

6 November 2009

CONTENTS

# Non-pharmacological management of pain in children

H Ekwueme

Commentator: S Naidu

Moderator: L Cronje



Department of Anaesthetics

INTRODUCTION .....	3
LIMITATIONS OF CONVENTIONAL PHARMACOLOGICAL PAIN MANAGEMENT IN CHILDREN .....	4
ASSESSMENT OF PAIN IN CHILDREN .....	5
METHODS / TECHNIQUES .....	6
MECHANISM OF ACTION.....	8
ADVANTAGES OVER CONVENTIONAL METHOD.....	9
EVIDENCE.....	9
CRITICISMS .....	10
CONCLUSION.....	11
REFERENCES .....	12

## INTRODUCTION

Children and adolescents account for about 34% of hospital visits each year<sup>(1)</sup> and many of these visits are related to painful conditions<sup>(2)</sup>. Based on family reports, satisfaction with hospital experience is highly dependent on efforts made to manage pain<sup>(3)</sup>. The ideal goal of pain management in children is to make the procedure comfortable for the child and parents, success will be manifested by the child who is not afraid of subsequent procedures and not merely by a child who can be held still for procedures<sup>(4)</sup>.

Children are inconsistently assessed and under-medicated for pain<sup>(5)</sup>. Only during 44.5% of children's visit were pain scores documented<sup>(6)</sup> and in a Swiss study, only 37% of anesthesiologists / surgeons reported that they regularly assessed therapeutic success of analgesia<sup>(7)</sup>. It is therefore not unexpected that more than 50% of children experience severe pain while in hospital<sup>(8)</sup>.

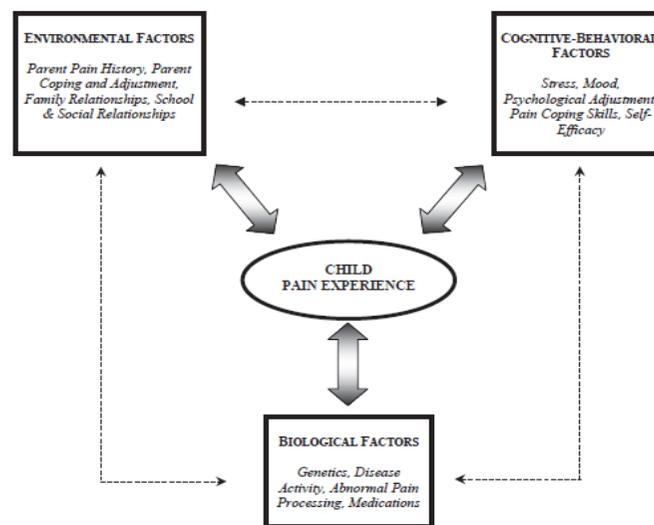
Traditionally, health care practitioners have approached pediatric pain management conservatively, such that 50% of Chinese pediatricians use placebos such as vitamin C or saline to relieve pain, they used placebos to "protect" children from becoming addicted to opioids or to test whether children were really experiencing pain. Although practice in controlling moderate to severe pain was far from ideal, majority of surveyed Chinese pediatricians believed that the training they had received in pain management was poor<sup>(9)</sup>.

Effective pain management in children is challenging because there are many special considerations when providing treatment.<sup>(10)</sup>, hence it has been documented that the standard pain care for children lags behind established guidelines<sup>(11)</sup>, and more frightening is the fact that many centres have no guidelines / protocol. More than 75% of US academic centres had no defined protocol for procedures of pain management<sup>(4)</sup>.

Barriers to adequate treatment of pain in children include the belief that neural immaturity protects from pain and no long term outcomes to infant pain, the belief that children do not remember noxious stimuli, pain in children does not fit within the strict definition of pain which requires a self report, lack of appropriate validated pain assessment tools, lack of training and concerns about drug overdose and its toxicity.<sup>(12)</sup>

## LIMITATIONS OF CONVENTIONAL PHARMACOLOGICAL PAIN MANAGEMENT IN CHILDREN

Pain is complex, multidimensional and inherently subjective<sup>(10)</sup>; and is best understood within the context of a biopsychosocial model that incorporates biologic, environmental and cognitive behavioral mechanisms in the development and maintenance of pain<sup>(13)</sup>. Therefore it should be managed as such<sup>(10)</sup>.



*Biopsychosocial model of pain (13)*

Health care practitioners focused on the treatment of pain rather than the prevention of pain and have erroneously approached pain management in children as "either/or", that is pharmacological interventions or alternate approaches. Specialties defined which method and interventions were used, physicians rely primarily on drugs and invasive technique to modulate nociceptive processing while non-physicians rely primarily on non pharmacological approaches. "Either/or" as we have noted, does not provide optimal care<sup>(14)</sup>. Biopsychosocial model of pain has showed the inadequacy of conventional approach to control all the factors associated with pain. Furthermore, sole reliance on conventional pharmacological method has been sub-optimal in pain management because of:

- (a) Drug pharmacokinetics / pharmacodynamics vary in the pediatric ages.
- (b) The commonest reason for drug toxicity in children is miscalculating doses from adult preparations.
- (c) Some medications are not recommended in children e.g. aspirin.
- (d) There are some techniques that are less appropriate in children e.g. PCA <sup>(15)</sup>

### ASSESSMENT OF PAIN IN CHILDREN

Until recently, the management of pain in children was hindered by a lack of reliable and valid instruments for pediatric pain assessment. This lack probably contributed to the general underestimation and treatment of pain in children <sup>(13)</sup>. There are many published guidelines for the assessment of pediatric pain and the assessment should be individualized, comprehensive, measured, continuous, monitored and documented <sup>(16)</sup>.

Self reporting is considered the most reliable indicator of the existence and intensity of pain <sup>(17)</sup>, one dimensional pain scales have been developed for use in the acute pain settings in children above age of 3 years <sup>(10)</sup>, though pain cannot be easily quantified by one dimensional parameters especially in neonates, infants and those children that cannot verbalize or express appropriately their pain. A multidimensional tool should account for all the factors that influence pain experience <sup>(10)</sup>. However, it is important to be sure that children particularly those between the 3 and 7 years of age are competent to provide information before their report is accepted <sup>(18)</sup>.

#### Box 1. One-dimensional pain scales

##### *Visual analog scale (VAS)—no pain to worst pain*

A 100 mm line on which patients place a mark to estimate their pain and the distance from the origin (no pain) is measured.

##### *Oucher Scale*

A vertical numerical scale from 10 to 100 for children who can count to 100, with a corresponding vertical photographic scale of expressions of no hurt to worse hurt. Pictures are available in different races.

##### *Colored Analog Scale (CAS)*

Colors are assigned (markers or crayons) for "most or worst hurt," "a little less hurt," and "no hurt." A numeric value can also be placed on each color.

##### *Faces Pain Scale*

Six cartoon faces ranging from very happy (smiling face) to very sad (sad face).

##### *Body Outline Tool*

The child marks an X or colors the painful area on a non gender-specific line drawing of a child's body. Different colors can be used to quantify the pain.

##### *Poker Chip Tool*

Four poker chips are used; one chip represents a little hurt and four chips is the most hurt the child could experience.

#### Box 2. Multidimensional pain scales that incorporate behavioral patterns and physiologic signs, showing appropriate age range of patients

##### *Postoperative pain*

Postoperative Pain Score (POPS); 0–3 years [53]

Liverpool Infant Distress Scale (LIDS); neonates [54]

Neonatal Facial Coding System (NFCS); neonates <4 months [55]

FLACC (face, legs, activity, cry, consolability);

2 months–7 years [56]

Toddler-Preschooler Postoperative Pain Scale (TPPS);

1–5 years [56]

COMFORT ; 0–3 years [56]

Children's Hospital of Eastern Ontario Pain Scale (CHEOPS);

1–7 years [57]

##### *Procedural pain*

Crying, Requires oxygen to maintain saturation greater than 95%, Increased vital signs, Expression, Sleepless (CRIES);

neonates [58]

Pain Assessment Tool (PAT); neonates [39]

Neonatal Infant Pain Scale (NIPS); neonates [52]

Modified Behavioral Pain Scale (MBPS); 4–6 months [59]

Neonatal Assessment of Pain Inventory (NAPI); 0–3 years [60]

##### *Decreased cognitive ability*

Noncommunicating Child's Pain Checklist—Postoperative Version (NCCPC-PV) [56]

### METHODS / TECHNIQUES

Given the influence of psychological and behavioral factors on pain, non-pharmacological interventions are important in altering pain perception/behaviours <sup>(19)</sup>. These interventions aim to reduce fear, minimize distress and pain and increase a child's sense of control. More so, peri-operative anxiety is a predictor of post operative pain outcome <sup>(20)</sup>.

To be effective, the techniques must be appropriate to age and developmental abilities and must also be appealing to the recipient.

The techniques can be assigned to three broad categories:

- (a) Cognitive methods which includes education/ preparation, music, guided imagery, distraction and hypnosis.
- (b) Behavioral methods among which are progressive muscle relaxation technique, biofeedback exercises, breathing control, and hypnosis.
- (c) Physical methods e.g. heat and cold application, massage and touch, Transcutaneous Electrical Nerve stimulation (TENS), acupuncture/acupressure etc.

### **Education / Preparation**

The goals are to provide information about the medical intervention as appropriate and begin desensitizing the child. Sensations, sounds and visuals that will occur during a procedure are explained in an age/developmentally appropriate manner. The provision of information allows a patient to plan coping strategies and have greater sense of control.

### **Distraction**

Children less than 6 years of age respond well to distraction techniques, such as blowing bubbles, counting, video games etc. The goal is to refocus attention from threatening anxiety provoking aspect of medical treatment to ideally pleasant and engaging situations.

### **Suggestion**

Children are susceptible to the power of suggestion, which makes the magic glove technique especially effective. The basic principle is willingness to be involved and ability to have enough strength and energy to participate. An imaginary glove is placed on a child's hand, finger by finger where a procedure is to be performed.

### **Breathing control**

Specific patterns of regulated breathing can enhance a child's relaxation. The pattern requires concentration and attention of the child thereby taking the mind away from the procedural pain. It gives the child the tool to manage stress. Two types of breathing techniques can be used: rhythmic deep chest breathing and patterned shallow breathing.

### **Guided imagery**

It is a form of relaxed focused concentration. It entails using sound and sight in one's imagination to produce a sense of wellbeing. It has been useful for preoperative anxiety and postoperative pain management. The child is encouraged to imagine being in the favorite place and then imagine the sights, sounds and smell of that favorite place.

### **Progressive muscle relaxation**

Extensive practice with systematic tensing and relaxing of muscle groups allows the child to differentiate painful stimuli. It is designed to help children recognize and reduce body tension associated with pain. Instructions are given to tense a muscle group and hold it in that condition for 10 seconds and notice the way a muscle feels when tense compared with how it feels when the tension is relaxed.

### **Biofeedback**

The principle is to translate the body's physical state into audio-visual signals. The child may then be able to voluntarily control specific physiological parameters e.g. skin temperature, muscle electromyography etc.

### **Hypnosis**

The technique involves focusing attention towards achieving deeper level of relaxation and pain relief. An altered state of consciousness is used, whereby a child's attention is focused, narrowed and absorbed. The tendency of children to have a short attention span allows hypnotic technique to better capture that attention span and keep it focused away from the painful procedure.

### **Acupuncture**

It is based on traditional Chinese medicine for pain relief. It originated from the theory that energy (chi) flows through the body along channels (meridians) which are connected by acupuncture points. The obstruction of the flow of energy results in pain and subsequent restoration of that energy eliminates pain. The flow is restored by insertion of fine needles at acupuncture points along the meridians involved. Effectiveness of acupuncture in other conditions has been well documented.

### **MECHANISM OF ACTION**

The precise physiologic mechanisms are unknown, but various postulates have been made.

- (a) Gate control hypothesis: It postulates the presence of blocking or gating mechanisms along the pain pathway, prohibiting pain from reaching the brain through stimulation of inhibitory neurons. The neurons close the pain gates through stimulation of non-painful receptors or excitatory messages from the brain <sup>(21)</sup>.
- (b) Endogenous opioids mechanism: The body is stimulated to produce and release endorphins and enkephalins, which then act at the native opioid receptors thereby blocking the perception of pain <sup>(14)</sup>.
- (c) Wind up mechanism: via indirect c-fibre activity, some approaches may decrease c-fibre activity, an indirect but major component in the development of hyperalgesia and central sensitization <sup>(22)</sup>.
- (d) Relaxation response: A physical state of deep rest that changes physical and emotional response to stress. By focusing attention away from the painful stimuli, alterations may occur in nociceptive responses, thus triggering an internal pain suppressing system and the potential to modify cognitive pain perceptions <sup>(23)</sup>.

## ADVANTAGES OVER CONVENTIONAL METHOD

Most of the techniques are non-invasive, carry minimal risks and give a child a degree of control over his/her situation<sup>(24)</sup>, by capitalizing on a child's natural imaginative skills and high degree of suggestibility<sup>(14)</sup> wherein the sense of mastery seems to replace the sense of helplessness that hospital procedures may produce among the pediatric group<sup>(25)</sup>.

Behavioral program before surgery decreased anxiety, rates of emergence delirium and the use of analgesia and resulted in faster discharge after surgical intervention. By decreasing anticipatory anxiety and distress in children, it has become effective in reducing parental perception of pain distress in children<sup>(26)</sup>.

Generalizability of the skills makes it an attractive adjunctive therapy; moreover, the approach is relatively inexpensive<sup>(27)</sup>.

## EVIDENCE

Few qualified studies are available regarding the use of non-pharmacological approach in children; however, there is a body of literature supporting the efficacy of the technique for both acute and chronic pain management.

Non pharmacological approach has been found to be an effective adjunctive method for the control of pain. Jones described its use in pediatric patients undergoing Harrington rods placement. Those taught the technique required less amount of pain medication after surgery<sup>(28)</sup>. Cochrane review recommends the use as an adjunct for the treatment of procedural pain and anxiety in sickle cell patients<sup>(29)</sup>. In a study by Zelter et al, it was shown that combining pharmacological and non pharmacological measures resulted in decreased distress of painful procedures and increase quality of life in children with leukemia.<sup>(30)</sup>

A blinded randomized study showed that 75% sucrose dummy before immunization decreased infant crying time, as well as parent and nursing perception of pain and distress<sup>(31)</sup>. Patients having upper abdominal surgery who were treated post operatively with TENS were shown to have improved pulmonary function compared with control group, pain control was better, they required less opioids and as a result had improved pulmonary function<sup>(32)</sup>.

Eccleston and colleagues found very strong evidence for the effectiveness of psychological treatment in reducing the pain of chronic and recurrent headache<sup>(33)</sup>. Non pharmacological methods have played a recognizable important role in the management of chronic pain<sup>(34)</sup>.

## CRITICISMS

Efficacy for acute pain management has not been explored adequately, as it is commonly believed in evidence based medicine, that a treatment is not considered risk free unless evidence suggest otherwise. The findings of studies are difficult to evaluate because of inherent difficulties in such research with standard control.

The approach may require more preparation time with the patient and also more time to complete than conventional method<sup>(24)</sup>, in a busy establishment, physicians may not be able to provide time for and attention to preparing patients<sup>(26)</sup>. However, the participation of other professionals e.g. nurses, psychologists, child life specialist, play therapists, physical/occupational therapists etc is crucial and effective. Once the child acquires the skills, it can be used even without the presence of a coach<sup>(24)</sup>.

Sinha et al reported that the approach did not reduce self reported pain, even though that it did reduce self reported anxiety and parental perception of pain in younger children<sup>(26)</sup>.

There have been no official generally accepted standards of quality, but it is practiced by qualified and registered professionals, whose practice and conduct are regulated by the registration boards.

Some techniques may not be risk free and have been associated with some hazards eg certain exercises in yoga have caused documented basilar/vertebral artery occlusion. There have also been reports of serious complications affecting the upper spine during chiropractic manipulation. These complications are very rare and there were other variables associated with the occurrence of these rare complications.

Gunnar et al has cautioned that the reduction of pain by these unconventional methods may be deceiving because it did not cause any significant effect on the serum level of cortisol - a stress hormone - when compared to control<sup>(36)</sup>. T. Field in 1995 however reported (from studies in infants) lowered levels of stress hormones<sup>(37)</sup>.

## CONCLUSION

Attitudes are changing in area of pediatric pain management <sup>(38)</sup> and the traditional belief that children are incapable of experiencing pain has been abandoned <sup>(39)</sup>. What is known now suggests that the use of these adjunctive methods of pain management would complement pharmacological management, hence the American Academy of Pediatrics/Canadian Paediatric Society recommend non-pharmacologic interventions to prevent, reduce or eliminate pain <sup>(18)</sup>. Currently, about 85% of US tertiary institutions offer one or more techniques <sup>(35)</sup>.

There is continuous need to educate the medical community regarding the long term outcomes of pain control <sup>(40)</sup>, however, many areas require further study to provide stronger evidence.

## REFERENCES

1. Tamariz VP, Fuchs S, Baren JM, et al; Pediatric emergency medicine education training programme, *Acad Emerg Med* 2007; 7:774-8
2. Bauman BH, McManus JG. Pediatric Pain Management in the Emergency Department. *Emerg. Med. Clinics of N. AM* 23 (2005) 393-414
3. Chan L, Russell TJ, Robak N. Parental Perception of the adequacy of pain control in their child after discharge from the emergency department. *Pediatr Emerg Care* 1998; 14:251-3
4. Zelter LK, Altman A, Cohen D, Lebaron S, Munkesela E, and Schechter NL. Report of the subcommittee on the management of pain associated with procedures in children with cancer. *Pediatrics* 1990; 86: 826-830
5. Eland JM, Anderson JE. The experience of children. In: Jacox A, ed. *Pain: A Source book for Nurses and other Health Professionals*. Boston, MA: Little Brown; 1997: 455-6
6. Drendel AL, Brousseau DC, Gorelick MH. Pain assessment for pediatric patients in the emergency department. *Pediatric*. 2006; 117(5): 1511-18
7. Wilder-Smith OH, Mohrle JJ, Martin NC. Acute pain management after surgery or in the emergency room in Switzerland: a comparative survey of Swiss anaesthesiologists and surgeons. *Eur J Pain*. 2002;6(3):189-201
8. Gauthier JC, Finley GA, McGrath PJ. Children's self-report of postoperative pain intensity and treatment threshold: determining the adequacy of medication. *Clin J Pain*. 1998;14(2):116-120
9. Wang XS, Tang JY, Zhao M, Guo H, Mendoza T, and Cleeland CS. Pediatric Cancer Pain Management Practices and Attitudes in China. *T Pain Symptom Manage* 2003; 26:748-759
10. Bauman BH, McManus JG, Jr. Pediatric Pain Management in the Emergency Department. *Emerg Med Clin N Am* 23 (2005), 393-414
11. MacLaren J, Kain ZN, Research to Practice in Pediatric Pain: What Are We Missing? *Pediatrics* 2008; 122 (2) 443
12. Porter FL, Wolf CM, Gold J, Lotsoff D and Miller PJ. Pain and Pain Management in Newborn Infants: A Survey of Physicians and Nurses. *Pediatrics* 1997; 100 (4)
13. Anthony KK, Schanberg LE. Pediatric Pain Syndromes and Management of Pain in children and adolescents with Rheumatic Disease. *Pediatr Clin N Am* 52 (2005) 611-639
14. Rusy LM, Weisman SJ, Complementary Therapies for Acute Pediatric Management, *Pediatric Clinics of North America* 2000; 47 (3) 1-9
15. Thomas AJ. Perioperative Pain Control: Children and adults, Refresher Course 2008

16. Schechter NL, Berde CB, Yaster M, Pain in infants, Children and adolescents: an overview Baltimore (MD): Williams and Wilking; 1993, 3-9
17. Franck LS, Greenberg CS, Stevens B. Pain assessment in infants and children. *Pediatr Clin North Am* 2000; 47(3): 487-512
18. AAP/APS. The Assessment and Management of Acute Pain in Children and Adolescents. *Pediatrics* 2001; 108 (3) 793-7
19. Committee on Psychosocial aspects of child and Family Health. Task force on pain in infants, children and adolescents. The assessment and management of acute pain in infants, children and adolescents. *Pediatrics* 2001; 108: 793-7
20. Kain ZN, Mayes LC, Caldwell –Andrews AA, et al. Perioperative anxiety, postoperative pain, and behavioural recovery in young children undergoing surgery. *Pediatrics* 2006; 118:651-8
21. Fields H. Pain, New York; McGraw Hill, 1987
22. Anseloni V, Ren K, Dubner R, Ennis M. Ontogeny of analgesia elicited by non–nutritive suckling in acute and persistent neonatal rat pain models. *Pain* 2004;109:507-513
23. Benson H, Rosner BA, Marzetta BR et al; Decreased blood pressure in borderline hypertensive subjects who practiced meditation. *J. Chron Dis.* 1974; 27: 163-9
24. Khan KA, Weisman SJ. Non-Pharmacologic Pain Management Strategies in the Pediatric Emergency Department. *Clin Ped Emerg. Med* 2007,8, 240-7
25. McDonnell L, Broden ML; Breathing Management; A Simple stress and Pain Reduction Strategy for the use on a Pediatric Service. *Comprehensive Pediatric Nursing* 12: 339-344, 1989
26. Sinha M, Christopher NC, Fenn R, Reeves L. Evaluation of non-pharmacological methods of pain management for laceration repair in the pediatric emergency department. *Pediatrics* 2006; 117:1162-1168
27. Taylor BJ, Robbing JM, Gold JI, Lodsdon TR, Bird TM, Anand KJS. Assessing postoperative pain in neonates; A multicenter observational study. *Pediatric* 2006; 118; 992-997
28. Jones CWE. Hypnosis and spinal fusion by Harrington rod instrumentation . *Am J CLin Hypnosis* 19: 155-157, 1997
29. Milling LS, Constantino CA. Clinical hypnosis with children: Firsts steps toward empirical support. *Int J Clin Exp Hyp* 2000; 48: 113-37
30. Zeltzer L, LeBaron S. Hypnosis and non-hypnotic techniques for reduction of pain and anxiety during painful procedures in children and adolescents with cancer. *J Pediatr* 101: 1032-1035, 1982 Abstract
31. Lewindon PJ, Harkness L, Lewindon N. Randomized controlled trial of sucrose by mouth for the relief of infant crying after immunization. *Arch Dis Child* 78: 453-456, 1998 Abstract
32. Ali J, Jaffe CS, Serrel C. The effect of transcutaneous electrical nerve stimulation on postoperative pain and pulmonary function. *Surgery* 1981; 89: 507-508, Abstract
33. Eccleston C, Morley S, William AC, Yorke L, Mastroiannopoulou K. Systematic review of randomized controlled trial of psychological therapy of chronic pain in children and adolescents with a subset meta-analysis of pain relief. *Pain* 2002; 99:157-65
34. Astin J, Shapiro S, Eisenberg D, Forsy K. Mind body medicine: State of the science, implications for practice. *J Am Board Fam Pract* 2003; 16: 131-47
35. Lin YC, Lee ACC, Kemper KJ. Use of complementary and alternative medicine in pediatric pain management service: A survey. *Pain Medicine*, 2005, 6; 452-458
36. Gunner MR, Fisch RV, Korsvik S, Donhowe JM. The effects of circumcision on serum cortisol and behavior. *Psychoneuroendocrinology* 1981;6:269-75
37. Field T. Massage therapy for infants and children. *J. Dev. Behav. Pediatr.* 1995. 16(2): 105-11
38. McLaughlin CR, Hull JG, Edwards WH, Cramer CP, Dewey WL. Neonatal Pain; A comprehensive survey of attitudes and practices. *J. Pain symptom manage* 1993;8:7-16
39. McGraw MB. Neural maturation as exemplified in the changing reactions of the infant to pin-prick. *Child Dev.* 1941;12:31-42
40. McClain BC, Kain ZN, Procedural Pain in neonates. *The New Millenium. Pediatrics* 2005;116;1073-74

**NOTES**