pain related outcomes between boys and girls. However earlier work by Schechter et al (38) and Guinsburg et al (39) showed a subtle difference between males and females.

Although there is variation and improvement in pain management the incidence is still high (27).

1.6 Adverse effects of pain

The adverse effects of pain are associated with the neuro-humoral effects in response to trauma. There is a high incidence of postoperative complications in adults with increased hormonal and metabolic responses to major operations. An increase in morbidity and mortality has occurred in intensive care patients who have increased stress responses. The same evidence has also been shown in neonates. Therefore, in both adults and infants, an increased hormonal and metabolic response to surgery may be directly related to postoperative complications. (40, 41) Data describing the adverse effects of pain in paediatric patients is mostly found in studies done in neonates exposed to painful stimuli and followed up overtime. In children untreated pain has been reported to develop into chronic pain conditions as well as leading to maladaptive behaviour (42, 43).

1.6.1 General

The increase in catecholamine release leads to tachycardia, an elevated blood pressure and associated increased myocardial oxygen use (13, 44). An increase in heart rate results in increased cardiac output which can have negative effects in patients with left ventricular dysfunction, congenital cardiac defects or myopathies (45). If pain is not relieved, the cortisol and glucagon released during the stress response leads to insulin resistance, hyperglycaemia as well as alterations of protein and fat metabolism (44).

The altered hormonal response can lead to hypercoagulability as a result of increased levels of factor VIII and fibrinogen-platelet activity and inhibition of fibrinolysis. Immunosuppression occurs as a result of a reduction in number and function of lymphocytes and granulocytosis. (45)

The adequate treatment of pain after surgery can decrease the magnitude of these changes and thereby decrease postoperative complications.

1.6.2 Paediatric patients

Common short-term adverse outcomes of pain in paediatric patients include hypoxemia, alterations to the metabolic stress response as well as mortality. (46)

Increasingly, more evidence shows an occurrence of long-term negative effects as a result of inadequately treated pain in paediatric patients. Taddio et al (47) conducted a study which included a total of 87 new born male infants (32 uncircumcised, 29 circumcised under treatment with Emla cream and 26 who received placebo treatment during their circumcision), looking at the effects of neonatal circumcision on pain response during subsequent routine vaccination. Results demonstrated that circumcised infants have a stronger pain response to subsequent routine vaccination than uncircumcised infants.

In their review, Porter et al (48) discussed that infants who are exposed to multiple painful stimuli as part of medical treatment, had long term structural and physiological changes. Further in this review, in children aged 3 to 12 years undergoing venepuncture and vaccination

it is shown that pain response and memory of the event is related to temperament. Children who are sociable and adapt easily were less distressed during the event than those who were not.

Porter et al (49) in an experimental study including healthy infants (premature and full term) demonstrated that previous stress, such as handling and immobilisation during routine care in the nursery, can result in physiological instability when the infant is subjected to a painful stimulus such as heel-lancing. Furthermore, infants who are exposed to pain in the neonatal period were found to be more sensitive to pain as adolescence and displayed more somatisation at age 4.5 years (46). Reduced levels of ACTH are also seen with a resultant dampened stress response which may adversely affect other physiological systems. (50)

Compared to full-term infants, the surgical stress response of preterm infants can last longer and be of greater magnitudes than those seen in adults. Furthermore, Anand et al (51) showed that preterm infants may be ill-equipped to meet the metabolic demands of a severe catabolic reaction to surgery because of physiologic and metabolic immaturity and as a result their postoperative morbidity and mortality is high.

Animal studies done in rats support the data found in human neonates. Evidence shown in animal studies can be compared with those in humans and assist in interpreting and confirming findings (48). Experimental studies in rats show that repetitive perinatal stress can cause various changes in the neuro-humoral stress response and cognitive impairments lasting into adulthood. (52-54)

1.7 Pain assessment tools

There are numerous acute pain assessment measures for assessment of preterm and term infants, self-report in children, observational measures including variations to include various ethnicities and children with cognitive impairment. Despite the abundance of age appropriate measures, guidelines, policies, recommendations and hospital accreditation standards which specify routine measurement and documentation of pain as the fifth vital sign, numerous

reports of underassessment in hospitalised infants and children have been published over the years. (23, 28, 29, 31, 55)

The correct assessment of pain is the most critical component of pain management as it helps to guide pain management interventions, but it can be very difficult in children (9, 11, 56). The difficulty in pain assessment in children arises from the complex nature of pain, which is both a sensory and emotional experience (9). In addition, children at various developmental stages may have different levels of verbal communication skills and an altered understanding of questions. (57) The inadequate management of pain in children is most likely due to poor recognition of pain in children and poor use of pain assessment tools (11, 58).

Cognitive and emotional developments are two of the important variables to consider when assessing pain in a child. Children who are very young or have developmental delays may not have the capacity to communicate their pain experience adequately for correct assessment. Therefore, instruments used to measure pain intensity are adapted to suit a particular age group at their developmental stage. Measurements of recurrent and chronic pain require different tools compared to those used to measure acute pain. (9) "The most effective pain assessment tools must be simple, practical and useful, without imposing a large burden on caregivers" (57). Simplifying assessment tools has multiple benefits which include: "improved relief of pain in children, decreased workload for nurses and other health care workers related to improved pain relief and creation of a common pain language to facilitate communications about pain within and across settings." (57)

Three types of measures are used in health care settings to measure pain: self-report, observational and physiological. (57, 59) Physiological measures will not be discussed in this literature review.

1.7.1 Self-report

Self-report measures of the severity of pain are widely accepted as the gold-standard for the measurement of pain (11, 60). There are several types of scales used for self-report including linear visual analogue scales, graphic and numeric scales and thermometer-like derivatives,

verbal rating scales, projective measures where pain is inferred from drawings, selection of colours, poker chips, pain maps with colours to indicate intensity and interpretation of cartoon pictures. (61) Each of these measures has limitations in concept, validity, reliability, scaling properties, sensitivity, or practical applicability for children, particularly preoperative children (57, 60, 61).

The Wong-Baker Faces Scale

This scale was developed in 1988 by Donna Wong and Connie Baker (Wong and Baker) at the Hillcrest Medical Centre, United States. The need for a paediatric pain assessment tool was identified after an observation that children had difficulty using number and colour scales initially designed for adults and adapted for paediatric patients. At the time stickers were popular and used to encourage cooperation during burn treatments and children were seen to respond well to facial expressions. (62)

Wong and Baker (63) gave children of school-going age six empty circles (similar to stickers) and asked them to create facial expressions that indicated no pain to worst pain. With the help of a professional artist the final scale as it is known today was developed from the pictures received from these children (see Figure 1: The Wong-Baker Faces scale) (62). The scale has been widely used and validated for self-report in children older than three years experiencing acute pain.

The scale consists of six line-drawn faces that depict pain intensity. The first face is smiling showing no pain while the last face is sad and teary depicting worst pain. Originally the scoring was measured from 0 to 5 but has been changed to 0 to 10 as this is more consistent with other numerical scales. (62)

It is the preferred method of assessing the intensity of pain by parents and children (60, 63). However, there is controversy over the effect of having a smiling face for the “no pain” score in WBS compared to a neutral face on the FPS-R. The problem arises from significantly higher pain ratings given on scales that have smiling “no pain” faces compared with scales that have

neutral “no pain” faces although Gara et al (64) did not find affect to be a confounding factor in the WBS . (57)

Validity of the scale was determined by comparing the scale with other scales with known validity. In this process it is determined if the scale shows consistency in scores in comparison to other scales. The number of consistent responses are added and divided by the number of participants in each age group to calculate a percentage of consistent responses (63, 65, 66). The scale was validated for use in the age group 3 to 18 years and has a validity score of 0.67 – 0.73 (9, 63).



Figure 1: The Wong-Baker Faces Scale (64).

Visual Analogue Scale

The Visual Analogue Scale requires selecting a point on a line representing the dimension of pain intensity. It was developed in 1978 and is the most widely used assessment tool in the measurement of pain, especially in adults. The left side of Visual Analogue Scale line represents “no pain” and the right represents “unbearable pain”. The patient is asked to mark a point on the line that indicates their current degree of pain. Intensity is scored by measuring the millimetres from the left end of the scale to the mark made by the patient; thus obtaining a number between 0 and 100 that represents the severity of pain. It can be difficult to use the Visual Analogue Scale in the postoperative period because of the effects of the anaesthetic, nausea and blurred vision. (67) It has been shown to have good sensitivity and validity for most children from age seven years and older. (68) Evidence supports Visual Analogue Scale pain

ratings as valid indicators of pain in children. Their Visual Analogue Scale scores have been shown to correlate significantly with parent and medical staff ratings. (9)

The Faces Pain Scales

Faces scales show a series of hand-drawn faces which are graded in increasing intensity between “no pain” and “worst pain possible”. Two common and widely accepted metrics used to score pain are 0-5 or 0-10.

In 1979 the first faces scale was developed by Katz and consisted of a series of seven line-drawn faces. Since then a number of faces scales that have been developed. These scales vary in format as well as the number of faces included in a row but have a similar conceptual basis. For example the Wong and Baker faces scale (WBS) has six faces whilst there are seven in the scale by Bieri et al (61). In these two scales there are also variations on whether tears are present in the worst pain face or not and whether the ‘no pain’ face is a neutral face or a smiling face. (60)

Bieri et al (61) developed a scale in 1990 from which adaptations were made and the Faces Pain Scale-Revised (FPS-R) was introduced in order to deal with the problems encountered in the use of faces scales (57). The FPS-R has a concurrent validity of 0.84- 0.99 and similar inter-rater correlation (9).

1.7.2 Behavioural observational tools

Behaviour observational tools are used to assess behaviour that indicates patient pain and distress. (9, 11) These are helpful in assessing pain in children with limited communication skills as a result of age or those that are ventilated in the intensive care unit. (11, 69)

Children’s Hospital of Eastern Ontario Pain Scale

This scale is used to measure postoperative pain in children. It includes operational definitions for six domains: crying, facial, child verbal, torso, touch and legs. Each domain is scored on a 0 to 3 scale. Inter-rater reliability following surgical procedures for children aged 1 to 5 years ranges from 90% to 99.2% for the different domains. Scores correlate with child self-report of

pain during injections, and it has been found to be sensitive to the effects of pharmacological interventions to reduce pain. (9)

Face, Legs, Activity, Cry, Consolability

The FLACC assessment tool was developed to provide a simple, consistent method for evaluating pain in children. It consists of five behavioural items: face, legs, activity, cry and consolability. The scale has been evaluated for validity and reliability in children aged 0 to 7 years old with postoperative or other pain. It has also been used to assess pain in children with cognitive impairment. It is validated for use in intubated and ventilated patients. (69)

1.8 Pain management guidelines

The purpose of guidelines is to provide assistance to health care workers and patients when deciding about appropriate care in a specific clinical context. Guidelines are developed to improve clinical practice through research evidence. They may not guarantee changes in practice but allow valuable information to be available for consideration and implementation. (70)

According to a review by Lee et al (70) from 2000 to 2013, investigating paediatric clinical practice guidelines for acute procedural pain with the aim of providing recommendations for their use; there are few evidence-based guidelines available for clinical use in paediatrics. In their search, which initially yielded 4930 abstracts, only 18 guidelines were included in the study. Of the 18, only five were recommended for clinical use and the remaining 13 were recommended for use with modification. (70)

A well-known analgesic guideline is that of the World Health Organisation (WHO) which was first presented in 1986 for use in cancer patients. Since then, adaptations have been made in 2010 (see Figure 2) to include treatment for acute pain, chronic non-cancer pain and cancer pain. It has also been recommended for use in the treatment of postoperative pain in paediatric patients. (71)

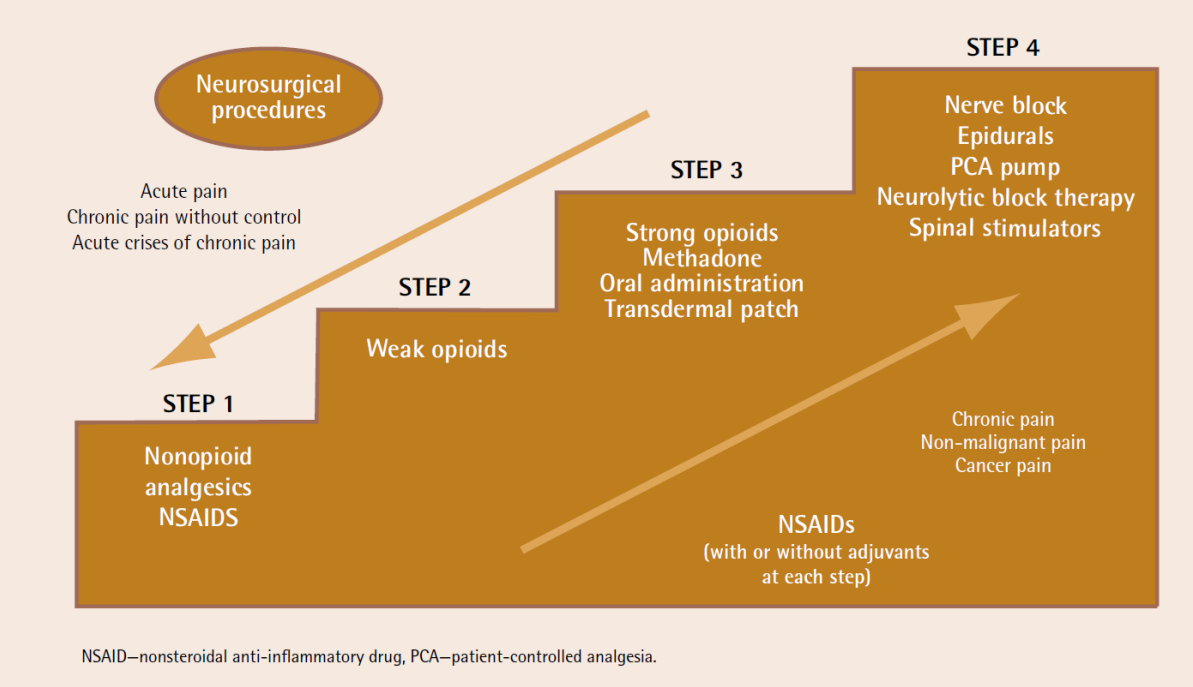

Figure 2: Adapted WHO analgesic ladder (71).

General recommendations in the WHO analgesic ladder are also given according to the type of surgery the child will have. Surgery can be minor which includes tonsillectomy, biopsies, debridement or major including abdominal, thoracic, orthopaedic or urogenital. For minor surgery the first three steps of the ladder may be followed, whilst for major surgery the fourth step may be added using continuous intravenous opioid infusions for children less than six years and patient controlled analgesia, regional anaesthesia for children older than six years. (72)

In recognising the importance of pain assessment as a critical step in treating pain, the National Institute for Health and Clinical Excellence developed guidelines in 2009. These intended to guide health care workers looking after children, in recognising and assessing acute pain. The guidelines recommends vigilance in identifying pain in children, allowing children to report pain using an appropriate tool and not relying on isolated indicators to assess pain and to record and re-evaluate pain regularly. A pain recognition and assessment cycle was introduced, whereby, if a child is anticipated to have pain a valid pain assessment tool is chosen to measure pain

intensity. An appropriate tool is chosen with consideration of the child's age, whether they can give a self-report or have cognitive impairments. (73)

After assessment the findings are recorded to ensure accurate communications and provide safe and high quality care as it supports clinical decision making. Treatment is then given accordingly and the pain measurement is re-assessed. If the management of pain is found to be effective then monitoring is continued. If it is ineffective then it is recommended that the assessment tool be changed. (73) Unfortunately the guidelines do not include management or treatment strategies.

In 2012 the updated guidelines commissioned by the Association of Paediatric Anaesthetists of Great Britain and Ireland provided evidence-based recommendations on the assessment and management of postoperative and procedural pain in children aged 0 to 18 years old. The recommendations are divided into those relevant for specific medical and surgical procedures and the use of pharmacological and non-pharmacological strategies in both groups. The guidelines have been endorsed by the British Pain Society and Royal College of Paediatrics and Child Health (74)

1.9 Effective pain management

The goals of treating pain are to relieve patients of an unpleasant experience as well as to remedy the effects of the neuro-humoral response. Therefore, effective pain management can be described by patient satisfaction with pain management and the absence of the negative effects of the neuro-humoral response.

Dedicated paediatric pain services should be standard in paediatric institutions or institutions where a large number of paediatric procedures are performed; with a programme for continued training and improvement of clinical practices to expand long-term quality of postoperative pain management in children. (14, 75)

In the Boston Children's Hospital, a teaching hospital affiliated to Harvard Medical School and the Dana-Farber Cancer Institute, pain management is offered by a multidisciplinary team.

Treatment strategies vary from patient controlled analgesia for children, to cognitive behavioural therapies offered by psychologists. To measure the effectiveness of the pain management programme, the nurses' regular assessment of pain, administration of analgesia and assessment of the effectiveness of the analgesia is observed. This is called the assessment/ intervention/ reassessment cycle (AIR) and it is performed four times a year. The data is then sent to a national database which compares the performances of similar hospitals in the United States. In 2011 all three steps of the AIR were completed all of the time in the neonatal, critical care, medical and surgical units, which means they were fully compliant. (76)

The fourth step of the WHO analgesic ladder suggests pain management through the use of nerve blocks, patient controlled analgesia, epidurals etc. Lonnqvist et al (14) advocates for the use of a regional analgesic technique in all cases unless contra-indicated, with the technique done in anaesthetised children. Several studies looking at regional anaesthesia in children have shown that it provides exceptional postoperative pain relief, reduces the stress response to surgery and decreases the need for postoperative ventilation in procedures like tracheoesophageal fistula repair. However, Prys-Roberts et al (77) showed that there is no difference in haemodynamic response to surgical incision between patients receiving intravenous and those with a regional block. (14, 77-79)

In a one year survey by Giaufre and Dalens (79), which included up to 24 000 paediatric regional anaesthetic blocks, it was shown that there is a low incidence of adverse events associated with regional blocks (0.9 in 1000). (79)

Patient controlled analgesia with a background infusion of morphine has been used in children as young as five years old. It improves sleep patterns without increasing side effects but intensive monitoring is required. (14)

Putman et al (80) describes the use of intrathecal opioids in children as having better postoperative pain control outcomes than intravenous opioids for the first 16 hours after surgery. The technique is however associated with increased occurrence of pruritus, hypotension and constipation (80).

1.10 Summary

The understanding of pain and its treatment in children has improved since the 1980s. Attributed to the development of age appropriate pain assessment tools, we can today be able to recognise pain in the young population. These tools have led to the development of analgesic guidelines that can be applied in children. These vary from paracetamol to more complex regional analgesic techniques that have been proven to be safe to administer to children.

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Section 2

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Section 3

Draft article

The occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital

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Keywords: pain in paediatric patients, postoperative pain occurrence, recovery room, regional analgesic technique, intravenous analgesia.

Background

Postoperative pain in children remains high despite an improvement in assessment and management. Assessment is done using developmentally appropriate tools including the Wong and Baker FACES® Scale (WBS). Management of immediate postoperative pain is done using intravenous or regional analgesic techniques. The aim of this study was to describe the occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Hospital operating theatres using the WBS.

Methods

A prospective, descriptive and contextual study was conducted over a three month period. Convenience sampling was used and 124 participants from various surgical disciplines aged 4 to 12 years were included in the study. Pain scores were assessed using the WBS in the recovery room immediately postoperatively.

Results

Of the 124 participants, 113 (91%) had adequate pain control. Fifteen percent (6/40) of general surgery and 9% (3/35) of orthopaedic patients that had pain 67% (4/6 and 2/3 respectively) had intravenous analgesia only whilst 33% (2/6 and 1/3 respectively) had a combination of intravenous and regional analgesic technique. One participant each from the ENT and ophthalmology groups had inadequate pain control and had received intravenous only analgesia. There was no statistically significant difference between those that had received intravenous only and combined intravenous and regional analgesic techniques (p= 0.199) or between males and females with regards to WBS score reported (p=0.511).

Conclusion

The assessment of pain scores in the recovery room show adequate pain control in the immediate postoperative period. A large percentage of those with inadequate pain control had undergone a general surgery or orthopaedic procedure. In addition a greater number of these participants had an intravenous only analgesic technique although the difference was not statistically different to those that had a combination of analgesic techniques.

Introduction

Pain was previously thought to not occur in children.[1] Pathways involved in pain perception have developed by the second trimester of gestation and nociception is established by birth.[2] Neurotransmission, neural connections and receptor-mediated systems continue to mature after birth. Thus, due to the immaturity of these at birth, children may experience more pain than adults and the adverse effects of pain can last into adulthood.[3, 4]

The incidence of moderate-to-severe postoperative pain in children is high.[5-8] This does not reflect good standards of care as it is well-documented that untreated pain has harmful immediate and long-term consequences.[10- 15] The more immediate consequences of pain are as a result of the neuro-humoral stress response which causes a state of catabolism; long-term consequences of pain include a heightened autonomic cardiovascular response to pain.[16]

The challenge of assessing pain in children adds to the poor management of pain, therefore various age-appropriate pain assessment tools have been developed to assist with correct evaluation.[17-30] These are used for either self-report, which is the gold-standard of pain assessment, or observational assessment. Whether to choose a tool for self-report or observational assessment depends on the developmental age of the child, presence of cognitive impairment and ability to communicate verbally. The Wong-Baker FACES ® scale (WBS) (Figure 1) is a tool preferred by both children and parents and the most widely used by researchers.[24, 25]

Treatment guidelines and protocols have been developed to improve the treatment of pain. [31, 33] Included in these are intravenous and regional analgesic techniques that have proven to be effective in treating pain and reducing the surgical stress responses, thus ameliorating the associated consequences.[2, 34-36].

Currently there is no pain assessment tool used at CMJAH's theatre recovery room and the occurrence of postoperative pain in the paediatric population prior to discharge from the recovery room is not known. Also, the management of postoperative pain is not guided by formalised guidelines or protocols thus it is unknown how adequately pain is controlled in the recovery room. We therefore undertook a study with the aim to describe the occurrence and management of postoperative pain in paediatric patients immediately prior to discharge from the recovery room using the WBS.

Methods

This prospective descriptive and contextual study was undertaken at the CMJAH over a period of three months, after obtaining clearance from the Human Research Ethics Committee (Medical) of the University of the Witwatersrand and other relevant authorities. This study was conducted in accordance with the Declaration of Helsinki [37] and the South African Good Clinical Practice Guidelines. [38]

A convenience sampling method was used and a sample size of 124 patients was calculated in consultation with a biostatistician. This was calculated assuming a prevalence of postoperative pain of 20% at a 95% confidence interval and using a precision of 10%. Paediatric patients, aged 4 to 12 years presenting for general, orthopaedic, plastic, dental, ENT, maxilla-facial and ophthalmological surgical procedures under general anaesthesia at the CMJAH

theatres were invited to participate in the study. Children with cognitive impairment or developmental delay, refusal to consent by the caregiver and refusal to assent by the patient were excluded from the study.

The Wong-Baker FACES ® scale was deemed the most suitable pain assessment tool for the study population. The scale consists of six line drawn faces that depict pain intensity. The first face is smiling and indicates no pain while the last face is sad and teary depicting very bad pain. It is measured from 0 being no pain up to 10 depicting the worst pain possible. Permission to use the scale was granted by the Wong and Baker Foundation. Prior to commencing the study, the researcher approached paediatric patients in a ward at CMJAH and showed them two different pain scales (WBS and Facial Pain Scale-Revised). The WBS was unanimously chosen by the patients as the scale they would like to use to describe their pain.

During the preoperative visit the caregivers and the patients were given information about the study and the scale was shown to them. Consent was obtained from all caregivers who agreed that their child could participate in the study. Assent was obtained from children six years and older. A pain assessment was done postoperatively in the recovery room prior to discharge to the ward. Additional data collected included the participant's age, gender, type of surgery, intraoperative analgesia (intravenous only or regional and intravenous analgesic technique) and analgesia given in the recovery room prior to discharge to the ward.



Figure 1: The Wong- Baker FACES ® Scale [23]

Data was analysed with the assistance of a biostatistician using Statsoft's Statistica® version 13.0. Results were summarised using numbers and percentages (rounded off to the nearest whole number), means and standard deviations. Comparisons between groups were done using the Fisher's exact test, with the level of significance set at ≤ 0.05.

Results

A total of 124 participants were included in the study, with a mean (SD) age of 7.5 (2.5) years. The participants' demographic characteristics are presented in Table 1.

Table 1: Demographics of participants

Demographics	**Number**	**Percentage**
Gender		
Male	79	64%
Female	45	36%
Discipline		
General surgery	40	32%
Orthopaedic	35	28%
Plastic surgery	7	6%
Dental	14	11%
ENT	13	11%
Maxillofacial surgery	3	2%
Ophthalmology	12	10%
Intraoperative analgesia		
Intravenous only	75	61%
Regional and intravenous	48	39%
None	1	1%

A WBS ≤ 4 out of 10 indicates adequate pain control. Eleven (9%) of the participants had inadequate pain control prior to discharge from the recovery room. The WBS scores of participants are shown in Figure 2.

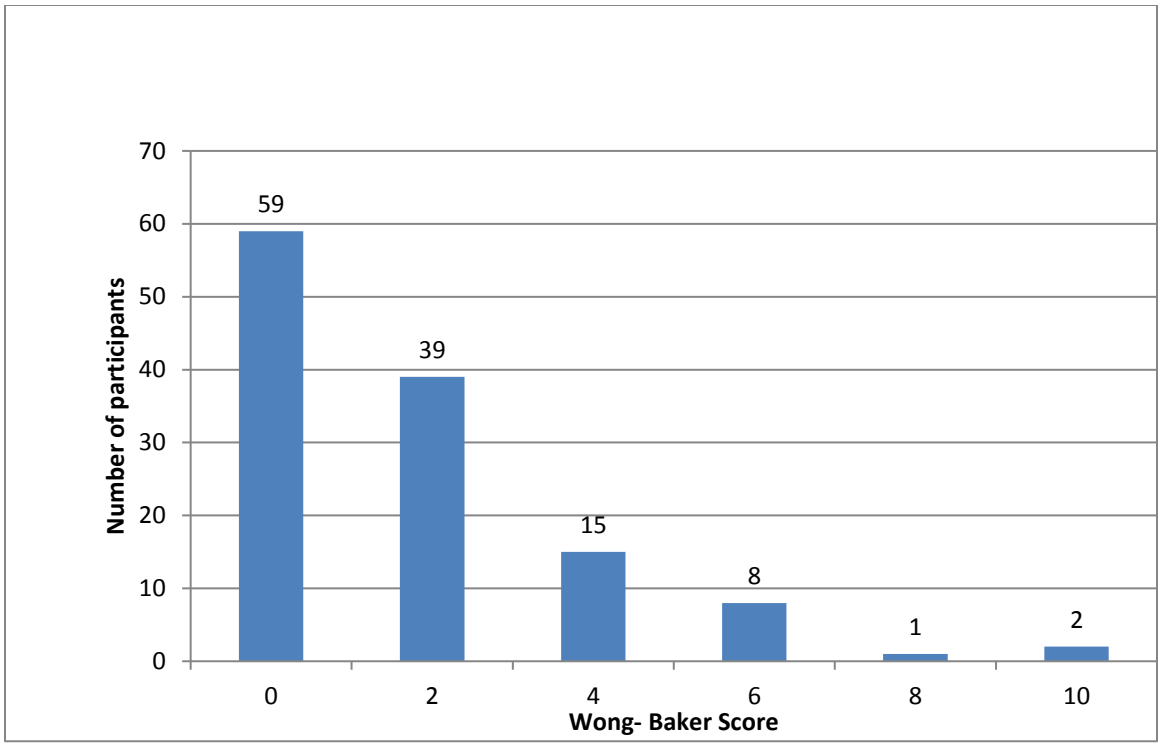

Figure 2: The WBS scores of participants.

Of those having inadequate pain control six had undergone general surgery and three orthopaedic procedures. The procedures and WBS are depicted in Table 2.

Table 2: WBS scores in various disciplines

Discipline	Total	WBS ≤ 4	WBS > 4
General surgery	40	34 (85%)	6 (15%)
Orthopaedics	35	32 (92%)	3 (9%)
Dental	14	14 (100%)	0
Ophthalmology	12	11 (92%)	1 (8%)
ENT	13	12 (92%)	1 (8%)
Maxillofacial	3	3 (100%)	0
Plastics	7	7 (100%)	0

All participants presenting for dental procedures received both intravenous and regional analgesic techniques. Both techniques were used in 30% of those coming for general surgery procedures and 34% having orthopaedic procedures. The types of analgesic techniques used are illustrated in Table 3.

Table 3: Types of analgesic technique by disciplines

Discipline	Total	IV analgesic only	WBS>4	IV and regional analgesia	WBS>4
General surgery	40	28 (70%)	4 (14%)	12 (30%)	2 (17%)
Orthopaedics	35	23 (66%)	2 (9%)	12 (34%)	1 (8%)
Dental	14	0	0	14 (100%)	0
Ophthalmology	12	8 (67%)	1 (13%)	4 (33%)	0
ENT	13	13 (100%)	1 (7%)	0	0
Maxillofacial	3	2 (67%)	0	1 (33%)	0
Plastics	7	2 (29%)	0	5 (71%)	0

Table 3 shows the number of participants who had inadequate pain control in the two groups (intravenous only or intravenous and regional) by discipline. Of the six participants who had inadequate pain control in those coming for a general surgery procedure, 4 (67%) had intravenous analgesia only. Intravenous only analgesia included drugs such as paracetamol, ketamine, fentanyl, remifentanil and morphine. The types of regional analgesic provided included 7 caudal, 2 spinal, 1 tranversus abdominus plane, 1 ankle, 2 finger, 4 penile, 14 dental, 4 wrist, 5 ilio-inguinal and 4 eye blocks.

There was no statistically significant difference between those who received intravenous only and those that received intravenous and regional analgesic techniques (p=0.199). However, a WBS > 4 was seen more frequently in those who had intravenous analgesic only technique. Furthermore no statistically significant difference was found in WBS scores between males and females (p= 0.511).

Discussion

In 1983 a survey by Mather and Mackie [39] changed the opinion that children do not experience pain. They demonstrated that 40% of children in their study who had undergone surgery experienced moderate to severe pain. In addition 16% of these children were not prescribed analgesia. This was later supported by Johnston et al [40] in 1992 who showed that 46% of children who report moderate to severe pain had received no analgesia in the past 24 hours. These are a few of the studies that have changed the view and practices regarding the management of pain in children. Despite developments in pain management, pain in children remains undertreated. [42]

Internationally the incidence of postoperative pain in hospitalised children is still high.[6, 39, 40, 42-44] In 1996 Cummings et al [45] , in a Canadian study, reported up to 49% children experienced pain and in 2009 a study by Fortier et al [8] showed that 41% of children aged 2 to 12 years post tonsillectomy and adenoidectomy procedure had pain. In South Africa there is limited data regarding the occurrence of postoperative pain and the international prevalence is higher than the occurrence of 9% demonstrated in our study.

The observed difference between our study and that by Fortier et al [8] may be due to the time frame in which data was collected. In the study by Fortier et al [8] pain assessments were done on admission to the ward postoperatively. The time from discharge in the recovery room and arrival in the ward is varied.

In our study, pain scores were recorded for the postoperative period immediately prior to discharge from the recovery room, which was less than one hour postoperatively. This does not include postoperative pain management in the ward but evaluates pain management within the intraoperative and the recovery room period. If pain was assessed in the ward the occurrence may be influenced by factors such as prescription by doctors, nursing staff administration of prescribed analgesia, route of administration etc.[39, 45] It is also possible that analgesia given in the intraoperative period may have worn off by the time the child arrived in the ward. It is important to assess pain management in the postoperative period to ensure patient satisfaction and decrease the neuro-endocrine response that may result in short and long-term adverse effects.[10, 46]

The type of surgeries were not homogenous in our study, whilst Fortier et al [8] observed pain scores for tonsillectomy and adenoidectomy procedures postoperatively. It is known that pain intensity varies according to different procedures.[7] In our study those that had undergone general surgery procedures or orthopaedic procedures reported higher pain scores that those that had procedures in other disciplines such as dental, ophthalmology etc.

This study at CMJAH had only 11 (9%) participants out of 124 who experienced pain requiring analgesia in the recovery room i.e. WBS >4, with only one child not prescribed or given analgesia. It appears that pain medication is generally appropriately prescribed and administered in the recovery room prior to discharge to the ward. The one child who did not receive analgesia despite a WBS of 6, after ENT procedure, was thought to be anxious. There was no tool used to exclude anxiety therefore it may have been inappropriate not treat the pain. Our study did not include children who could not communicate, had delirium or neurodevelopmental delays thus it should be expected that if the child had met the inclusion criteria they should be treated if they report pain. It is not appropriate to disregard the reporting of pain as it is known that pain results in significant morbidity.[11, 12, 14, 15, 47- 49]

Lonnqvist et al [2] described satisfactory postoperative analgesia provided by regional analgesic techniques as well as a reduction in the stress response. The types of regional techniques found to have been used in CMAJH included peripheral nerve block (i.e. wrist, ankle, ilio-inguinal) and neuraxial blocks (caudal or spinal blocks). Epidural catheters and patient controlled analgesia were not used due to concerns of follow-up and further management in the ward.

In the immediate postoperative period the level of pain control may be similar in both groups (intravenous only or intravenous and regional analgesic technique) regardless of analgesic technique but varies as time lapses. Intravenous analgesia is likely to lead to breakthrough pain earlier than a regional block, thus those that receive intravenous only may experience inadequate pain control.

There was no gender difference in the reporting of pain in our study which is consistent with the results of other studies.[7, 14, 51] Earlier research on neonates and infants looking at differences in pain scores, perception of pain, pain threshold, tolerance and coping strategies; reported subtle difference between males and females.[51- 53] The difference in these studies is the intensity and type of pain the children were subjected to that may affect findings.

As convenience sampling was used in this study certain elements may have been over or under represented and the results should therefore be interpreted with caution.

Conclusion

Postoperative pain occurrence at CMJAH is low compared to other studies and management in the recovery room is mostly appropriate. It is vital that no one should feel pain postoperatively. Higher pain scores were found in the group that received intravenous analgesic technique only thus it may be beneficial to provide intravenous and regional analgesic techniques where there is no contraindication. Improvement of multidisciplinary teamwork for multimodal analgesic approaches is essential to enhance pain management strategies provided within the hospital.

The postoperative period extends beyond the recovery room and this study cannot determine the adequacy of postoperative pain management in children in the wards. The researchers recommend that research in this regard be extended to the wards and possibly after discharge from the hospital so to improve quality of care.

Acknowledgements

This research was done as partial fulfilment of a Master of Medicine degree.

Conflict statement

We declare that we have no financial or personal relationship which may have inappropriately influenced us in writing this paper.

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Section 4

Appendices

Appendix 1: Human Research Ethics Committee (Medical) approval

Human Research Ethics Committee (Medical)

Research Office Secretariat: Senate House Room SH 10005, 10th floor. Tel +27 (0)11-717-1252
Medical School Secretariat: Phillip Tobias Building, 2nd Floor, Tel +27 (0)11-717-2700
Private Bag 3, Wits 2050, www.wits.ac.za.

28 October 2014

Dr M Mofokeng
Clinical Director
Charlotte Maxeke Johannesburg Academic Hospital (CMJAH)
Parktown
Johannesburg

Dear Dr Mofokeng

SUBJECT: **CONFIRMATION OF STUDY APPROVAL**
Protocol Ref no: M140836
Protocol Title: The Occurrence and Management of Postoperative Pain in Paediatric patients on Discharge from the recovery Room of the Charlotte Maxeke Johannesburg Academic Hospital
Principal Investigator: Dr NP Hlatshwayo
Department of Anaesthesiology

This letter serves to confirm that the Human Research Ethics Committee (Medical) has approved the above mentioned study. In order for a clearance certificate to be issued, the researcher is required to submit written approval to conduct the study in your hospital.

Yours Sincerely,

Ms Zanele Ndlovu
Administrative Officer
Human Research Ethics Committee (Medical)

UNIVERSITY OF THE WITWATERSRAND
OFFICE OF THE DEPUTY VICE CHANCELLOR RESEARCH
28 OCT 2014
RESEARCH OFFICE
JOHANNESBURG

Appendix 2: Postgraduate approval

Faculty of Health Sciences
Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Ms Thokozile Nhlapo
E-mail: thokozile.nhlapo@wits.ac.za

14 October 2014
Person No: 1020400
PAG

Dr NP Hlatshwayo
PO Box 1188
Shongwe Mission
1331
South Africa

Dear Dr Hlatshwayo

Master of Medicine: Approval of Title

We have pleasure in advising that your proposal entitled *The occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix 3: Parent or guardian information letter

Dear Parent/ Guardian

Hi! My name is Nozipho Hlatshwayo and I am a doctor working in the operating theatre at this hospital. What I do in theatre is put people to sleep for their operation and I make sure they do not feel pain while having their operation. I have to do a research study as part of my degree and I would like to invite you your child to take part in the study: the occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital.

I am doing a study that looks at the number of children who have pain after their operation and seeing how well the pain is treated. This will help the sleep doctors who do the same work as I do, to know if they are doing a good job treating your child's pain or if they need to do more.

After coming into the operating theatre, your child will be taken into the operating theatre and be put to sleep for the operation. While they are sleeping, they will be given pain medication. The doctor will try make sure that your child is given enough medication for pain. After the operation is done, the sleep doctor will wake your child and take them to the recovery room where there are nurses who look after your child.

To help me do the study, I will ask you to come to the recovery room. I will be using the scale that is on a piece of paper and has six faces showing different levels of pain. I explained this scale to you and your child before the study. The first face is a happy smiling one that tells me your child does not feel pain and the following faces get sadder until there is a crying face showing they have bad pain. I will ask you to help your child to show you how they are feeling by pointing to the face they think best show how much pain they have. This will take a few minutes.

If your child has pain I will ask the sleep doctor to give them something for the pain and I will stay with you and your child until the doctor arrives.

Please know that:

- I will not use yours or your child's name as I will be giving your child a study number, and only I and my supervisors will see your child's information.
- I will ask you to sign a form that gives me permission to include your child in the study.
- If your child is 6 years and older I will ask them to sign a form giving permission to include them in the study. This will be done after explaining to the child what will happen.
- You can refuse to allow your child to be part in the study even after you have signed the form to give permission. You do not have to give reasons for refusing. This will not affect how we treat your child in the operating theatre or the recovery room.
- If you have any questions later you can contact me on: (011) 488 43 97 or the chairman of the Ethics Committee on (011) 717 1234.

Thank you for your consideration,

Nozipho Hlatshwayo

Appendix 4: Parent or guardian consent form

Research Title: The occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital.

I _____ give permission for my child/ child I care for to take part in this study. I have read and understand what the study is about. I understand that my child/ child I care for will not be harmed during this study and further understand that I can refuse to take part in the study at any time during the study and that this will not result in poor care for my child/ child I care for.

_____ _____ _____

Parent/Guardian name Signature Date

Appendix 5: Children's information letter

Research title: the occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital.

Dear _____

Hi! My name is Nozipho. I am the doctor that will put you to sleep for your operation. Whilst you are sleeping the sleep doctor will give you something for pain so that you are not sore when you wake up after the operation.

When the operation is finished and you are awake, I will take you to a room with nice people who will look after you. Mommy/Daddy/Gogo (Granny) will also be there. When you are able to talk to them we will ask you if you feel any pain and how much pain you feel. You can show us this by pointing to a face on this picture (show scale) that shows how much pain you feel.

The first face means you do not feel pain, it is happy and smiling. The next one shows you hurt just a little bit, next one shows you hurt a bit more, then you hurt even more, next one you hurt a whole lot more until the one with tears which tell us you hurt very very much.

By showing us how much pain you feel we can know if we must give you more medicine to make it go away. This will also help us to make your friends feel better if they have pain after an operation. Then everyone can have smiling faces.

If you do not want to be part of this, then you can say "no". If you say "no" we will still make sure that you do not feel any pain and your friends will also be helped to not feel pain. If you decide to help us know about the pain, please write your name on the form to say you will take part in the study.

If you have pain I will ask the sleep doctor to give you medication for the pain and I will stay with you until they come.

Thank you,

Nozipho

Appendix 6: Children's assent form

Research title: the occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital.

I _____ agree to take part in this study. I understand that after my operation I will be asked to show, on a paper with faces, how much pain I feel. I also understand that I will not be hurt in this study and that I can say "no" when I do not want to take part anymore. I know that I will be treated well even if I say "no".

_____ _____

Child's name Date

_____ _____ _____

Researcher's name Signature Date

Appendix 7: Data collection sheet

Study Number: _____

Date: _____

Demographics:

Gender

Male	Female

Age in years | |

Type of Surgery: _____

Intraoperative analgesia:

Intravenous	Regional technique with/out IV

Recovery room analgesia:

WBS score: | |

Section 5

Proposal

The occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital

Nozipho Hlatshwayo

Student number: 102 0 400

Supervisor: Ms H. Perrie

Department of Anaesthesiology

Co-supervisor: Dr P. Motshabi

Department of Anaesthesiology

1. Introduction

Pain in children is complex and in neonates controversial. Although it was previously thought that children do not experience pain, it is now known that this is incorrect. Pathways involved in pain perception have developed by the second trimester of gestation and nociception is established by birth (1, 2). However, neurotransmission, neural connections and receptor-mediated systems continue to mature after birth. Due to the immaturity of these at birth, children may experience more pain than adults and the adverse effects of pain may last into adulthood (2, 3).

Much of the research done to understand paediatric pain has been done in neonates and rats (1, 4-15). The more immediate consequences of pain are as a result of the neuro-humoral stress response which causes a state of catabolism characterised by increased carbohydrate, fat and protein metabolism, and biochemical changes cause impairment to organ systems. (16, 17) These changes may not be well tolerated by infants especially those who are preterm, who may not be able to meet the increased metabolic demands of a catabolic state due to immaturity (14). Experimental studies in 1989 and 1991 done in rats by Meaney et al (4, 5) demonstrated the long-term consequences of pain which included an heightened autonomic cardiovascular response to pain in rats that were subjected to repetitive painful procedures. Vallee et al (6), in 1999, showed that prenatal stress caused cognitive impairment that lasted into adulthood in rats. Studies published by Young (7), Taddio et al (8), Porter et al (9), Grunau et al (12) and Anand et al (15) have shown similar results in human new-borns. These studies also showed an increased sensitivity to pain in adulthood. It is important for health care workers caring for children to be equipped with knowledge of the detrimental effects of pain in a child and to relieve pain adequately.

Studies done in Australia, Canada, Brazil, Sweden and America show a high (40 to 57%) incidence of pain in hospitalised children, particularly those who have undergone surgery (18-24). Of concern is that these studies also reveal that pain is under-recognised and inadequately treated in hospitalised children. In the Canadian study by Johnston et al (19), 46% of the children who experienced moderate to severe pain did not receive analgesia in the preceding

24 hours and an American study by Fortier et al (24) showed that 24% of children who had pain post tonsillectomy and adenoidectomy were not given analgesia at all. Therefore, worldwide the incidence of pain in children appears to be high as it is inadequately treated.

Pain intensity and patient satisfaction in children are difficult to assess for numerous reasons and this could contribute to the under-diagnosis and under-treatment of pain in children. To assess pain intensity in the postoperative period, numerous tools have been developed and validated. These are used for either self-report, which is the gold-standard of pain assessment, or observational assessment. Whether to choose a tool for self-report or observational assessment depends on the developmental age of the child, presence of cognitive impairment and ability to communicate verbally. The Wong-Baker Faces scale (WBS) is the tool preferred by both children and parents and the most widely used by researchers. (25-27)

For the effective management of pain in the postoperative period, the World Health Organisation has developed guidelines for the treatment of pain. These were first presented in 1986 for the treatment of cancer-associated pain and have since been adapted (in 2010) to include pain not associated with cancer such as postoperative pain. The guideline highlights a stepwise approach in the treatment of pain by increasing the potency of drug used and number of adjuvants as the pain intensity increases. The guideline also advocates frequent dosing instead of pro re nata administration of analgesics. (28) It is important to note that the guideline only includes pharmacotherapy treatment of pain but non-pharmacological therapies have been advocated (10, 11).

Successful postoperative pain management programmes such as the one found at the Boston Children's Hospital in the United States of America have provided effective pain management strategies for children. Strategies such as patient controlled analgesia for children and epidurals have been beneficial in the treatment of pain. Furthermore, the programme is monitored and evaluated quarterly to ensure continued satisfaction of children and parents. (29)

1. Problem Statement

The incidence of postoperative pain in paediatric patients is high, however, it remains under-diagnosed and under-treated. Untreated pain is associated with short and long-term consequences and is an unpleasant experience for both the caregiver and the child.

There is no pain scale used currently in the recovery room at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) and the occurrence of postoperative pain is not known. Also, the management of postoperative pain is not guided by formalised guidelines or protocols, therefore it is unknown how effective treatment is in the recovery room.

2. Aim

The aim of the study is to describe the occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the CMJAH operating theatres using the WBS.

3. Objectives

The objectives of this study are to:

- describe the occurrence of postoperative pain in paediatric patients on discharge from the recovery room using the WBS
- describe the perioperative management of postoperative pain in paediatric patients in the recovery room
- compare the pain scores of paediatric patients who receive a block with those who receive intravenous analgesia only
- compare the pain scores between male and female paediatric patients.

4. Research assumptions

The following definitions will be used in this study.

Paediatric patient: According to the South African Bill of Rights and Children's Act, a child is a person under the age of 18 years. However, for the purpose of the study, paediatric patients will be those aged between 4 to 12 years old will be selected to participate. In this study they will be referred to as participants.

Caregiver: includes parents and guardians of children presenting for surgical procedure.

Surgical paediatric patients: includes patients who have undergone ENT, dental, ophthalmology, general, urogenital and orthopaedic surgeries.

Regional technique: a form of analgesic strategy that does not involve the intravenous administration of analgesic agents, for example caudal block or epidural analgesia and nerve blocks.

Intravenous analgesia: any analgesic agent, including paracetamol, non-steroidal anti-inflammatories or opioids and ketamine, administered intravenously.

Wong and Baker Scale (WBS): a validated pain assessment tool developed by Wong and Baker in 1988 and is used for the self-reporting of pain intensity in paediatric patients 3 to 18 years (30).

Adequate pain control: a score of four or less on the WBS (31).

5. Demarcation of study field

This study will be conducted in the recovery room at CMJAH. It is a central hospital affiliated to the University of the Witwatersrand and has a total of 1088 beds. It provides quaternary hospital service and central referral services and may also provide national referral services (32).

The recovery room consists of a total of eight stations, equipped with suggested standard American Society of Anaesthesiologists (ASA) monitoring equipment, of which three are dedicated for paediatric patients.

6. Ethical considerations

Approval to conduct the study will be sought from the Human Research Ethics Committee (Medical) and the Postgraduate Committee of the University of the Witwatersrand. Permission to conduct the study at CMJAH will be requested from the hospital's Chief Executive Officer once approval by the Ethics Committee has been granted (Appendix 1). The ward managers, theatre nursing manager and recovery room nurse manager will be informed of the study.

The WBS (Appendix 2) is copyrighted and permission to use the scale was granted by the Wong-Baker Foundation.

Parents of patients undergoing surgical procedures will be invited to take part in the study, if they agree a study information letter will be given to them and written consent will be obtained (Appendix 4 & 5). In addition, paediatric patients who are six years and older will be invited to participate and sign an assent form (Appendix 6 & 7).

Anonymity will be ensured by allocating a study number to each enrolled patient. A list of the names and study numbers of the patients will be kept separate and only the study number will be used in the data collection form. Confidentially will be ensured as only the researcher and the supervisors will have access to the raw data. The raw data will be stored for six years following capture of the study data.

If the patient is found to have a score of greater than four on the WBS, the researcher will contact the anaesthetist responsible for pain management and remain with the patient until the anaesthetist arrives.

This study will be conducted in accordance with the Declaration of Helsinki (33) and the South African Good Clinical Practice Guidelines (34).

7. Research methodology

7.1 Research design

Research design is the blueprint for a study and it determines the methods by which the researcher obtains subjects, collects data, analyses the data and interprets results (35, 36).

This study will be a prospective, contextual, descriptive study.

In a prospective study a group at risk of a particular event are selected and followed over time to determine if the event occurs (36). This study uses a WBS to collect pain scores from paediatric patients postoperatively at the time the study is conducted.

The context describes the area where the study will be conducted (37). In this study data will be collected in the recovery room in CMJAH operating theatres.

Descriptive study designs allowed the researcher to gain information about characteristics within a particular field of study without establishing a causal link (35). This study is descriptive as it looks at the occurrence and management of postoperative pain in paediatric in the recovery room at CMJAH operating theatres.

7.2 Study population

The population for this study will consist of paediatric patients undergoing surgery at the CMJAH operating theatres.

7.3 Study sample

Sample size

The sample size was calculated in consultation with a biostatistician. The overall minimum sample size required is 124. This was calculated assuming a prevalence of postoperative pain of 20% at a 95% confidence interval and using a precision of 10%.

Sampling method

Convenience sampling will be used in this study. This method of sampling is used where there is a homogenous population and the researcher cannot ensure that there is no under or over representation of the different groups. (38)

Inclusion and exclusion criteria

The following inclusion criteria will be used:

- paediatric patients aged 4 to12 years
- patients accompanied by a caregiver
- caregivers must understand English or Zulu
- patients who can communicate verbally.

The following exclusion criteria will be used:

- patients with cognitive impairment or developmental delay
- refusal to consent by caregiver
- refusal to assent by the patient.

7.4 Data collection

The researcher did an extensive literature review and identified the WBS as the most appropriate pain rating scale for the study sample. Paediatric patients in a ward in CMJAH were approached and shown different pain scales (WBS and Facial Pain Scale-Revised). The WBS was unanimously chosen by the patients to describe their experience of pain.

The WBS (Appendix 2) is copyrighted and permission was granted by the Wong-Baker Foundation to use the scale in this study (Appendix 3).

On their arrival in theatre prior to surgery the parent or guardian and the child will be given information about the study and they will be invited to participate. The scale will be shown to the patient prior to surgery and the meaning of each of the six faces will be explained, this will

be done again in the recovery room once the patient is awake. Consent (Appendix 3 & 4) from caregivers as well as assent (Appendix 5 &6) from a child more than six years old will then be obtained. After the surgery, in the recovery room, the child will be asked to point to the face that best describes how they feel and the researcher will document the score accordingly.

Collection of data will be done during the researcher's paediatric rotation at CMJAH. The data will be collected by the researcher.

The following data will be collected preoperatively on a data collection sheet (Appendix 7);

- study number
- age
- gender
- type of surgery.

Once the patient is awake and ready to leave the recovery room they will be asked to point to the face that best describes their level of pain on the WBS (with the assistance of a caregiver if necessary). Perioperative pain management until discharge from the recovery room will be documented (Appendix 7).

The data will be entered in a Microsoft Excel® Spreadsheet.

7.5 Data analysis

Data will be analysed with the assistance of a biostatistician using Statistica version 12. Descriptive and inferential statistics will be used. Categorical variables will be summarised using frequencies and percentages and continuous variables using means and standard deviations if the data are normally distributed, otherwise medians and ranges. Chi-squared or Fishers exact tests will be used for comparisons between the two groups. The level of significance will be set at 0.05. Where appropriate, 95% confidence intervals will be reported.

8. Significance of study

The incidence of postoperative pain in paediatric patients is high; however, it remains under-diagnosed and under-treated. Untreated pain is associated with short and long-term consequences and is an unpleasant experience for both the caregiver and the child.

The results of the study will highlight the occurrence and adequacy of perioperative management of postoperative pain in the recovery room at CMJAH. This may lead to:

- a formal pain assessment in the recovery room prior to discharge using a formal rating scale such as WBS
- the introduction of formal pain management guidelines
- improved caregiver satisfaction.

9. Validity and reliability

Validity refers to the degree to which a measurement represents a true value and whether the conclusions of the study are justified (38). Reliability is the consistency with which a valid measuring tool will produce the same results in various situations (35).

In this study, validity and reliability will be ensured by:

- choosing an appropriate study design
- using appropriate data gathering techniques
- sample size will be determined with the assistance of a biostatistician
- data will be collected by the researcher only
- using the validated WBS for all patients
- data analysis will be done in consultation with a biostatistician
- the researcher will be the only data capturer
- every fourth entry into the Excel ® spreadsheet will be checked for accuracy.

10. Potential limitations

Limitations are defined as restrictions or problems within a study that may limit the ability to generalise findings to a population (36).

This study will be done in the context of CMJAH and the results may therefore not be generalised to other hospitals, provinces or the South African paediatric population as a whole.

Patients with cognitive impairment secondary to anaesthesia or other cause will not be included. This may exclude patients with a cognitive impairment secondary to pain.

Patients may not be cooperative postoperatively, especially the younger patients, resulting in inaccurate information being recorded or loss of information.

Anaesthetist may become aware of the study and alter their practice accordingly.

11. Project outline

Time frame

The time frame for completion of this study is outlined in the Gantt chart below.

Activity	Jun. '14	Jul. '14	Aug. '14	Apr. '15	May '15	Jun. '15	Jul. '15	Aug. '15	Jan. '16	Feb. '16	Mar. '16
Proposal preparation											
Ethics submission											
Post grad submission											
Data collection											
Analysis of results											
Draft article											
Submit											

Financial plan

Budget

	Item	Number	Price for each	Total Amount
Paper and printing	Proposal	900	R1.00	R1 200.00
	MMED	300		
Binding	MMED	3	R200.00	R600.00
				R1 800.00

Funding

The costs for printing and paper will be covered by the Department of Anaesthesiology, University of the Witwatersrand.

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Appendix 1: Letter to CMJAH CEO

Dr N. P. Hlatshwayo

MBCHB (UCT) DA (SA)

Contact: 072 68 21 875

Email: zipho.hlatshwayo@gmail.com

July 2014

The CEO of Charlotte Maxeke Johannesburg Academic Hospital

Dear Doctor

Re: Request for permission to conduct research

My name is, Nozipho Hlatshwayo, and I am a registrar in the Department of Anaesthesiology at the University of the Witwatersrand. I am conducting an Mmed research study titled: The occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH), and I would like to request permission to conduct my study in the operating theatres of CMJAH using the Wong and Baker Faces Scale.

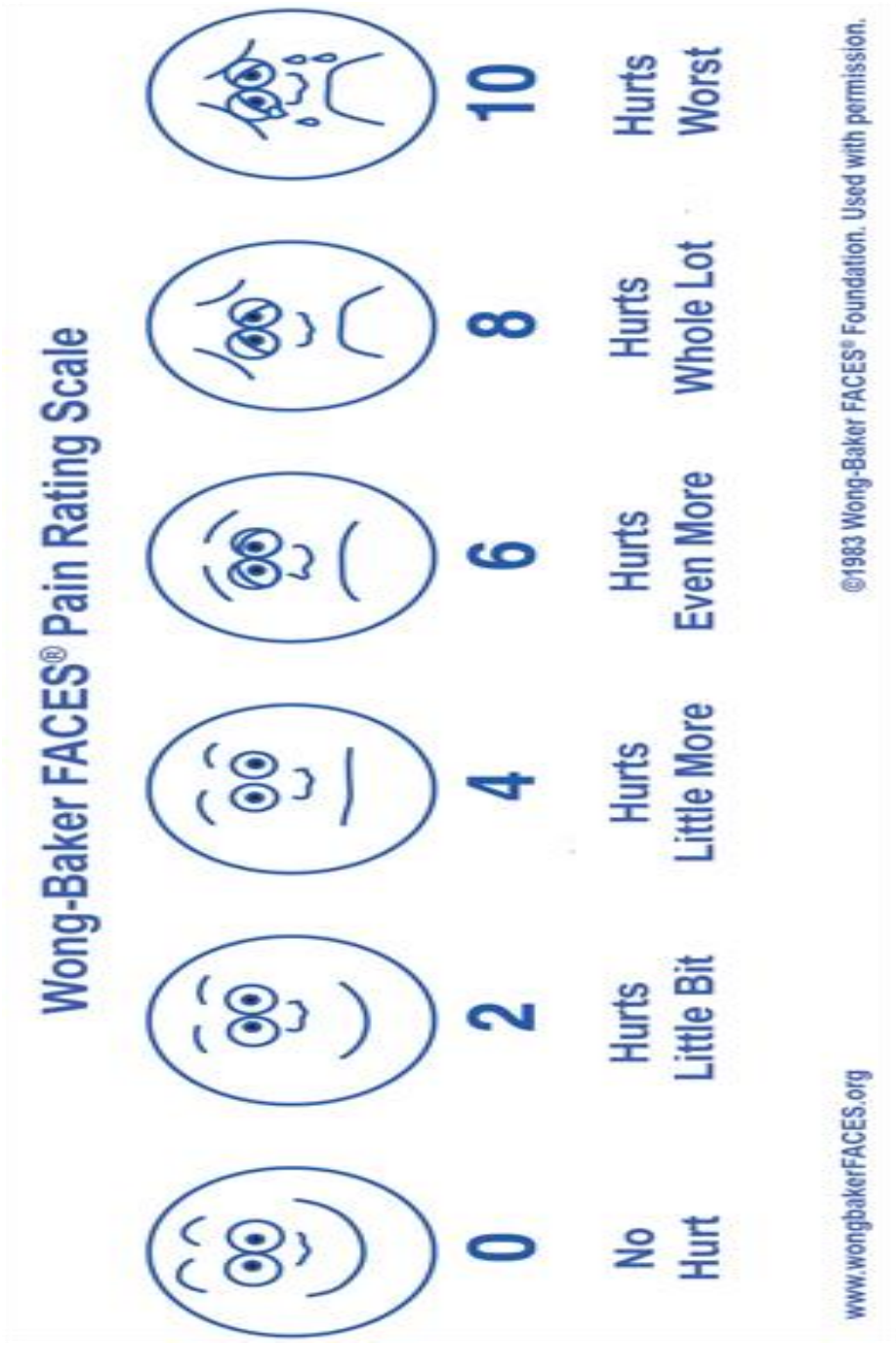
The study may be beneficial to the hospital in that appropriate pain assessment tools can be introduced for use in the recovery room and assist in improving pain management. There will be no additional cost to the hospital.

The Human Rights Ethics Committee (HREC) and the Post-graduate Committee of the University of the Witwatersrand have approved the study. Attached please find my ethics clearance certificate and a copy of my proposal.

Sincerely,

Nozipho Hlatshwayo

Appendix 2: The Wong-Baker Faces Scale



Appendix 3: Information letter for the caregiver

Dear caregiver

Hi! My name is Nozipho Hlatshwayo and I am a doctor working in the operating theatre at this hospital. What I do in theatre is put people to sleep for their operation and I make sure they do not feel pain while having their operation. I have to do a research study as part of my degree and I would like to invite you and your child to take part in the study: The occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital.

I am doing a study that looks at the number of children who have pain after their operation and seeing how well the pain is treated. This will help the sleep doctors, who do the same work as I do, to know if they are doing a good job treating your child's pain or if they need to do more.

After coming into the operating theatre, your child will be taken into the operating theatre and put to sleep for the operation. While they are sleeping, they will be given pain medication. The doctor will try to make sure that your child is given enough medication for pain. After the operation is done, the sleep doctor will wake your child and take them to the recovery room where there are nurses who look after your child.

To help me do the study, I will ask you to come to the recovery room. I will be using a scale that is on a piece of paper and has six faces showing different levels of pain. I will explain this scale to you and your child before the study. The first face is a happy smiling one that tells me your child does not feel pain and the following faces get sadder until there is a crying face showing they have bad pain. I will ask you to help your child to show you how they are feeling by pointing to the face they think best show how much pain they have. This will take a few minutes.

If your child has pain I will ask the sleep doctor to give them something for the pain and I will stay with you and your child until the doctor arrives.

Please know that,

- I will not use yours or your child's name as I will be giving your child a study number, and only I and my supervisors will see your child's information.
- I will ask you to sign a form that gives me permission to include your child in the study.
- If your child is six years and older I will ask them to sign a form giving me permission to include them in the study. This will be done after explaining to the child what will happen.
- You can refuse to allow your child to be part in the study even after you have signed the form to give permission. You do not have to give reasons for refusing. This will not affect how we treat your child in the operating theatre or the recovery room.
- If you have any questions later you can contact me on: (011) 488 43 97 or the chairman of the Ethics Committee on (011) 717 1234.

Thank you for your consideration,

Nozipho Hlatshwayo

Appendix 4: Consent form

Research Title: The occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital.

I _____ give permission for my child/child I care for to take part in this study. I have read and understand what the study is about. I understand that my child/child I care for will not be harmed during this study and further understand that I can refuse to take part in the study at any time during the study and that this will not result in poor care for my child/child I care for.

_____ _____ _____

Parent/Guardian name Signature Date

_____ _____ _____

Researcher name Signature Date

Appendix 5: Information letter for the patient

Research title: the occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital.

Dear _____

Hi! My name is Nozipho. I am one of the doctors who will put you to sleep for your operation. Whilst you are sleeping the sleep doctor will give you something for pain so that you are not sore when you wake up after the operation.

When the operation is finished and you are awake, I will take you to a room with nice people who will look after you. Mommy/Daddy/Gogo (Granny) will also be there. When you are able to talk to them we will ask you if you feel any pain and how much pain you feel. You can show us this by pointing to a face on this picture (show scale).

The first face means you do not feel pain, it is happy and smiling. The next one shows you hurt just a little bit, next one shows you hurt a bit more, then you hurt even more, next one you hurt a whole lot more until the one with tears which tell us you hurt very very much.

By showing us how much pain you feel we can know if we must give you more medicine to make it go away. This will also help us to make your friends feel better if they have pain after an operation. Then everyone can have smiling faces.

If you do not want to be part of this, then you can say “no”. If you say “no” we will still make sure that you do not feel any pain and your friends will also be helped to not feel pain. If you decide to help us know about the pain, please write your name on the form to say you will take part in the study.

If you have pain I will ask the sleep doctor to give you medication for the pain and I will stay with you until they come.

Thank you,

Nozipho

Appendix 6: Assent form

Research title: the occurrence and management of postoperative pain in paediatric patients on discharge from the recovery room of the Charlotte Maxeke Johannesburg Academic Hospital.

I _____ agree to take part in this study. I understand that after my operation I will be asked to show, on a paper with faces, how much pain I feel. I also understand that I will not be hurt in this study and that I can say “no” if I do not want to take part anymore. I know that I will be treated well even if I say “no”.

_____ _____

Child’s name Date

_____ _____ _____

Researcher’s name Signature Date

Appendix 7: Data Collection Sheet

Study Number: _____

Date: _____

Demographics:

Gender

Male	Female

Age in years | |

Type of Surgery: _____

Intraoperative analgesia:

Intravenous	Regional technique with/out IV

Recovery room analgesia:

WBS score: | |