Pain in Newborns During Ophthalmologic Exam

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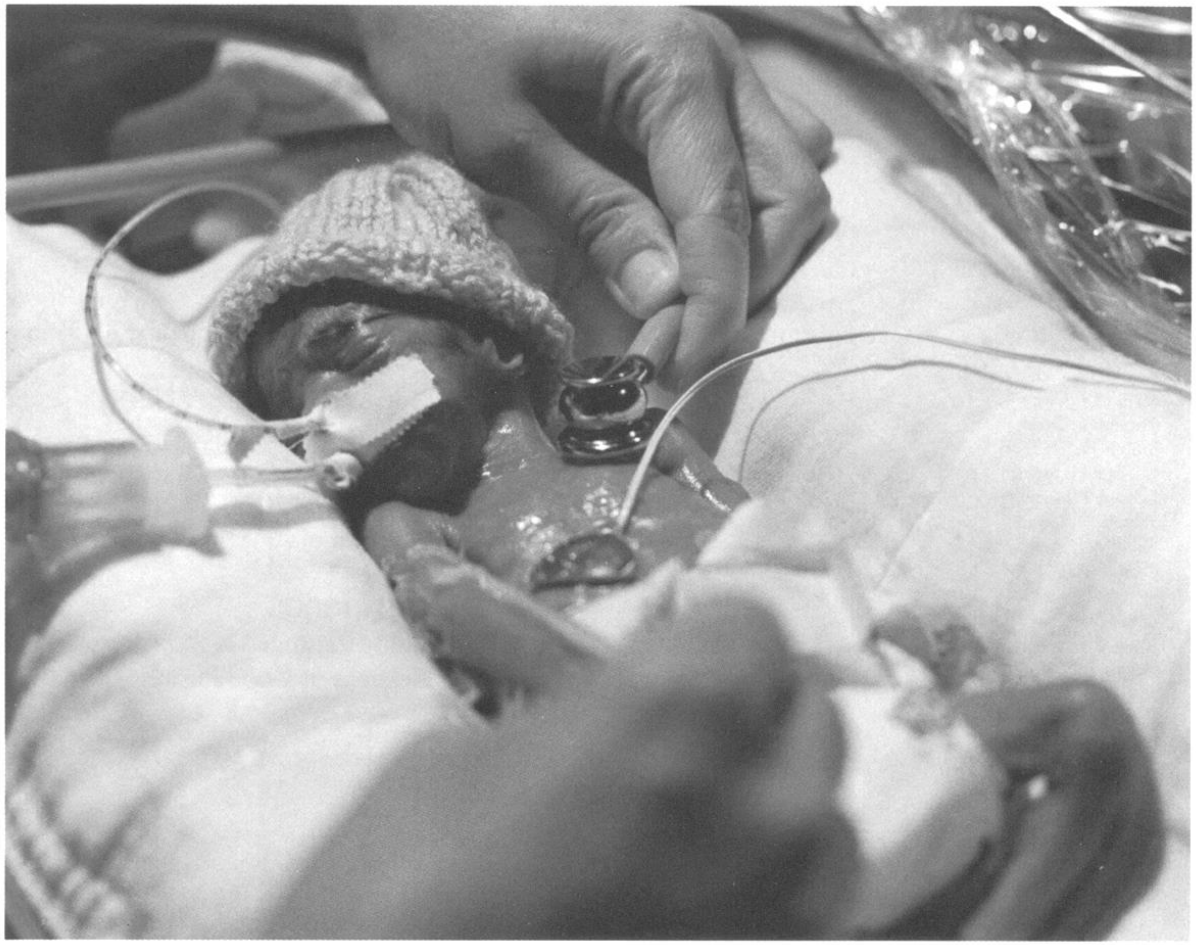
Outline

- Fundamental principles of neonatal pain
- Measuring neonatal pain
- Developmental aspects of pain
- Pharmacologic treatment of pain
- Non-pharmacologic treatment of pain

Life in the NICU



4:24 a.m., April 4 – *Johnny King, born one pound two ounces, arrives at Glennon's NICU.*

Studies indicate a lack of awareness among health care professionals of pain perception, assessment, and management in.

Fear of adverse reactions and toxic effects often contributed to the inadequate use of analgesics.

In addition, health care professionals often focused on treatment of pain rather than a systematic approach to reduce or prevent Several

PAIN MANAGEMENT MYTHS

- Neonates do not feel pain.
- Infants are less sensitive to pain than adults
- Neonates have no memory of pain.
- Children will tell you when they are having pain.
- If a child can be distracted, he is not in pain.
- Neonates are not able to tolerate the effects of analgesics.
- Narcotics can lead to addiction in children.
- Infants become accustomed to pain.

Newborns can't remember pain

pain

So, what are the facts?

- Newborn infants have functional nervous systems which are capable of perceiving pain
- Physiologic means of assessing pain (VS) can be an unreliable predictor of pain
- Infants often develop an increase in signs of discomfort with repeated painful procedures
- Premature infants can have unpredictable responses to painful stimuli
- Unmanaged pain in the neonatal period can cause long term developmental complications

The Effects of Pain

- Physiological Effects
  - changes in vital signs, pupils
- Behavioral Cues
  - how the baby acts when she is in pain
- Hormonal/Metabolic Responses
  - what happens chemically

What can we do?

Common sense tells us that not all crying babies are in pain.

A chronically stressed baby in the NICU may not react at all to pain.

Premature Infant Pain Profile

- Facial Actions
  - Brow bulge
  - Eye squeeze
  - Nasolabial furrow
- Physiological Indicators
  - Heart rate
  - Oxygen saturation
- Context
  - Gestational age
  - Behavioral state
- Inter-rater reliability >.93

Premature Infant Pain Profile

Pain Score Flow Chart

Score 0-6 - No Action.

Score 7-12 - Non Pharmacological Intervention e.g. Positioning, Containment, Swaddling, Non-nutritive sucking.

Reassess in 30 Minutes for effectiveness of intervention.

Score > 12 - Pharmacological Intervention e.g. Narcotics.

Reassess in 15-30 Minutes for effectiveness of intervention.

Facial expression of physical distress and pain in the infant

PIPP Scale

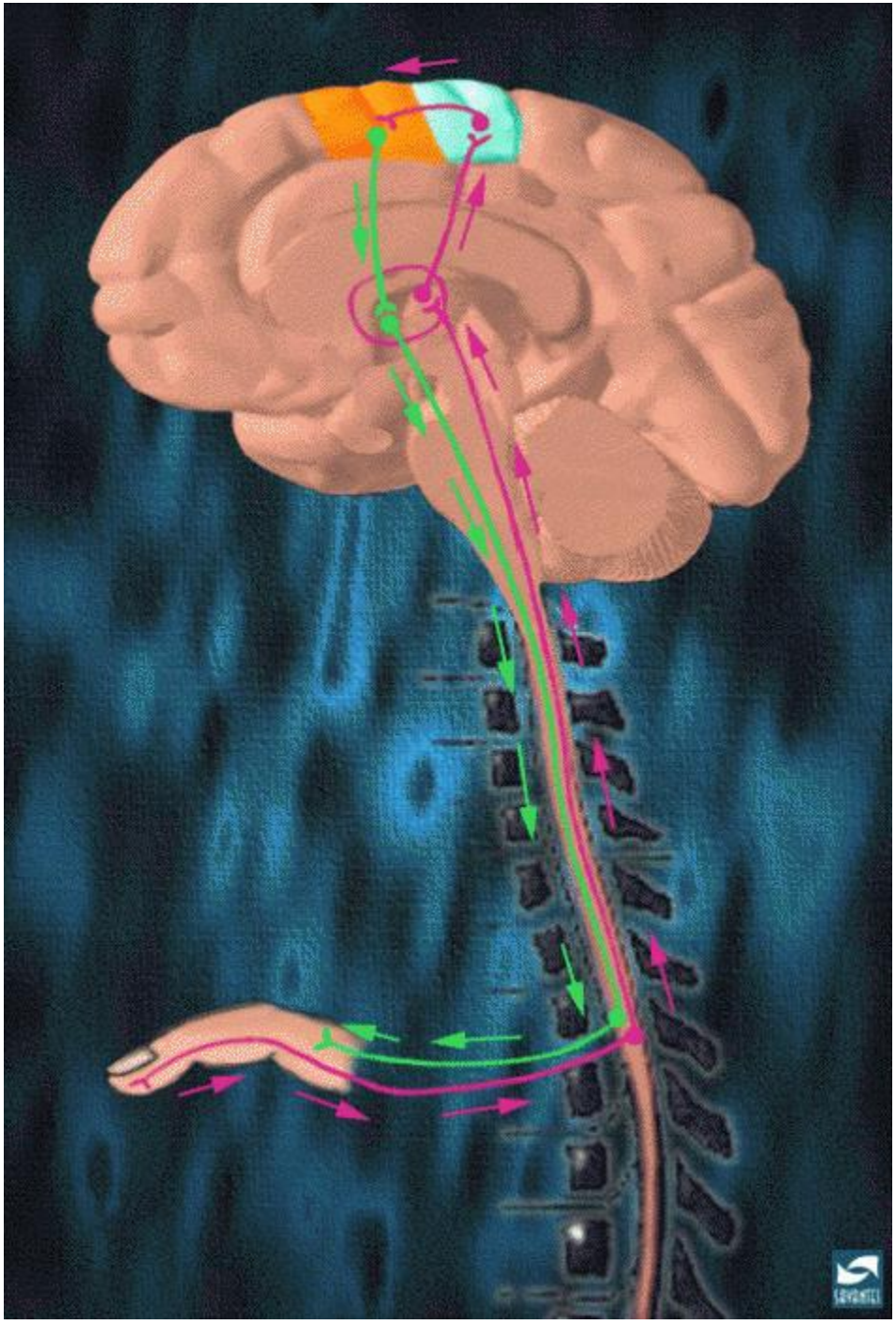
	0	1	2	3
GA	> / = 36 Wks	32-36 6/7 Wks	28-31 6/7 Wks	< / = 28 Wks
Behavioral State	Active/Awake	Quiet/Awake	Active/Sleep	Quiet/Sleep
HR	0-4 Beats/ Minute Inc	5-14 Beats/ Minute Inc	15-24 Beats/ Minute	25 Beats or > Inc
O2 Sats	0-2.4% Decrease	2.5-4.9% Decrease	5-7.4% Decrease	7.5% or > Decrease
Brow Bulge	None	Minimum	Moderate	Maximum
Eye Squeeze	None	Minimum	Moderate	Maximum
Nasolabial Furrow	None	Minimum	Moderate	Maximum

I.M.H.O.

Common Sense

=

Babies Feel Pain



Anatomic developments

• Dendritic arborization	21 weeks PCA
• Nerve tracts in spinal cord and brainstem	22 weeks PCA
• Connections with thalamocortical fibers	22 weeks PCA

Acute complication of pain

- Apnea
- Hypoxemia
- Bradycardia
- Increase systemic blood pressure
- Increase Intracranial pressure

Prolonged Effects of Pain

- Preterm infants show prolonged hyperalgesia within an area of local tissue damage and secondary hyperalgesia in the contralateral limb.

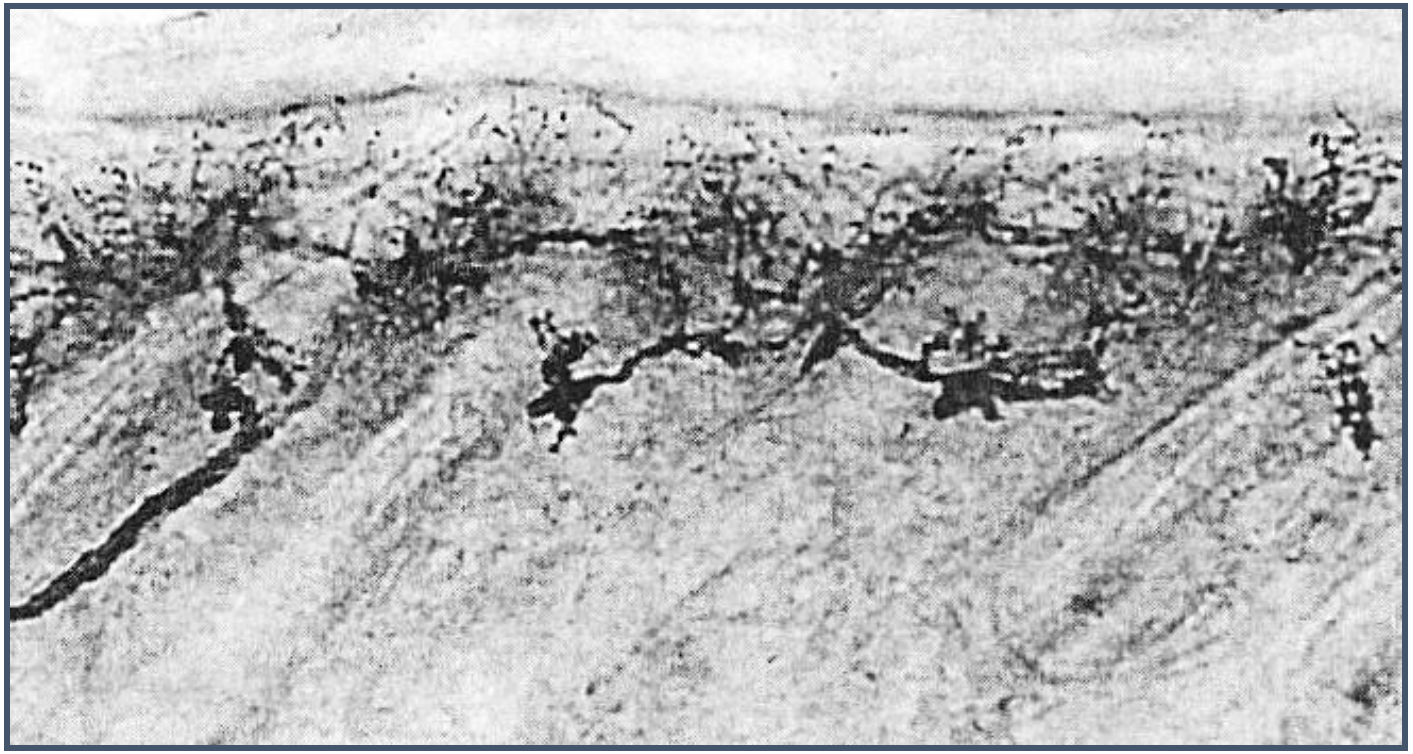
- Circumcision results in increased pain behavior 3 months later.

- Birth trauma linked to increased acute stress responses to pain in infancy.

Long Term Effects of Untreated Pain

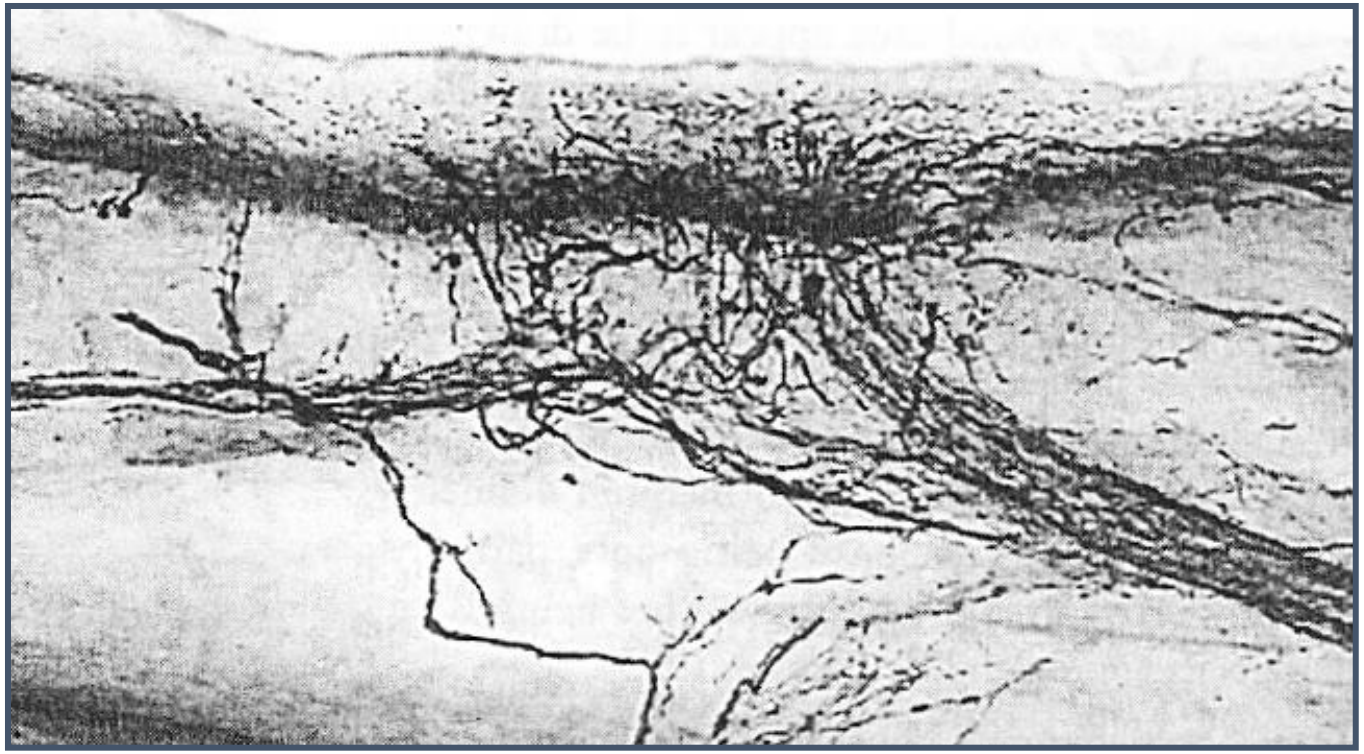
- Some experts believe that untreated pain in the newborn period forces abnormal pathways to form in the brain
- This aberrant brain activity results in impaired social/cognitive skills and specific patterns of self-destructive behavior
- Studied MRI's of newborns-reactions to pain transferred into similar electrical reactions to any kind of stressful situation

This Study



Normal Mouse Nerve

The Problem



Repair Response to Pain

Nonpharmacologic treatment of neonatal pain

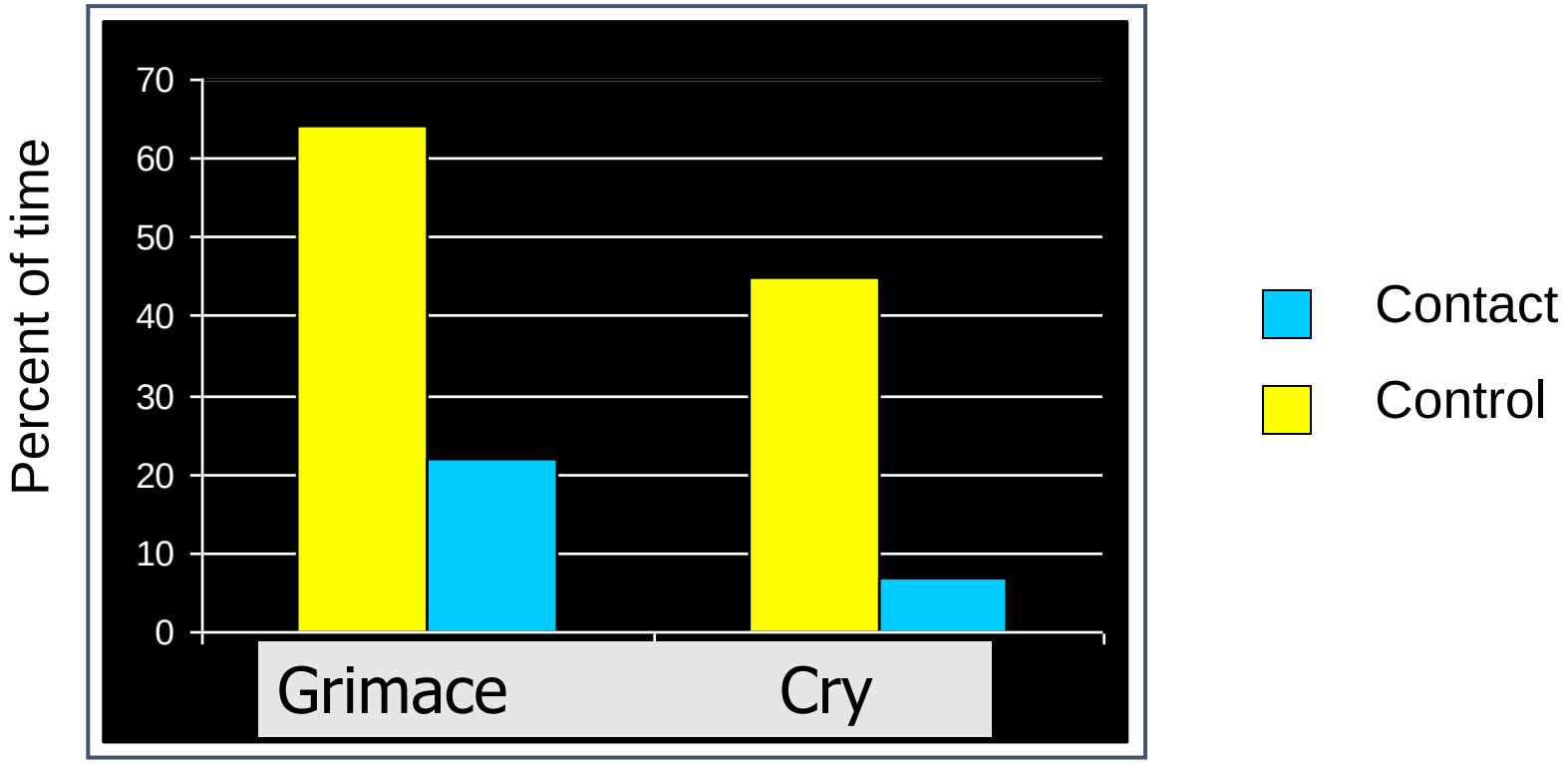
"How sweet for those faring badly to forget their misfortunes for even a short time."

--- Sophocles

Avoid Painful Procedures

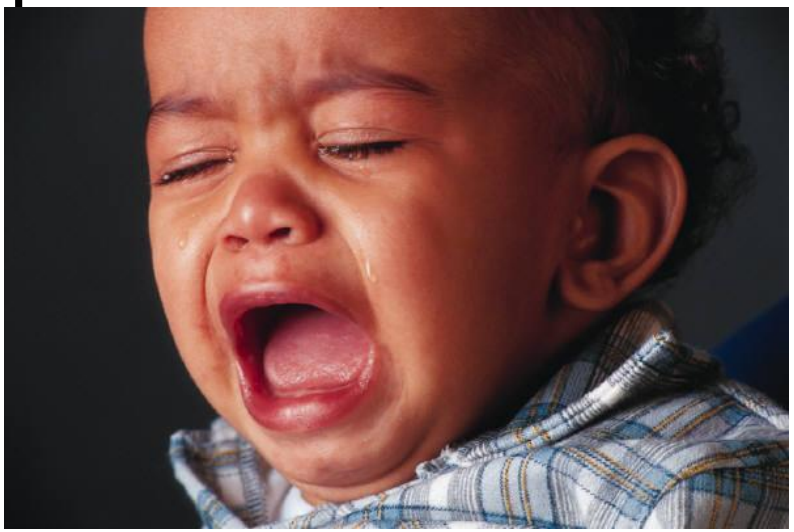
- Painful or stressful procedures should be minimized and, when appropriate, coordinated with other aspects of the neonate's care.
- Skillful placement of peripheral, central, or arterial lines reduces the need for repeated intravenous punctures or intramuscular injections.
- Thus, in some such cases, the risk-benefit balance may favor the more invasive indwelling catheters. Whenever possible, validated noninvasive monitoring techniques (e.g., pulse oximetry) that are not tissue damaging should replace invasive methods.

Tactile: skin-skin contact



Gray, et al
Pediatrics 2000

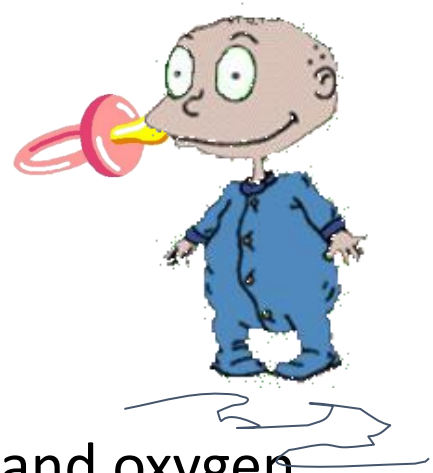
Management of Severe Pain



- developmental support
- parental involvement
- pharmacological management

  - medications given on a prn basis result in peaks and valleys of pain relief
  - pain is better controlled if medication is given prior to the climax of pain
  - continuous drip or regularly scheduled doses maintain a constant level of analgesia

Non-nutritive sucking

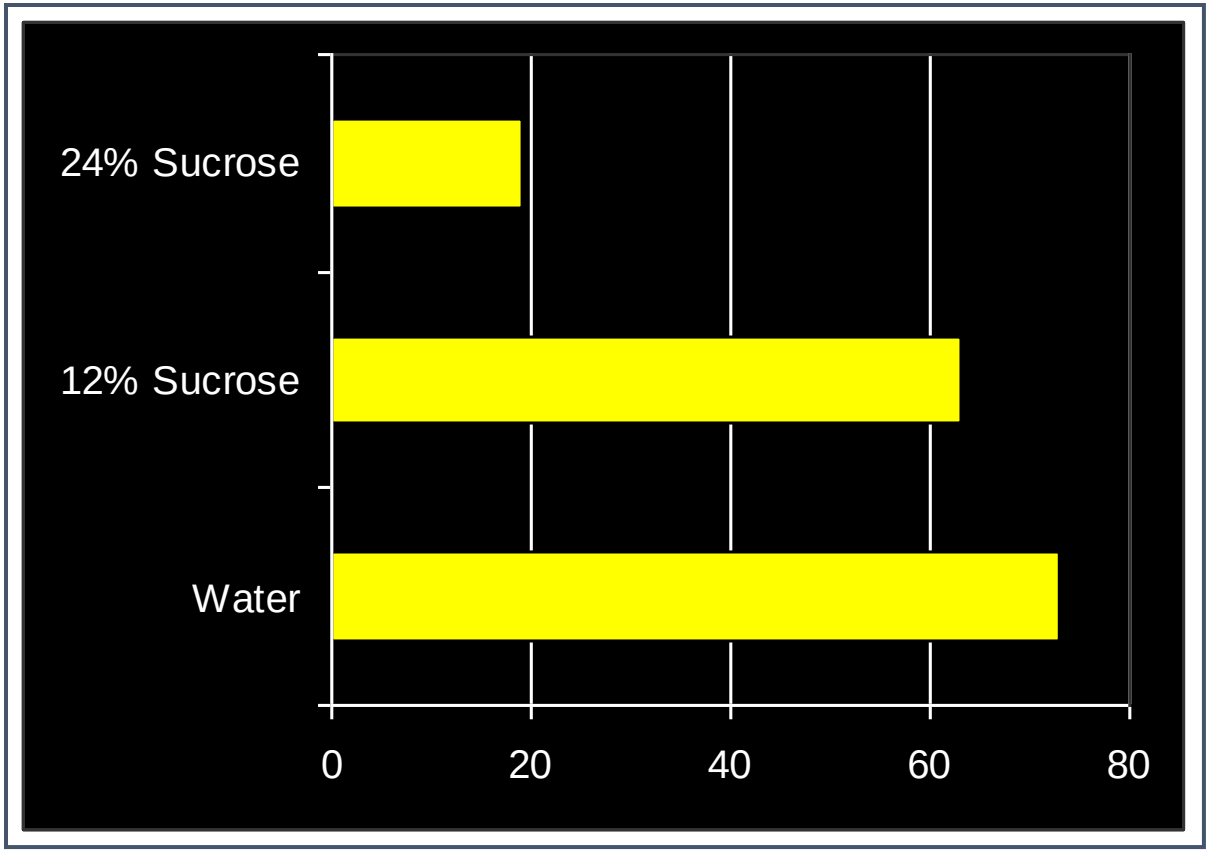


- Tested during heelstick procedure
  - Heelstick caused no effect on respiratory rate and oxygen saturations
  - Sucking reduced time of crying and heart rate increases

--Corbo, et al. Biol Neonate, 2000

Orogustatory

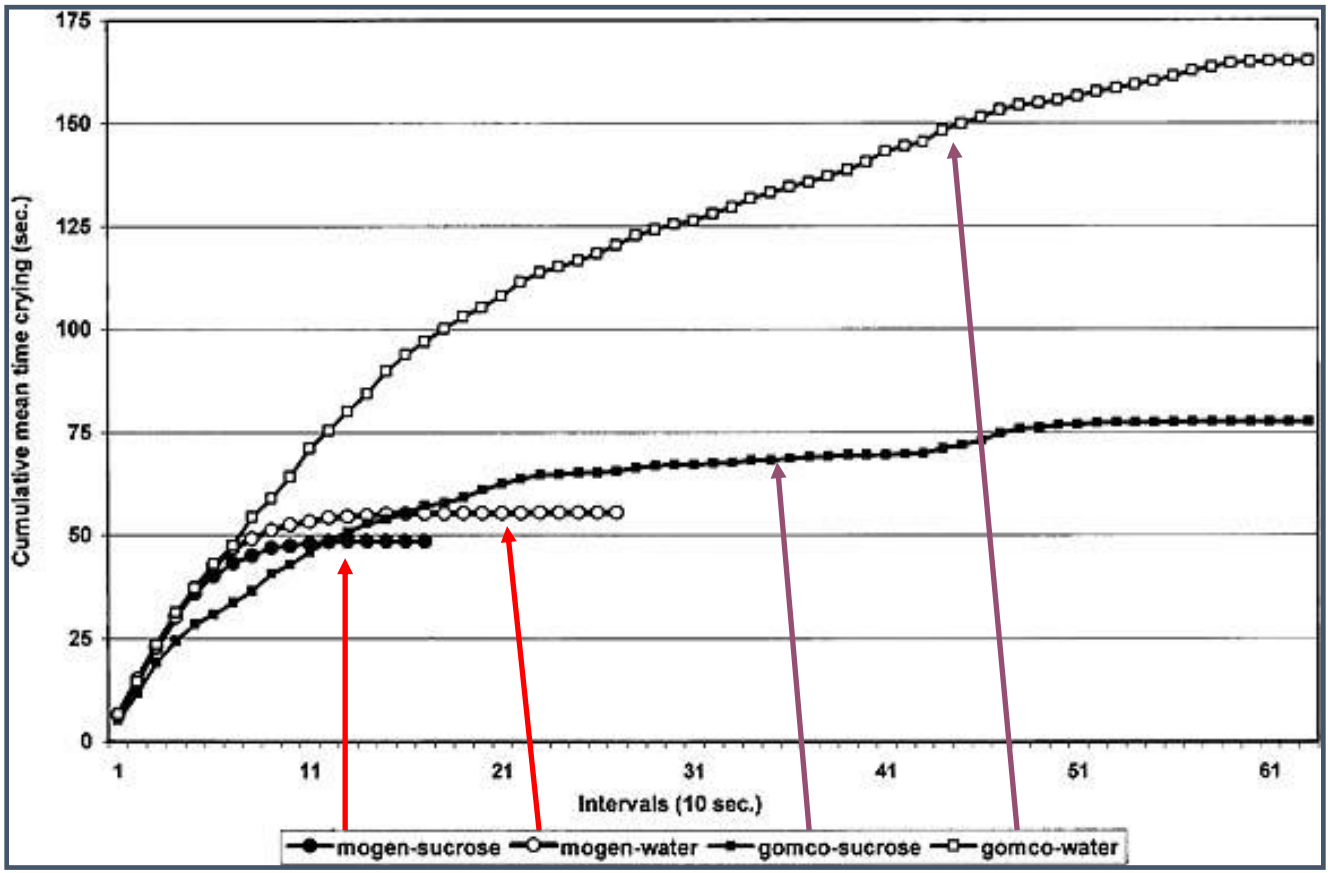
Effect of Oral Sucrose Solution on Venipuncture Pain



Time crying (sec)

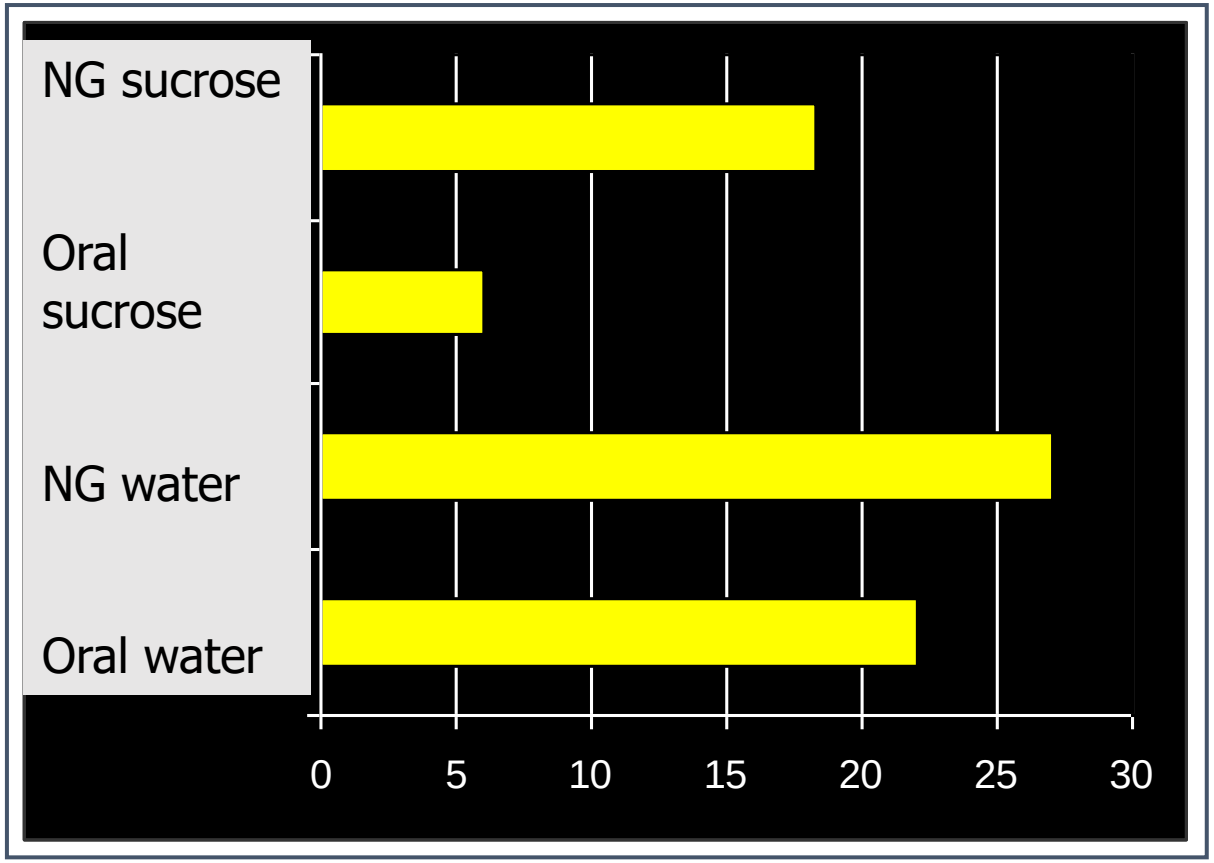
Abad, et al
Acta Paediatr, 1996

Effect of sucrose and procedure on circumcision pain



AJOG 2002;186:564-8

Effect of solution and route on heelstick pain



Percent time crying (Median)

Ramenghi, et al
ADC (Fetal Neonatal Ed), 1999

Breastfeeding is Analgesic in Healthy Newborns

-- Gray, et.al, Pediatrics Vol. 109, No. 4, April 2002

- The purpose of this study was to unite the different components of nursing (taste, suckling, and skin-to-skin contact), which have been shown to be individually analgesic, by allowing newborns to suckle their nursing mothers before, during, and after a standard heel lance procedure for blood collection.
- The efficacy of this intervention was determined by evaluating video recordings of infant crying and facial expressions and by assessing blockade of heart rate increases that normally accompany the blood collection procedure.
- Method:
  - 30 healthy, term, breast-fed infants @ Boston Medical Center Hospital
  - Randomized to breast-fed and control
  - Heel lance performed while swaddled, with and without

Results - Crying & Grimace

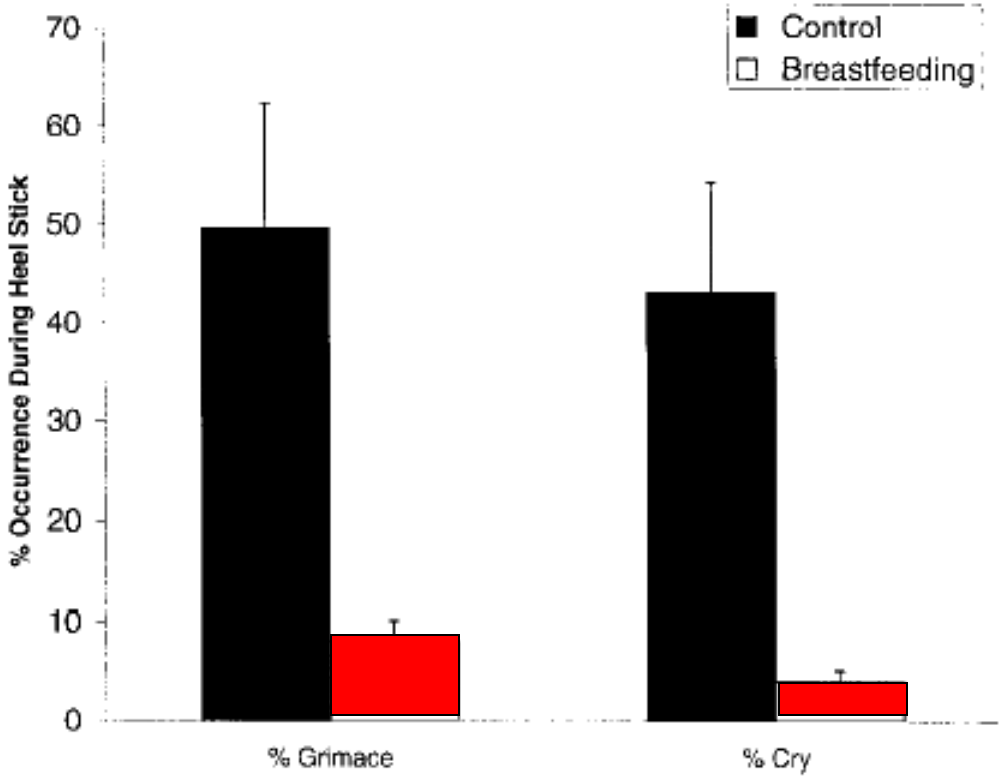


Fig 1. Mean (+ SEM) percentage occurrence of grimacing and crying during the heel stick procedure for control newborns and newborns who were breastfeeding before and during the procedure (N = 15/group).

Results - Heart Rate

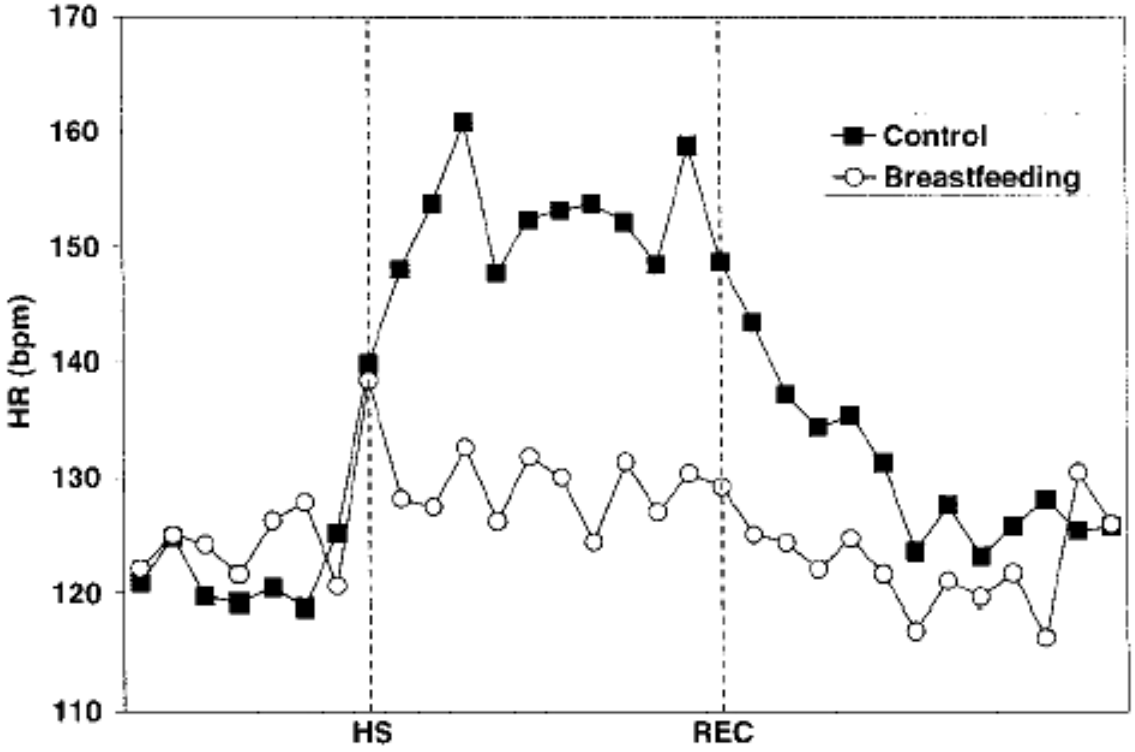


Fig 2. Mean heart rate (bpm) at 10-second intervals for the entire study of control and breastfeeding infants.

A Simple Guideline

Table 4. Recommended Analgesic Doses for Neonates*

Agent	Intermittent Dose	Infusion Dose	Local/Topical
Opioid analgesics			
Morphine sulfate	0.05-0.1 mg/kg intravenously (IV)	0.01-0.03 mg/kg per hour	. . .
Fentanyl citrate	0.5-3 µg/kg IV	0.5-2 µg/kg per hour	. . .
Anesthetic agents			
Lidocaine (local/topical)	. . .	. . .	2-5 mg/kg subcutaneously; 0.5-1 mg/kg endotracheally
EMLA† (local/topical)	. . .	. . .	0.5-2 g under occlusive dressing 1 h before the procedure
Ketamine hydrochloride (systemic)	0.5-2 mg/kg IV	0.5-1 mg/kg per hour	. . .
Thiopental sodium (systemic)	2-5 mg/kg IV	. . .	. . .
Other agents			
Acetaminophen	10-15 mg/kg orally; 20-30 mg/kg rectally‡		
Sucrose	12%-24% solution given orally 2 min before the procedure, 2 mL for term neonates and 0.1-0.4 mL for preterm neonates		

Recommendations

- The appropriate use of environmental ,behavioral, and pharmacologic Interventions can prevent, reduce or eliminate neonatal pain in many clinical situations.
- Sedation does not provide pain relief and may mask the neonate's response to pain.
- Health care professionals have the responsibility for assessment, prevention and management of pain in newborns.
- Clinical units providing health care to newborns should develop written guidelines and protocols for the management of neonatal pain.

Ophthalmologic Exam

- **Phenylephrine 2.5%** and **Cyclopentolate 0.25%** eye drops are used to dilate both pupils prior to examination

- (1 drop in each eye) one hour prior to the examination. Repeat the dose 10 -20 minutes after the initial dose

- dark coloured eyes may require a third dose twenty minutes after the second dose.

- **Tetracaine 0.5% (or Propracain) One Drop each eye**
- Administer immediately prior to the examination, and during the examination if indicated

Oral Sucrose

- The evidence supporting the benefit of using oral sucrose, in addition to topical anaesthetic eye drops

- Administer dose prior to the commencement of the procedure

- Small amounts of sweet solutions (oral sucrose) are placed on the infant's tongue to reduce procedural pain.
- The mechanism is an orally mediated increase in endogenous opioid.

- The analgesic effect lasts 5-8 minutes making it an ideal strategy for the management of short term pain.
- There is no analgesic effect if sucrose is given directly into the stomach via a nasogastric tube

Breast Milk and Developmental care

- The sweetness of breast milk has proven to be as effective as a pain relieving strategy.

- Breast milk and Breastfeeding (providing comfort, diversion and maternal contact) should be used where available to relieve procedural pain.

- The application of supportive measures such as; kangaroo care, facilitated tucking, swaddling, warmth, NNS and distraction (in older infants), should occur prior to oral sucrose administration

Ophthalmologic Exam

- Ensure required dilating eye drops have been administered at the appropriate time
- Wrap infant securely in a blanket (with arms at sides)
- administer oxygen as required
- Position the infant to allow adequate viewing of the retina

The infant needs to be held securely

- Use a pacifier if infant is more settled with it
- Assess the infant throughout the procedure; ask the ophthalmologist to cease the examination if the infant is unstable
- Settle infant appropriately after the examination
- The ophthalmologist will speak to the parents after the examination

Pain management during eye examinations for retinopathy of prematurity in preterm infants: a systematic review

Acta Pædiatrica 2010

- Eight studies were included and grouped according to intervention: oral sucrose (group 1), anaesthetic eye drops (group 2) and non-pharmacological measures (group 3).

- or group 1, the mean PIPP score with sucrose was 1.38 (WMD) (95% CI: 0.41–2.35) lower than that of placebo (p = 0.005).

- For group 2, one study showed a reduction of two points on the PIPP score with topical proparacaine, whereas another showed no benefit.

- For group 3, developmental care improved developmental scores and salivary cortisol in one study.

Conclusion

- Sucrose reduced pain during the eye examination

- whereas the efficacy of proparacaine was not consistent in the studies included.

- However, PIPP scores remained relatively high in all the studies; thus further research is required to delineate better pain reduction strategies.

Pain management during retinopathy of prematurity eye examinations: a systematic review

Samra HA, McGrath JM

CRD summary
The authors concluded that evidence indicated that pain management during retinopathy of prematurity examination was inadequate and further research was needed. The unclear quality of the available evidence and the small number of studies for each intervention make the authors' caution warranted.

Authors' objectives
To evaluate the effectiveness of pain-management interventions during examinations for retinopathy of prematurity (ROP).

Searching
MEDLINE, The Cochrane Library, NLM Gateway, CINAHL, Nursing Consult, Health Source: Nursing/Academic Edition, HealthStar and BIOSIS Previews were searched between January 1985 and November 2008 for English-Language articles. Search terms were reported. Conference and symposia proceedings, abstracts and dissertations were searched. Bibliographies of retrieved articles were handsearched for further articles.

Study selection
Studies that investigated the impact of pain management and comfort measures during retinopathy of prematurity were eligible for inclusion.

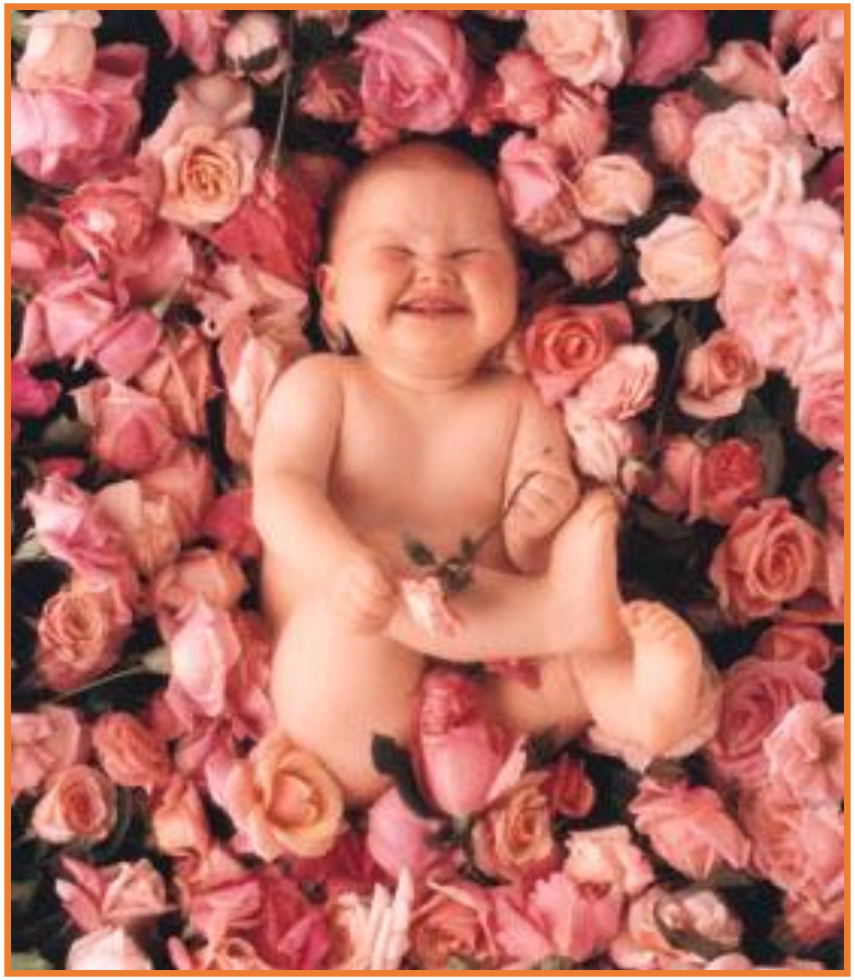
NHS STUDY

- oral Sucrose (five studies, n=155): Two studies found significantly lower PIPP scores in the oral sucrose group compared with the placebo group (p=0.01 and p=0.08). Three trials reported no significant differences between groups. All studies used topical anaesthetic eye drops as a cointervention in both intervention and control groups.
- Topical Eye Drops (two studies, n=77): One study reported significantly lower PIPP scores during speculum insertion in the group that received proparacaine HCL ophthalmic solution compared with controls. The other study reported no significant difference between groups.

NHS STUDY

- RetCam Screening (two studies, n=101): RetCam screening significantly increased the examination time compared to indirect opthalmoscope or BIO examination (two studies, 14.5 minutes versus 9 minutes and 7.8 minuntes versus 3.9 minutes) and decreased SaO_2 (one study, no statistics) compared to baseline.
- Nesting (one study, n=28): Nesting was associated with less body movement ($p<0.001$) and shorter crying time ($p<0.01$) compared with infants placed on a standard cot (one study, n=28). Heart rate and SaO_2 did not differ significantly between groups.
- NIDCAP (one study, n=68): NIDCAP was associated with a faster recovery time in cortisol levels (statistical data not reported) compared with a standard care control group. There were no differences between groups in PIPP scores, heart rate, SaO_2 or oxygen requirements.

Thanks for Listening



Because of you…

Life is Good !

Thanks