NEONATAL PAIN REDUCTION DURING VENIPUNCTURE BY NON-PHARMACOLOGICAL ANALGESIA WITH PREMATURE INFANT PAIN PROFILE TOOL ASSESSMENT

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CERTIFICATE

This is to certify that **"NEONATAL PAIN REDUCTION DURING VENIPUNCTURE BY NON-PHARMACOLOGICAL ANALGESIA WITH PREMATURE INFANT PAIN PROFILE TOOL ASSESSMENT"** is a bonafide work done by **DR.V.NANDHAKUMAR, M.B.B.S,** under the guidance and supervision of **PROF.DR.V.ILAKKUMI,M.D,D.C.H.** It is submitted in partial fulfillment of the award of the degree of **M.D BRANCH VII PAEDIATRIC MEDICINE** for the **March 2009** examination to be held under the **Tamilnadu Dr. M.G.R Medical university, Chennai.**

HEAD OF THE DEPARTMENT **DEAN**

DECLARATION

I declare that this dissertation entitled "**NEONATAL PAIN REDUCTION DURING VENIPUNCTURE BY NON-PHARMACOLOGICAL ANALGESIA WITH PREMATURE INFANT PAIN PROFILE TOOL ASSESSMENT"** has been conducted by me at the department of paediatrics and department of obstetrics & gynecology, Government Raja Mirasudar hospital, Thanjavur, attached to Thanjavur Medical college, under the guidance and supervision of my unit Chief and Head Of the Department **Prof.Dr.V.ILAKKUMI,M.D,DCH** and **Prof.Dr.S.SELLARAMAN,M.D,D.C.H.** It is submitted in partial fulfillment of the award of the degree of **M.D BRANCH VII PAEDIATRIC MEDICINE** for the **March 2009** Examination to be held under the Tamilnadu Dr.M.G.R. Medical University, Chennai. This has not been submitted previously by me for the award of any degree or diploma from any other university.

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CONTENTS

INTRODUCTION

In the last decade of 20th century, the pool of resources and information available to support medical & surgical teams in neonatal pain management has expanded rapidly[1].

One of the institutional practical guidelines and standards of care should include " a patient's right to regular and systemic assessment of pain, interventions to relieve pain, evaluation of effectiveness of interventions, attention to long term pain management needs, deleterious effects of unmanaged pain, and educational needs of families and staff who provide care"[2,3,4].

Despite these initiatives, surveys of physicians and nurses continue to suggest that pain in the neonatal population is underestimated and under managed even in western countries [5 6,7].

Various studies state that infants born at 27 to 31 weeks of gestation may experience as many as 134 painful procedures in the first 2 weeks of life[8].

The prevention of pain in neonates is an expectation of parents. Not only it is an ethical expectation, but also because the stress induced by the pain response, produce sequelae in multiple organ systems.

Acute effects include elevations of cortisol, catecholamines and lactate, hypertension, tachycardia, respiratory instability, glucose instability and changes in cerebral blood flow.

Chronic pain may affect growth, immune function, recovery and discharge.

Neonatal pain also influences long term memory, social and cognitive development and neuro plasticity[9, 10].

Neonates at greatest risk of neurodevelopmental impairment as a result of preterm birth (i.e., the smallest and sick neonates) are also those most likely to be exposed to the greatest number of painful stimuli, creating a double hit phenomenon[11].

Because the most effective and safest ways to prevent pain in the neonate are unknown, striking a proper balance between effective pain relief and avoidance of serious adverse effects from pain medications is a major challenge[12, 13, and 14].

This study is designed to assess the pain response of the neonate and compare the efficacy of various non-pharmacological methods in reliving pain, due to venipuncture using a multidimensional tool.

The most useful and feasible one is incorporated in the hospital policy.

REVIEW OF LITERATURE

Physiology of pain perception in neonates

By 20 weeks of gestation, the fetus is served by a highly differentiated and fully functional sensory system, as evidenced by presence of nociceptive nerve endings in the skin, arborization of dendritic processes in the neocortex and synaptogenesis of

thalamocortical fibers[15].

The functional maturity of pain pathway is evidenced by the presence of various neurotransmitters and pain related neuromodulator substances like substance p, somatostatin, calcitonin gene regulated peptide (CGRP) and vasoactive peptides.

The large number of nociceptive nerve endings in the skin and mucous membranes of the fetus far exceed that in adults.

Nociceptive impulses in babies travel to the spinal cord through unmyelinated rather than myelinated fibers and there is also a relative paucity of inhibitory neurotransmitter in them. Babies also have large receptive fields and possibly a higher concentration of substance p receptors. They have a lower threshold for excitation and sensitization, resulting in more central effects of nociceptive stimuli. These factors are believed to make infants feel pain more severely than older persons[1, 15].

Ascending pathways between the peripheral nervous system and spinal cord rich in excitatory neurotransmitter, which potentiate pain transmission, but poor in mediating neurotransmitters which blunt the pain response.

There is no doubt that newborn babies do feel pain as evidenced by variety of facial, behavioral, autonomic, biochemical [hypoglycemia, rise in serum lactate& pyruvate], hormonal response and even rise in pulmonary artery pressure leading to right to left shunt.

Neonates also harbor unpleasant memories of pain in later life.

Although development of complex structures of the central nervous system

parallels that in the peripheral nervous system and a vast supply of neurons purveys the cortex itself, differentiation of structure and function in the cortex is a slower process and compromises preterm infants ability to integrate and assimilate pain information. Their response patterns both physiologic and behavioral are less organized, less robust less ordinate and more difficult to interpret. 50% of premature infants do not cry during painful procedures.

Local tissue injury resulting from repeated heel sticks and invasive procedures trigger increased proliferation of nerve endings in surrounding tissues may remain hypersensitive well beyond the neonatal period[16].

Mechanisms of pain perception and pain suppression:

The periaqueductal grey and periventricular mesencephalic regions serve as an inherent analgesic system. Signals from these regions are transmitted through nuclei in the pons and medulla, to the dorsal horn of the spinal cord, to block the sensation of pain.

The neurotransmitters involved in the suppression of are endogenous opiates that include b-endorphin, met and leu encephalins and dynorphin.

Other neurotransmitters such as serotonin and GABA also decrease the sensation of pain[17].

Possible reasons for the neglect of pain relief in neonates:

1. Lack of awareness of neonate's capability to perceive pain.
2. Lack of awareness of clinical situations where in pain is perceived.
3. Inability of infants to express pain specifically.
4. Medical attention focused towards treatment of primary clinical condition.
5. Neonates' expression of pain interpreted as expressions of fear.
6. Caregivers' temptation to perform quick procedures without analgesia.
7. Reluctance to use analgesics due to side effects.
8. Fear of inducing dependence on opioid drugs.
9. Lack of awareness of painless routes and methods of analgesia[17].

ASSESSMENT OF PAIN

Although self-reporting of pain is the gold standard for assessment of the site, nature and severity of pain, it is not precisely applicable in neonates. Hence in neonates, surrogate markers are used. Pain is associated with physiological, biochemical, behavioral, and psychological alterations that can be recorded and some extent, quantified[18]. These changes are as follows,

Physiological changes:

Increase in

1. Heart rate
2. Blood pressure
3. Respiratory rate

4. Oxygen consumption
5. Mean airway pressure
6. Muscle tone
7. Intracranial pressure

Autonomic changes:

1. Mydriasis
2. Sweating
3. Flushing
4. Pallor

Behavioral changes:

Change in facial expression

1. Grimacing
2. Screwing up of eyes
3. Nasal flaring
4. Deep nasolabial groove
5. Curving of the tongue
6. Quivering of the chin

Body movements:

1. Finger clenching
2. Thrashing of limbs
3. Writhing

4. Arching of back
5. Head banging

Biochemical changes:

Increased release of:

1. Cortisol
2. Catecholamines
3. Glucagons
4. Growth hormone
5. Rennin
6. Aldosterone
7. Antidiuretic hormone

Decreased secretion of:

1.Insulin.

It is reported that 20% increase in the measurable physiological parameters in response to pain. These changes are secondary to increased cortisol and catecholamine secretion, which sets up the classical fight and flight sequence in older children and adults. It is easy to measure alterations in most of the physiological parameters without invasive equipment.

These measurements coupled with certain consistent behavioral responses are very sensitive indicators of newborn pain. Of the behavioral changes facial expression

of the baby is considered the most reliable and consistent indicator, with the least interobserver disagreement as well[19].

Although the biochemical changes are perhaps the most sensitive quantifiable parameters, the need to use invasive methods is a major drawback.

Consequences of pain in infants:

Immediate effects:

- Irritability
- Fear
- Disturbance of sleep and wakefulness state
- Increased oxygen consumption
- Ventilation-perfusion mismatch
- Diminished nutrient intake
- Increased gastric acidity.

Short-term effects:

- Enhanced catabolism
- Altered immunological function
- Delayed healing
- Impaired emotional bonding

Long-term effects:

- Memory pain

- Developmental retardation
- Alteration in response to subsequent painful experience.

MANAGEMENT OF PAIN:

The management of infant pain rests primarily on the tripod of

1. Awareness of infants' capacity to perceive pain.
2. Sensitivity to situations where infants may experience pain may be encountered
3. Appropriate steps to prevent and treat pain[17].

Basis management strategies for infant pain

- Awareness of infants' capacity to perceive pain.
- Sensitivity to situations where infants may experience pain
- Prevention of pain.
- Assessment of cause and severity of pain
- Pharmacological interventions
- Non-pharmacological interventions.
- Modification of techniques used for diagnostic and therapeutic procedures.

Pharmacological interventions

Systemic administration of drugs:

The **opioids**, including morphine, methadone, oxymorphine, codeine, fentanyl, alfentanil, and sufentanil are the most potent class of analgesic drugs. They have the

added advantage of this group is that in the event of over dosage, the effects are easily reversed. These drugs have the potential for tolerance and dependence. Risk of adverse effects like respiratory and central nervous system depression, often hampers the rational use of these agents[20].

Non-steroidal anti-inflammatory drugs are used to treat pain of lesser intensity and as an adjunct to reduce the total dose of opioids.

Local techniques

Local anesthetic agents block the transmission of impulses from receptors to the spinal cord. They can be administered in any one of three ways:

1. Infiltration into local area
2. Nerve blockade
3. Intravenous regional block

Various local anesthetic agents available are lignocaine preparations, bupivacaine, amethocaine gel, and ropivacaine. Mixing with the adrenaline increases the duration of action[21].

A eutectic mixture of 2.5% lignocaine and 2.5% prilocaine, designated EMLA is becoming popular. A mixture of tetracaine, amethocaine and cocaine(TAC) in another local anesthetic[22].

<u>Non-pharmacological interventions:</u>

These are interventions that enhance activity in descending inhibitory systems and there by decrease pain perception. Attenuation of transmission of impulses to the spinal cord can be achieved by stimulation of large sensory nerve fibers mediating sensations of touch and temperature.

The non-pharmacological interventions may also modulate pain sensation and response to pain through changes in attention and decreasing apprehension.

Some of the strategies are as follows,

- Facilitated tucking--- positioning and restraining the infant in a relatively flexed posture[23].
- Stroking---stimulation of nerve fibers transmitting tactile and thermal sensations.
- Combining these methods with soothing vocal stimulation[24].
- Breast feeding[25, 26]
- Feeding of sweet compounds such as sucrose27, glucose[28, 29] and saccharine.
- Non-nutritive sucking on pacifiers[31, 32].
- Kangaroo care---skin to skin contact
- Gentle rocking
- Swaddling
- Development care, which includes limiting environmental stimuli, lateral positioning, the use of supportive bedding, and attention to behavioral clues.

Oral sucrose eliminates the electroencephalographic changes associated with a painful procedure in a neonate, but the mechanism of pain relief by sucking oral sucrose is not known for certain. In one study, endogenous endorphin concentrations did not increase with administration of oral sucrose.

Although the intra oral administration of sucrose to preterm infants without suckling is effective, intragastric administration is not.

Concentrated oral glucose has also been used and diminishes the pain response of venipuncture, but it does not decrease oxygen consumption or energy expenditure, suggesting there may still be a stress response.

A wide range of oral sucrose doses have been used in neonates for pain relief, but an optimal dose has not been established .

The dosage range of sucrose for reducing pain in neonates is 0.012 to 0.12g (0.05-0.5 ml of 24% solution). Some authors have suggested that multiple doses for a procedure (2 minutes before and 1-2 min after) are more effective than a single dose[33, 34].

Because oral sucrose reduces but dose not eliminate pain in neonates, it should be used with other non-pharmacological measures to enhance its effectiveness.

Clinical settings where in infants experience pain (a partial list)[17]:

Disease conditions:

- Otitis media

- Pharyngitis and oral infections
- Aphthous ulcers
- Chestpain associated with coughing
- Infantile colic
- Headache due to variety of causes
- Tissue injury due to trauma
- Hydrocephalus
- Intracranial bleeding
- Necrotising enterocolitis
- Intestinal obstruction
- Spasticity.

Diagnostic procedures:

- Heel puncture
- Venous and arterial puncture
- Suprapubic bladder puncture
- Squeezing muscles during blood sampling
- Lumbar puncture
- Ventricular puncture
- Endotracheal suction
- Bronchoscopy

- Paracentesis thoracis
- Ascitic fluid aspiration
- Gastrointestinal endoscopy
- Cystoscopy

Therapeutic procedures:

- Intravenous cannulation
- Intamuscular injection
- Umbilical catheterization
- Insertion or removal of infant feeding tube
- Urinary bladder catheterization
- Endotracheal intubation and suction
- Circumcision
- Wound dressing
- Incision and drainage procedures
- Postoperative state
- Insertion/ removal of drainage tubes
- Endoscopic sclerotherapy.

Pain assessment scales in infants[17]:

Various pain scales have been designed and validated to assess pain. Some of the commonly used scales as follows,

Based on behavioral changes:

- Neonatal facial coding system (NFCS)
- Infant baby coding system (IBCS)
- Neonatal infant pain scale (NIPS)
- Pain assessment in neonates (PAIN)
- Liverpool infant distress scale (LIDS)
- Modified behavioral pain scale
- Children's hospital of eastern Ontario pain scale (CHEOPS)
- Neonatal assessment of pain inventory (NAPI)
- Behavioral pain score
- Clinical scoring system.

Combination of physiological and behavioral changes:

- CRIES (acronym for crying, change in transcutaneous oxygen saturation, heart rate, blood pressure, facial expression and alteration in sleep pattern)
- Pain assessment tool (PAT)
- Premature infant pain profile (PIPP)
- Scale for use in newborns (SUN)
- COMFORT score

The pain assessment tool used should be multidimensional, including measurements for both physiologic and behavior indicators of pain. One such tool is PREMATURE INFANT PAIN PROFILE.

PREMATURE INFANT PAIN PROFILE:

It is a seven indicator multidimensional tool originally developed to assess acute pain in term and preterm infants. Scoring with PIPP is unique, is that special consideration is given to the infant's gestational age in addition to physiologic and behavioral indices. Each indicator is evaluated in a scale of 0 to 3, with a total score range of 21 for premature infants and 18 for term or older infants.

∗ A score of </= 6 indicates minimal or no pain.

A score of >12 indicates moderate to severe pain[1].
Scoring guidelines:

1. Score the corrected gestational age before scoring.
2. Assess baseline heart rate and oxygen saturation;
    a. For procedural pain asses before the event
    b. If pain is already present, review he chart for earlier base line.
3. Score behavioral state by observing the infants for 15 seconds immediately before the event.
4. Observe the infant for 30 seconds immediately after the event[35].

AIM OF THE STUDY

- To assess the magnitude of the pain response of healthy preterm and term neonates to venipuncture, objectively.
- To compare some of the non-pharmacological methods and objectively to find out the efficacy of single versus combined non-pharmacological methods.
- To find out the best method(s) to incorporate into the hospital policy.

STUDY JUSTIFICATION

Though ample numbers of studies were done, related to non-pharmacological methods of pain relief, only meager studies are available in our country especially in the southern part.

Only few studies used multidimensional scale to assess the pain response particularly, the ***"Premature infant pain profile"*** – which is one of the well-known and accepted multi dimensional scales universally.

Also only very few studies included preterm in the study.

Although all methods have shown promise, no single method is universally recommended.

Though review of literature says that combining two methods is superior to single method, the effectiveness of this combination is not proven objectively in most of the studies.

With the above-told justification this study is carried out.

SUBJECTS AND METHODS

Study design:

Prospective randomized, partially blinded study.

Study place:

Post natal ward, post caesarian ward, preterm ward and transitional care unit of the Government Raja Mirasudar Hospital, Thanjavur, which is attached to the Thanjavur Medical College Hospital, Thanjavur.

Study period:

12 months starting form July 2007 to August 2008.

Study population:

150 preterm and term neonates requiring blood sampling for blood groping & jaundice.

Eligibility criteria:

Inclusion criteria:

1. Gestational age: Preterm and term newborn babies who established the sucking & swallowing coordination.
2. Neonatal age more than 24 hours, less than or equal to 28 days.

Exclusion criteria:

1.Clinically ill (irritable, poor or incessant cry, lethargy, refusal of feeds,

sluggish neonatal reflexes for the corresponding gestational age, breathlessness, unstable vitals).

2. Major congenital anomalies
3. Risk of sepsis
4. Any sedative or analgesic drug intake
5. Any other painful condition (Skin infections, parenteral medication, immunization)
6. On intravenous fluids.

Informed consent was obtained from the mother before inclusion of the neonates for the study.

On inclusion, the neonates were randomly assigned to one of the 6 groups by simple randomization techniques namely,

1. Control group
2. 24% sucrose solution
3. Rocking
4. Non-nutritive sucking
5. 24% sucrose & Non-nutritive sucking
6. Rocking & Non-nutritive Sucking.

Neonates in the Control group were given 2ml of distilled water orally 2 min before venipuncrure.

Neonates in the 24% sucrose group were given 2ml of 24% sucrose solution 2 minutes before the venipuncture.

In the Rocking group, neonates were rocked by lifting the baby's head off the cot on palm of the hand (without lifting the baby off the cot) and making rocking movements in a gentle, rhythmic manner. This was continued during and up till 2 minutes after the procedure.

A sterile pacifier (standard silicone rubber) was held gently in the neonate's mouth, in the Non-nutritive sucking group and the palate tickled to stimulate sucking. This was continued during and up till 2 minutes after venipuncture.

In the 5th group both 24% sucrose 2 minutes prior to procedure and Non-nutritive sucking were given as described above.

In the 6th group both Rocking and Non-nutritive sucking were given as described above.

PROCEDURE:

The baby was placed in a cot under radiant warmer in a quiet, diffusely lighted room. The pulse oximeter probe was attached firmly to the foot. All interventions were kept ready for every baby.

Blinding was achieved by one of the observers (observer 1) leaving the bedside and

standing behind a screen.

The baby was then assigned to one of the groups.

A trained staff nurse1 gave the selected intervention before or during the procedure as described above according to the group.

Base line parameters like heart rate and oxygen saturation were studied from the pulse oximeter for duration of 15 seconds prior to the procedure.

The dorsum of the hand was held between the thumb and index finger just tight enough to make the vein prominent and venipuncture was done with a 23 G needle by a trained staff nurse 2, with instructions to avoid squeezing, manipylation of the needle tip or removal reintroduction of the needle during the next 30 seconds during which the observer 1 recorded the duration of the facial expressions namely, Eye squeeze, Brow bulge and Nasolabial furrowing.

The observer 2 completed the recording of data like maximal heart rate and minimum oxygen saturation in the 30 seconds following the procedure from the pulse oximeter in the proforma. The observers were blinded to the group allocation of the neonates.

Blinding was partial as in some of the groups intervention needed to be continued during the venipuncture.

The staff nurse then continued and completed the procedure of blood sampling.

Strict aseptic precautions were carried during preparation of solutions and throughout the procedure.

The neonates enrolled were followed up at 24 hours and 48 hours to look for any possible adverse effects to the administration of oral solution or the other interventions. Mothers or the care givers were also to instructed watch for and report immediately, if in case the neonates experienced any new symptoms, bluish discoloration, abdominal distension, refusal of feeds etc.

OBSERVATIONS AND RESULTS

STATISTICAL ANALYSIS

The results were analyzed by using the following statistical analysis.

Data was analyzed using SPSS version 10.5.

ANOVA (Analysis of variance) followed by Fischer's exact 't' test where required.

Multivariate analysis was used for demographic data.

Pearson's correlation test was used where required.

RESULTS AND OBSEVATION

In this study total number of subjects were 150(n). They are randomly divided in to 6 groups.

Among them 88 are female babies and 62 are male babies. Their distribution is as follows,

Table-1
Sex distribution of the total subjects

SEX

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FEMALE	88	58.7	58.7	58.7
	MALE	62	41.3	41.3	100.0
	Total	150	100.0	100.0	

The majority were female babies 58.7% and male babies are 41.3%

Table-2
Frequency of gestational age

GA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	32	8	5.3	5.3	5.3
	34	22	14.7	14.7	20.0
	36	38	25.3	25.3	45.3
	38	49	32.7	32.7	78.0
	40	28	18.7	18.7	96.7
	42	5	3.3	3.3	100.0
	Total	150	100.0	100.0	

The majority of babies 49 out of 150 that is 32.7% are 38 weeks of corrected

gestational age.
Followed by 36 weeks (38%), 40 weeks (18.7%), 34 weeks (22%), 32 weeks (8%), and least was 42 weeks (5%).

Table-3
Sex distribution in different groups

SEX * Type

		Type						
		Rocking	NNS	SUCROSE	ROCK & NNS	SUCROSE & NNS	CONTROL	Total
FEMALE		14	16	15	15	11	17	88
		56.0	64.0	60.0	60.0	44.0	68.0	58.7
MALE		11	9	10	10	14	8	62
		44.0	36.0	40.0	40.0	56.0	32.0	41.3
TOTAL		25	25	25	25	25	25	150
		100.0	100.0	100.0	100.0	100.0	100.0	100.0

P =0 .62 (NS)

Except in sucrose & NNS in which males were more, all other groups' females were more.

Table-4
Comparison of Mean gestational and neonatal age between the groups

Repor

Typ		GA	NA
Rocking	Mean	37.8	1.60
	N	25	25
	Std. Deviation	1.72	.76
NNS	Mean	36.7	1.84
	N	25	25
	Std. Deviation	2.15	.75
Sucrose	Mean	38.8	4.52
	N	25	25
	Std. Deviation	2.89	6.03
Rock & NNS	Mean	36.8	1.84
	N	25	25
	Std. Deviation	1.53	.99
Sucrose & NNS	Mean	36.0	1.20
	N	25	25
	Std. Deviation	1.63	.50
Control	Mean	36.3	3.28
	N	25	25
	Std. Deviation	2.98	4.05
Total	Mean	37.0	2.38
	N	150	150
	Std. Deviation	2.40	3.20

The mean age is highest in sucrose (38.88 weeks) and lowest in sucrose&NNS (36 weeks).

Table-5
Comparison of type of delivery between the groups

DELIVERY * Type

			Typ						
			Rocking	NNS	SUCROSE	ROCK & NNS	SUCROSE NNS	Control	Total
DELIVERY	LSCS	Count	25	11	9		25	7	77
		% within	100.0	44.0	36.0		100.0	28.0	51.3
	VAGINAL	Count		14	16	25		18	73
		% Within		56.0	64.0	100.0		72.0	48.7
Total		Count	25	25	25	25	25	25	150
		% Within	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Among the 150 babies 77 (51.3%) were delivered by LSCS and 73 (48.7%) were delivered by vaginal.

P < 0.005 (S)

Table-6

DELIVERY

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	LSCS	77	51.3	51.3	51.3
	VAGINAL	73	48.7	48.7	100.0
	Total	150	100.0	100.0	

Table-7

Report

WT

Type	Mean	N	Std. Deviation
Rocking	2.812	25	.312
NNS	2.456	25	.466
Sucrose	2.466	25	.582
Rock & NNS	2.645	25	.498
Sucrose & NNS	2.407	25	.455
Control	2.451	25	.695
Total	2.539	150	.527

Mean birth weight is highest in rocking (2.8kg) and lowest in sucrose&NNS (2.4kg)

Table-8

Comparison of mean time (hours) since last feed in between the groups

Report

TIME

Type	Mean	N	Std. Deviation
Rocking	1.720	25	.7371
NNS	1.660	25	.7735
Sucrose	1.250	25	.6166
Rock & NNS	1.500	25	.7773
Sucrose & NNS	1.480	25	.5099
Control	.8480	25	.4788
Total	1.409	150	.7123

Time is lowest in control (0.8 hours) and highest in rocking (1.72 hours)

Table-9

Mean values of demographic characters

Statistics

		GA	NA	WT	TIME
N	Valid	150	150	150	150
	Missing	0	0	0	0
Mean		37.09	2.38	2.5397	1.4097
Std. Error of Mean		.20	.26	4.303E-02	5.816E-02
Median		38.00	1.50	2.6400	1.0000
Std. Deviation		2.40	3.20	.5270	.7123

Frequencies

Table-10
Mean heart rate rise and oxygen saturation fall

Frequencies

Statistics

		HR1	HR2	HR2-HR1	OS1	OS2
N	Valid	150	150	150	150	150
	Missing	0	0	0	0	0
Mean		135.5933	157.6533	22.0200	99.5733	94.7267
Std. Error of Mean		.5435	1.3467	1.2450	4.668E-02	.2298
Median		136.0000	155.0000	20.0000	100.0000	95.0000
Std. Deviation		6.6566	16.4932	15.2480	.5717	2.8139

Table-11
Mean of fall in oxygen saturation and behavioral indicators

Frequencies

Statistics

		OS3	BB	ES	NLF
N	Valid	15	15	15	15
	Missing	0	0	0	0
Mean		4.89	37.88	33.56	34.35
Std. Error of Mean		.22	5.91	2.23	2.26
Median		4.04	20.00	25.00	25.00
Std. Deviation		2.77	72.41	27.37	27.69

Table-12
Mean of behavioral state before the procedure and PIPP

Frequencies

Statistics

		BSBP	PIPP
N	Valid	150	150
	Missing	0	0
Mean		1.9600	9.0667
Std. Error of Mean		.5311	.3603
Median		1.0000	9.0000
Std. Deviation		6.5044	4.4127

Table-13

Recoding of PIPP

pipprec

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5	33	22.0	22.0	22.0
	6-10	75	50.0	50.0	72.0
	11-15	23	15.3	15.3	87.3
	16-20	19	12.7	12.7	100.0
	Total	150	100.0	100.0	

50% are fall between score of 6-10, which is the highest.

Table-14
Comparison of mean PIPP between the groups

PIPP * Type

Report

PIPP

Type	Mean	N	Std. Deviation	Median	Std. Error of Mean
Rocking	11.520	25	2.143	11.000	.428
NNS	8.880	25	1.235	9.000	.247
Sucrose	6.280	25	2.354	5.000	.470
Rock & NNS	7.400	25	1.118	7.000	.223
Sucrose & NNS	3.880	25	1.810	4.000	.362
Control	16.440	25	1.660	17.000	.332
Total	9.066	150	4.412	9.000	.360

The mean PIPP is lowest for sucrose & NNS group (3.88) followed by 24% sucrose solution (6.28), rocking & NNS (7.4), NNS (8.8), rocking (11.52), and highest for control (16.4).

That the table clearly shows, sucrose &NNS is the best non-pharmacological method to reduce the pain.

ANOVA value,

F=154.958
Degree of freedom=5
P<0.0005 -significant

Table-15
Comparison PIPP between the sexes

PIPP * SEX

Report

PIPP

SEX	Mean	N	Std. Deviation	Median	Std. Error of Mean
FEMALE	9.6818	88	4.2738	9.0000	.4556
MALE	8.1935	62	4.4935	7.0000	.5707
Total	9.0667	150	4.4127	9.0000	.3603

Female are having mean value of 9.68, which is higher than male value of 8.1. It shows that females are crying more than males.

Table-16
Comparison of PIPP between types of deliveries

PIPP * DELIVERY

Report

PIPP

DELIVERY	Mean	N	Std. Deviation	Median	Std. Error of Mean
LSCS	8.6494	77	4.4656	9.0000	.5089
VAGINAL	9.5068	73	4.3433	8.0000	.5083
Total	9.0667	150	4.4127	9.0000	.3603

The babies delivered by LSCS (mean PIPP-8.6) are crying lesser than those delivered by vaginal (mean PIPP-9.5).

Table-17

Recoding of PIPP between the sexes

SEX * pipprec

Crosstab

			pipprec				Total
			0-5	6-10	11-15	16-20	
SEX	FEMALE	Count	14	44	16	14	88
		% within SEX	15.9%	50.0%	18.2%	15.9%	100.0%
	MALE	Count	19	31	7	5	62
		% within SEX	30.6%	50.0%	11.3%	8.1%	100.0%
Total		Count	33	75	23	19	150
		% within SEX	22.0%	50.0%	15.3%	12.7%	100.0%

P = 0.9 (NS)

In the 0-5 groups male babies are higher and gradually percentage of male babies are decreasing and those of female babies are increasing as the PIPP increases towards 16-20. This again showed female babies are crying more than the male babies.

Table-18

Comparison of PIPP recoding between the groups

Type * pipprec

Crosstab

			pipprec				
			0-5	6-10	11-15	16-20	Total
Type	Rocking	Count		11	12	2	25
		% within Type		44.0%	48.0%	8.0%	100.0%
	NNS	Count		24	1		25
		% within Type		96.0%	4.0%		100.0%
	Sucrose	Count	13	10	2		25
		% within Type	52.0%	40.0%	8.0%		100.0%
	Rock & NNS	Count		25			25
		% within Type		100.0%			100.0%
	Sucrose & NNS	Count	20	5			25
		% within Type	80.0%	20.0%			100.0%
	No Intervention	Count			8	17	25
		% within Type			32.0%	68.0%	100.0%
Total		Count	33	75	23	19	150
		% within Type	22.0%	50.0%	15.3%	12.7%	100.0%

P < 0.0005 (S)

This table again shows that sucrose & NNS has got the best efficacy, followed by sucrose.

Table-19
Comparison of PIPP recoding between the type of deliveries

DELIVERY * pipprec

Crosstab

			pipprec				
			0-5	6-10	11-15	16-20	Total
DELIVERY	LSCS	Count	23	32	15	7	77
		% within DELIVERY	29.9%	41.6%	19.5%	9.1%	100.0%
	VAGINAL	Count	10	43	8	12	73
		% within DELIVERY	13.7%	58.9%	11.0%	16.4%	100.0%
Total		Count	33	75	23	19	150
		% within DELIVERY	22.0%	50.0%	15.3%	12.7%	100.0%

P = 0.01 (s)

Table-20
PIPP recoding for demographic data

Report

pipprec		GA	NA	WT	TIME
0-5	Mean	36.36	1.58	2.3415	1.3864
	N	33	33	33	33
	Std. Deviation	2.52	1.06	.5169	.5452
6-10	Mean	37.41	2.55	2.5883	1.5467
	N	75	75	75	75
	Std. Deviation	2.02	3.74	.4558	.7314
11-15	Mean	38.00	2.78	2.6826	1.2826
	N	23	23	23	23
	Std. Deviation	2.70	3.37	.5612	.7512
16-20	Mean	36.00	2.63	2.5189	1.0632
	N	19	19	19	19
	Std. Deviation	2.67	3.11	.6900	.7455
Total	Mean	37.09	2.38	2.5397	1.4097
	N	150	150	150	150
	Std. Deviation	2.40	3.20	.5270	.7123

Table-21
Comparison of mean heart rate rise between the groups

HR 2 – HR 1

HR2-HR1 * Type

Report

HR2-HR1

Type	Mean	N	Std. Deviation	Median	Std. Error of Mean
Rocking	22.3600	25	9.9494	21.0000	1.9899
NNS	18.8800	25	4.3428	21.0000	.8686
Sucrose	21.3200	25	13.2656	24.0000	2.6531
Rock & NNS	18.8400	25	5.6101	18.0000	1.1220
Sucrose & NNS	7.8400	25	4.1097	6.0000	.8219
No Intervention	42.8800	25	20.4233	40.0000	4.0847
Total	22.0200	150	15.2480	20.0000	1.2450

Maximal rise in heart rate for control (42.88), and minimum for sucrose & NNS (7.8).

Table-22
Comparison of rise in heart rate between the sexes

HR2-HR1 * SEX

Report

HR2-HR1

SEX	Mean	N	Std. Deviation	Median	Std. Error of Mean
FEMALE	24.0341	88	16.2505	21.0000	1.7323
MALE	19.1613	62	13.3087	17.0000	1.6902
Total	22.0200	150	15.2480	20.0000	1.2450

Table-23
Comparison of rise in heart rate between the type of deliveries

HR2-HR1 * DELIVERY

Report

HR2-HR1

DELIVERY	Mean	N	Std. Deviation	Median	Std. Error of Mean
LSCS	17.9870	77	12.7769	14.0000	1.4561
VAGINAL	26.2740	73	16.5255	21.0000	1.9342
Total	22.0200	150	15.2480	20.0000	1.2450

Table-24
Comparison of fall in oxygen saturation between the groups

OS 3

Report

OS3

Type	Mean	N	Std. Deviation
Rocking	6.6300	25	2.1640
NNS	3.8976	25	1.0700
Sucrose	5.4264	25	2.6957
Rock & NNS	3.3260	25	.8019
Sucrose & NNS	1.8028	25	1.0434
No Intervention	8.2804	25	2.0131
Total	4.8939	150	2.7750

Minimal fall in saturation for sucrose & NNS, and maximal fall for control group.

Table-25
Comparison of mean percentage of brow bulge time between the groups

Report

BB%

Type	Mean	N	Std. Deviation
Rocking	56.400	25	18.580
NNS	29.800	25	16.550
Sucrose	8.200	25	8.765
Rock & NNS	21.800	25	7.889
Sucrose & NNS	8.000	25	6.123
No Intervention	70.800	25	157.423
Total	37.886	15	72.412

ean time is lowest in sucrose & NNS, and highest in control.

Table-26

Comparison of mean percentage of time for eye squeeze, nasolabial furrow and behavioral state before the procedure between the groups

Report

Type		ES%	NLF%	BSBP
Rocking	Mean	60.6000	61.1200	1.0800
	N	25	25	25
	Std. Deviation	17.1391	17.0130	1.1150
NNS	Mean	30.6000	31.0000	1.2400
	N	25	25	25
	Std. Deviation	15.0914	15.4785	.9695
Sucrose	Mean	8.2000	8.0000	1.9600
	N	25	25	25
	Std. Deviation	8.7655	8.8976	1.2069
Rock & NNS	Mean	23.2000	23.8000	1.2800
	N	25	25	25
	Std. Deviation	7.6212	8.2006	.7916
Sucrose & NNS	Mean	8.0000	8.0000	1.2000
	N	25	25	25
	Std. Deviation	7.3598	7.6376	.9129
No Intervention	Mean	70.8000	74.2000	5.0000
	N	25	25	25
	Std. Deviation	16.2455	7.3144	15.6684
Total	Mean	33.5667	34.3533	1.9600
	N	150	150	150
	Std. Deviation	27.3740	27.6956	6.5044

Table-27
Pearson's correlation for PIPP with weight, time since last feed, gestational age, and neonatal age.

FACTOR	**PEARSON VALUE (R)**	**P VALUE**	**SIGNIFICANCE**
WEIGHT	+0.046	0.573	NS
TIME	-0.192	0.019	S
NEONATAL AGE	+0.110	0.182	NS
GESTATIONAL AGE	-0.031	0.707	NS

DISCUSSION

The present study is a randomized, partially blinded study to compare the analgesic effects of common non-pharmacological methods to reduce pain in neonates.

Complete blinding was not possible as many of the interventions had to be continued during the venipuncture.

Previous studies have demonstrated that veni puncture would be a better option for blood sampling compared to heel stick[36, 37]. However, Bautcher et al (1992) has shown that analgesics for venipuncture was used in only 2% of the subjects exposed.

PIPP was selected as the scoring tool of pain analysis mainly because of fact, that it looks into account the baseline behavioral status of the neonates, which would influence the pain response of the neonates[38].

Measures like containment, comforting and saddling were all avoided because the effects of the measures will depend on the interests of the parent / comfort provider.

Because many studies have shown that previous painful experience might influence subsequent pain response, care was taken in include only neonates without previous pain experience.

Mean total PIPP pain score was high in the control as compared to the intervention groups (see Table-14).

A number of studies have compared the effects of sucrose with other non-pharmacological methods of pain assessment.

The cochrane analysis suggests that sucrose is better than placebo in reducing the effects of painful stimuli. In our study also sucrose is better than other methods (single method).

Stevens et al (1997) [39] have found sucrose to be superior to expressed breast milk.

Carbajal et al (1999) [40] have shown pacifiers alone are better than sucrose.

Campos et al (1994) [41] have shown rocking and pacifiers have been compared and both have ben found to reduce crying.

Bellieni et al (2002) [42] have shown that multimodal stimulation is better than just sucrose. In our study also multimodal (sucrose & NNS) method relieved pain better than sucrose alone.

Corbo et al (2000) [43] have shown that NNS reduces the stress of pain.

Gray et al (2002) [44] have found out that breast-feeding is better than others as has got multimodal stimulation.

There was a significant rise in heart rate in the control group on exposure to venipuncture as compared to the intervention groups (see Table-21).

Taksande amar et al (2005) [45] found out tha mean rise in heart rate in neonate to venipuncture was 14.12 beats/minutes. In our study it is 22.02 beats/ minutes, which is

higher than their study.

There was a significant decline in the variation of oxygen froe the baseline in the control group and was significantly different when compared to the base line variation in the groups (see Table-24).

Taksande amar et al (2005) and other studies observed similar changes in oxygen saturation from the baseline in response to venipuncture.

It was observed that various behavioral responses were present for the maximum time and brow bulge was present longer than the eye squeeze and nasolabial furrow (see Table-25, 26).

Roshfurth JA et al (1994) has observed similar results in his previous study where eye squeeze was present for the least duration.

An interesting finding in our study is that female babies are crying more than male babies (Table- 15, 17).

In our study babies those born by LSCS feel more pain than those born by vaginal delivery (Table-16).

CONCLUSION

The present study puts forth the following conclusions based on study results.

- The simple and commonly used invasive procedure like venipuncture produces severe pain in a significant number of neonates with considerable physiological and behavioral changes.
- Female babies are more sensitive to pain than male babies.
- The babies born by LSCS feel more pain than those born by vaginal delivery.
- Non-pharmacological interventions reduce pain during venipuncture.
- Combining two methods reduces pain better than single method.
- Providing 2ml of 24% sucrose solution 2 minutes prior to procedure and establishing Non-nutritive sucking during and up till 2 minutes after the procedure is the best method.
- Among the single method, 2ml of 24% sucrose solution 2 minutes prior to procedure is the best to reduce venipuncture pain.

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PROFORMA

NEONATAL PAIN REDUCTION DURING VENIPUNCTURE BY NON-PHARMACOLOGICAL ANALGESIA WITH PREMATURE INFANT PAIN PROFILE TOOL

Name :

IP no :

Random no :

Group :

Gestational age :

Neonatal age :

Sex :

Birth weight :

Weight at procedure:

Mode of delivery : vaginal/LSCS

Time since last feed:

Premature Infant Pain Profile:

MASTER CHART
ROCKING

NNS

S.NO	SEX	GA [DAYS]NEONATAL AGE	MODE OF DELIVERY	WEIGHT [Kg]	TIME	HR1	HR2	HR2-HR1	OS1	OS2	[OS1-OS2/OS1] X1OO	BB%	ES%	NLF%	BSBP	PIPP (SCORE)
1	M	40	2LSCS	2.4		214	116	120	100	97	3	45	50	50	1	10
2	F	38	1VAGINAL	2.7		212	81	49	21	100	96	4	50	45	45	0	9
3	F	34	2VAGINAL	1.7		112	91	50	21	100	96	4	20	25	25	1	9
4	F	36	3VAGINAL	2.2		313	01	51	21	100	96	4	50	45	45	0	9
5	F	36	3VAGINAL	2.1		113	01	48	18	100	96	4	20	20	20	2	8
6	M	36	2VAGINAL	2.330	min	126	147	21	100	96	4	45	45	45	1	10
7	F	34	1VAGINAL	1.8		212	51	46	21	100	96	4	50	50	45	1	11
8	F	38	3LSCS	2.7		114	01	50	10	100	96	4	50	45	45	2	10
9	F	40	2LSCS	2.4		213	81	58	20	100	97	3	45	45	45	1	10
10	F	34	1LSCS	2		114	115	2	11	100	96	4	50	50	60	0	9

11	F	38	2	VAGINAL	3	31	34	154	20	99	963.03	10	15	15	3	9
12	F	40	2	VAGINAL	3	21	35	155	20	99	963.03	15	25	25	1	7
13	M	36	2	VAGINAL	2.48	11	35	156	21	99	963.03	15	20	20	2	8
14	M	40	1	VAGINAL	3.3	31	36	157	21	99	963.03	20	20	20	0	6
15	F	38	3	VAGINAL	3	31	36	158	22	100	97	3	15	20	20	3	9
16	M	34	2	VAGINAL	1.76	11	35	157	22	100	97	3	20	15	15	3	10
17	M	38	1	LSCS	2.68	11	40	162	12	99	936.06	20	20	20	2	9
18	M	34	1	LSCS	2.7	11	41	163	22	99	936.06	15	15	25	2	10
19	F	38	2	LSCS	2.88	21	41	151	10	99	954.04	45	50	50	0	8
20	F	34	1	LSCS	1.7	21	38	148	10	99	954.04	50	45	45	1	10
21	F	38	1	VAGINAL	2.8	11	42	164	22	99	936.06	10	15	10	1	8
22	F	36	2	LSCS	2.5	11	40	162	22	99	936.06	10	10	10	0	7
23	M	38	3	VAGINAL	3	11	38	160	22	100	97	3	15	15	15	1	7
24	F	34	1	LSCS	1.9	21	39	161	22	100	97	3	15	15	15	2	9
25	M	36	2	LSCS	2.4	21	40	160	20	100	97	3	45	45	45	1	10

24%SUCROSE

S.NO	SEX	GA	[DAYS]NEONATAL AGE	MODE OF DELIVERY	WEIGHT [Kg]	TIME	HR1	HR2	HR2-HR1	OS1	OS2	[OS1-OS2/OS1] X1OO	BB%	ES%	NLF%	BSBP	PIPP (SCORE)
1	F	42	2	VAGINAL	2.6	1	130	159	29	99	954.04		5	5	5	3	7
2	F	38	2	LSCS	1.85	30min	128	156	28	99	954.04		5	5	5	3	7
3	F	36	1	VAGINAL	1.7	2	134	148	14	99	954.04		5	5	0	2	5
4	F	40	1	LSCS	2.5	45min	125	134	9	99	954.04		0	0	0	3	5
5	F	38	22	VAGINAL	1.8	1	146	174	28	100	88	12	5	5	5	3	9
6	F	32	2	VAGINAL	1.63	45min	156	165	9	99	954.04		5	5	5	2	5
7	M	40	8	LSCS	2.3	2	146	170	24	99	954.04		25	25	25	1	7
8	M	40	5	VAGINAL	3	1	128	136	8	100	95	5	5	5	5	0	3
9	M	40	5	VAGINAL	3.2	1	125	134	9	100	95	5	5	5	5	0	3
10	F	42	2	VAGINAL	2.6	1hour 30 min	132	157	25	99	954.04		5	5	5	3	7

11	F	38	2	LSCS	1.85	30min	128	156	28	99	95	4.04	5	5	5	3	7
12	F	36	1	VAGINAL	1.7	2	134	148	14	99	95	4.04	0	0	0	2	5
13	M	40	8	LSCS	2.5	2	146	170	24	99	95	4.04	25	25	25	1	7
14	F	40	1	LSCS	2.8	45 min	130	137	7	99	95	4.04	0	0	0	3	5
15	F	38	25	VAGINAL	2	2	130	158	28	100	92	8	5	5	5	3	9
16	M	34	2	VAGINAL	1.7	1	134	148	14	99	95	4.04	0	0	0	2	5
17	M	32	2	VAGINAL	1.74	1	156	165	9	99	95	4.04	5	5	5	2	5
18	M	40	3	VAGINAL	2.8	1	128	158	30	99	93	6.06	5	5	5	0	5
19	F	42	3	LSCS	3	30min	130	159	29	99	95	4.04	5	5	5	3	7
20	M	40	2	VAGINAL	2.78	30min	134	203	69	100	93	7	5	5	5	0	5
21	F	40	2	LSCS	3	2	125	134	9	100	97	3	5	5	5	3	5
22	F	42	3	LSCS	3.15	30min	146	174	28	100	88	12	25	25	25	3	12
23	M	40	4	VAGINAL	3	2	146	170	24	99	95	4.04	25	25	25	1	7
24	M	40	3	VAGINAL	3.4	2	125	134	9	100	95	5	5	5	5	0	3
25	F	42	2	VAGINAL	3.05	2	146	174	28	100	88	12	25	25	25	3	12

ROCKING & NNS

S.NO	SEX	GA	AGE[DAYS]NEONATAL	MODE OF DELIVERY	WEIGHT[Kg]	TIME	HR1	HR2	HR2-HR1	OS1	OS2	[OS1-OS2/OS1]X1OO	BB%	ES%	NLF%	BSBP	PIPP(SCORE)
1	M	38	3	VAGINAL	3.16	2	135	149	14	100	97	3	20	25	25	2	7
2	F	38	2	VAGINAL	3.05	2	136	150	14	100	97	3	15	20	20	1	6
3	F	38	2	VAGINAL	3.4	2	138	154	16	100	96	4	20	25	20	1	7
4	F	38	1	VAGINAL	3.16	3	128	154	26	100	97	3	25	25	25	1	8
5	M	34	1	VAGINAL	1.9	30min	130	144	14	100	97	3	25	25	25	0	6
6	F	34	2	VAGINAL	1.92	1	128	140	12	100	97	3	25	25	20	1	7
7	F	38	1	VAGINAL	2.78	1	142	162	20	100	96	4	25	25	25	3	9
8	F	36	2	VAGINAL	2.88	2	146	156	10	100	97	3	20	15	15	2	7
9	M	36	1	VAGINAL	2.75	2	138	158	20	98	96	2.04	15	10	10	2	8
10	F	36	3	VAGINAL	2.7	1	134	160	26	100	95	5	20	25	25	2	10

11	F	38	2	VAGINAL	3	1	130	144	14	100	96	4	30	30	25	1	6
12	F	38	4	VAGINAL	3	3	138	158	20	100	97	3	25	25	35	1	7
13	M	38	2	VAGINAL	3	2	138	154	16	100	97	3	20	25	35	1	7
14	F	38	4	VAGINAL	1.9	1	126	154	28	100	97	3	20	25	25	1	8
15	M	38	1	VAGINAL	3	30min	120	150	30	100	95	5	25	25	20	1	9
16	F	38	3	VAGINAL	3	2	140	162	22	99	96	3.03	30	25	25	1	7
17	M	36	1	VAGINAL	2.5	1	140	164	24	100	96	4	15	10	10	1	7
18	F	36	1	VAGINAL	2.25	1	135	148	13	100	98	2	10	15	15	2	6
19	M	38	2	VAGINAL	2.92	1	138	158	20	98	94	4.08	15	25	25	1	7
20	M	38	1	VAGINAL	3.2	1	140	158	18	100	97	3	15	20	20	0	6
21	M	38	1	VAGINAL	2.5	3	128	156	28	100	96	4	25	25	20	0	7
22	M	34	3	VAGINAL	1.8	30min	140	160	20	100	97	3	15	20	30	2	9
23	F	36	1	VAGINAL	2.08	2	136	154	18	100	96	4	15	15	25	1	7
24	F	36	1	VAGINAL	2.48	1	130	144	14	100	98	2	50	50	50	1	8
25	F	34	1	VAGINAL	1.8	1	144	158	14	100	97	3	25	25	25	3	9

24%SUCROSE & NNS

S.NO	SEX	GA	[DAYS]NEONATAL AGE	MODE OF DELIVERY	WEIGHT [Kg]	TIME	HR1	HR2	HR2-HR1	OS1	OS2	[OS1-OS2/OS1] X1OO	BB%	ES%	NLF%	BSBP	PIPP (SCORE)
1	M	36	1	LSCS	2.4	1	130	136	6	99	96	3.03	5	5	5	1	3
2	M	36	2	LSCS	2.4	1	128	132	4	100	99	1	5	0	5	2	2
3	M	36	1	LSCS	2.4	1	130	136	6	100	99	1	5	5	5	3	4
4	F	36	1	LSCS	2.4	1	130	140	10	100	98	2	10	15	15	0	4
5	F	36	1	LSCS	2.4	2	134	144	10	100	97	3	5	5	0	2	4
6	M	36	1	LSCS	2.4	1	140	150	10	100	98	2	5	5	5	1	2
7	M	36	1	LSCS	2.4	2	134	144	10	100	97	3	0	0	0	0	2
8	M	36	1	LSCS	2.4	2	136	144	8	99	98	1.01	5	5	5	1	2
9	F	36	1	LSCS	2.5	1	128	134	6	100	99	1	5	5	0	2	3

10	F	34	1	LSCS	2	1	128	130	2	100	97	2	5	0	0	2	4
11	F	34	1	LSCS	1.8	1	144	148	4	100	98	2	15	10	10	0	4
12	F	38	2	LSCS	2.96	1	138	154	16	100	97	3	15	15	15	1	7
13	F	38	1	LSCS	3	1	140	154	14	99	96	3.03	10	10	15	1	6
14	M	38	1	LSCS	3	2	140	145	5	100	98	2	15	15	15	0	4
15	M	38	1	LSCS	3	1	140	154	14	100	97	3	20	25	25	2	7
16	F	38	1	LSCS	3	2	144	156	12	100	97	3	20	25	25	1	6
17	F	38	1	LSCS	3	2	128	134	6	100	99	1	10	10	10	0	4
18	M	38	3	LSCS	2.9	2	134	150	16	100	97	3	15	15	15	2	8
19	M	38	1	LSCS	2.8	2	134	138	4	100	100	0	0	0	0	1	1
20	F	34	1	LSCS	1.9	2	140	144	4	100	99	1	5	5	5	1	2
21	M	34	1	LSCS	1.8	1	140	145	5	100	99	1	0	0	0	2	4
22	F	34	2	LSCS	1.92	2	130	134	4	99	99	0	0	0	0	1	2
23	M	34	1	LSCS	1.8	1	140	150	10	100	98	2	15	15	15	0	5
24	M	34	1	LSCS	1.8	2	144	150	6	100	100	0	5	5	5	1	3
25	M	34	1	LSCS	1.8	2	134	138	4	100	98	2	5	5	5	3	4

CONTROL

KEY TO MASTER CHART

Sex : M-male

F-female

GA: : Gestational age

Neonatal age : Number of days after delivery

Mode of delivery : LSCS- lower segment caesarean Section

Vaginal- labour natural

Weight : Birth weight in kilogram

Time : Time since last feed in hours.

HR1 : Baseline heart rate

HR2 : Maximal heart rate during venipuncture.

HR2-HR1 : Rise in heart rate

OS1 : Baseline oxygen saturation

OS2 : Minimum oxygen saturation during procedure

[OS1-OS2/OS1]x100 =OS3 : Fall in oxygen saturation in percentage.

BB% : % of time of brow bulge during Venipuncture

ES% : % of time of eye squeeze during Venipuncture

NLF% : % of time of nasolabial Furrow during venipuncture

BSBP : Behavioral state before the Procedure

PIPP : Premature Infant Pain Profile

ABBREVATIONS

ANOVA	: Analysis Of Variance
CGRP	: Calcitonin gene regulated peptide
EMLA	: Eutectic Mixture of Local Anesthetics
G	: Gauge
GABA	: Gamma Amino Butyric Acid
IP	: In patient
LSCS	: Lower segment caesarean section
O2	: Oxygen
P value	: Probability value
PIPP	: Premature Infant Pain Profile
PIPPrec	: Premature Infant Pain Profile Recoding
Std	: Standard
TAC	: Tetracaine, Amethocaine, Cocaine.