

Sucrose for analgesia in newborn infants undergoing painful procedures

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[Overview]

- Pain in newborns- pain assessment
- Painful procedures
- Pain relief- “analgesia”
- Sucrose in painful procedures
- Analgesia practice in NICU and Neonatal department

[Pain in newborns]



We think the newborns DON'T feel pain...

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■ Neonatal pain vs adult pain



... or less than adults

KIẾN THỨC VÀ THỰC HÀNH ĐIỀU TRỊ GIẢM ĐAU KHI THỰC HIỆN THỦ THUẬT Ở TRẺ SƠ SINH CỦA ĐIỀU DƯỠNG TẠI KHOA SƠ SINH VÀ HỒI SỨC SƠ SINH BỆNH VIỆN NHI ĐỒNG 2

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TÓM TẮT

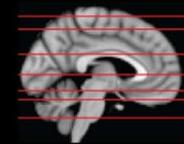
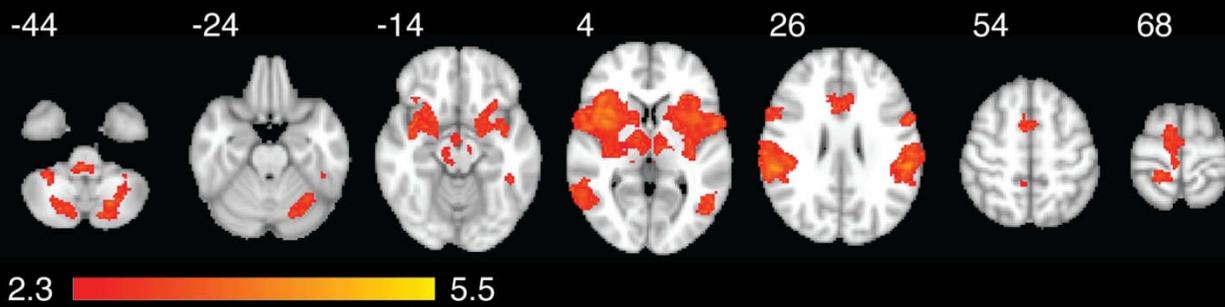
Mục tiêu: Xác định tỉ lệ nhân viên khoa Sơ Sinh (SS) và Hồi Sức Sơ Sinh (HSSS) có kiến thức, và thực hành đúng trong thực hành điều trị giảm đau ở trẻ sơ sinh tại khoa SS và HSSS Bệnh viện Nhi Đồng 2. So sánh mối tương quan giữa kiến thức đúng và thực hành đúng.

Phương pháp nghiên cứu: Cắt ngang mô tả

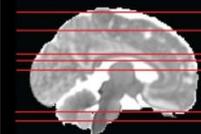
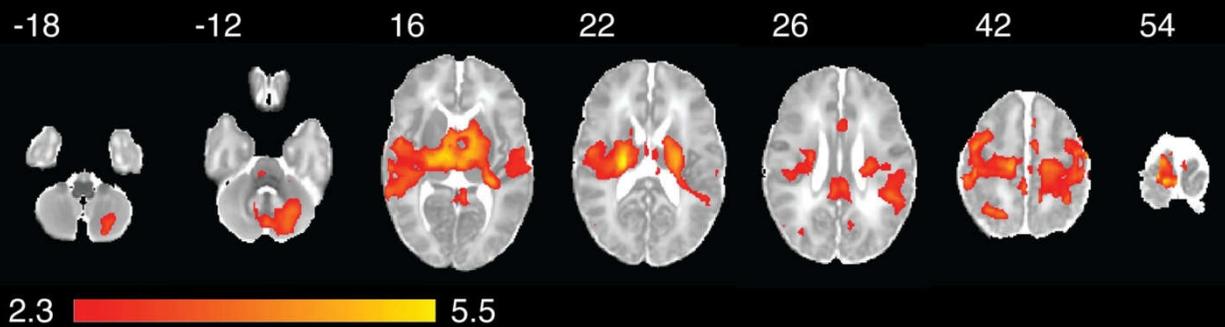
Kết quả: Qua nghiên cứu, có sự tương đồng về phân bố nhân sự giữa hai nhóm ≤ 5 năm và > 5 năm kinh nghiệm.

Khi tiến hành khảo sát trên 106 điều dưỡng đang làm việc tại khoa SS và HSSS, trên 96% nhận định việc kiểm soát đau ở trẻ SS là quan trọng. Tuy nhiên, 93,4% cho rằng trẻ SS không đau hoặc đau ít hơn trẻ lớn, 52,8% cho rằng đau không ảnh hưởng ngắn hạn đến sinh lý và hành vi cũng như dài hạn đến sự phát triển của não và tâm lý trẻ sơ sinh. Tất cả điều đồng ý đặt Catherter, chích động - tĩnh mạch, CDTS là những thủ thuật gây đau cho trẻ, trên 90% đồng ý lấy máu, thay băng vết thương, lấy dextrostix, đặt NKQ cũng gây đau không kém. Trên 70% điều dưỡng nắm rõ các phương pháp giảm đau cao nhất là surcrose (98,1), emla (97,2%).

A Adult



B Infant



[Pain assessment in newborns]

Tool	Parameters	Score	Utility
Premature infant pain profile (PIPP) (24)	Gestational age, behavioral state, heart rate, oxygen saturation, brow bulge, eye squeeze, nasolabial furrow	Total: 0–21 each parameter scored 0–3; ≤6 minimal pain; >12 moderate to severe pain	Procedural and postoperative pain
FLACC (25)	Face, legs, activity, cry, consolability	Total: 0–10 each parameter scored 0–2; >4 moderate pain; >7 severe pain	Procedural and postoperative pain
COMFORT scale (behavioral and physiological parameters) (26)	Alertness, calmness, respiratory distress, movement, muscle tone, facial tension, blood pressure, heart rate	Total: 8–40 each parameter scored 1–5; 17–26 adequate sedation; ≥27 inadequate sedation/analgesia	Pain and sedation in NICU
COMFORT behavior scale (27)	Alertness, calmness, respiratory response (ventilated neonate) or crying (not ventilated), movement, muscle tone, facial expression	Total: 8–30 each parameter scored 1–5; >17 moderate pain requiring intervention	Postoperative pain in NICU

[Pain assessment in newborns]

NIPS

Neonatal Infant Pain Scale			
NIPS	0 point	1 point	2 points
Facial expression	Relaxed	Contracted	-
Cry	Absent	Mumbling	Vigorous
Breathing	Relaxed	Different than basal	-
Arms	Relaxed	Flexed/stretched	-
Legs	Relaxed	Flexed/stretched	-
Alertness	Sleeping/calm	Uncomfortable	-

Maximal score of seven points, considering pain ≥ 4 .

Pain assessment in newborns

N-PASS: Neonatal Pain, Agitation and Sedation Scale

Assessment Criteria	Sedation		Normal	Pain / Agitation	
	-2	-1	0	1	2
Crying Irritability	No cry with painful stimuli	Moans or cries minimally with painful stimuli	Appropriate crying Not irritable	Irritable or crying at intervals Consolable	High-pitched or silent-continuous cry Inconsolable
Behavior State	No arousal to any stimuli No spontaneous movement	Arouses minimally to stimuli Little spontaneous movement	Appropriate for gestational age	Restless, squirming Awakens frequently	Arching, kicking Constantly awake or Arouses minimally / no movement (not sedated)
Facial Expression	Mouth is lax No expression	Minimal expression with stimuli	Relaxed Appropriate	Any pain expression intermittent	Any pain expression continual
Extremities Tone	No grasp reflex Flaccid tone	Weak grasp reflex ↓ muscle tone	Relaxed hands and feet Normal tone	Intermittent clenched toes, fists or finger splay Body is not tense	Continual clenched toes, fists, or finger splay Body is tense
Vital Signs HR, RR, BP, SaO₂	No variability with stimuli Hypoventilation or apnea	< 10% variability from baseline with stimuli	Within baseline or normal for gestational age	↑ 10-20% from baseline SaO ₂ 76-85% with stimulation - quick recovery ↑	↑ > 20% from baseline SaO ₂ ≤ 75% with stimulation - slow recovery ↑ Out of sync with vent

The NPASS is a pain scale to assess pain in **neonates**.

- A score < 4 = mild pain (requires non-pharmacologic comfort measures).
- A score > 5 = moderate to severe pain (most likely requires pharmacologic intervention in conjunction with comfort measures)

[Painful procedure]

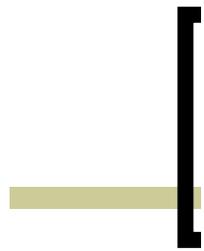
- ‘can cause skin damage or mucosal damage by inserting or removing foreign bodies, and disturbing the body integrity of a neonate through therapeutic or diagnostic methods’.
- Ex: oral suctioning, tracheal suctioning, venipuncture, IV catheter insertion, heel lancing, wound treatment, ROP exam...

The frequency of painful procedures

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International Journal of Nursing Practice 2014; 20: 398–407

- 145 preterm baby, mean GA 35.4 ws, mean BW 2326g.
- An average **105.6** painful procedures were performed in each neonate during 2 weeks, and **7.5** daily.
- The number of painful procedures increases in lower GA babies.



PAIN

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graph TD; PAIN([PAIN]) --> Acute[Acute effects]; PAIN --> LongTerm[Long-term effects];
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Acute effects

- Physiology and behavioral responses
- Changes in stress hormones

Long-term effects

- Changing levels of neural activity can alter the normal development of the central nervous system

- Poorer cognitive and motor scores, impairments of growth, reduced white matter and subcortical gray matter maturation, altered corticospinal tract structure

Procedural pain and brain development in premature newborns

Objective: Preterm infants are exposed to multiple painful procedures in the neonatal intensive care unit (NICU) during a period of rapid brain development. Our aim was to examine relationships between procedural pain in the NICU and early brain development in very preterm infants.

Methods: Infants born very preterm (N = 86; 24–32 weeks gestational age) were followed prospectively from birth, and studied with magnetic resonance imaging, 3-dimensional magnetic resonance spectroscopic imaging, and diffusion tensor imaging: scan 1 early in life (median, 32.1 weeks) and scan 2 at term-equivalent age (median, 40 weeks). We calculated N-acetylaspartate to choline ratios (NAA/choline), lactate to choline ratios, average diffusivity, and white matter fractional anisotropy (FA) from up to 7 white and 4 subcortical gray matter regions of interest. Procedural pain was quantified as the number of skin-breaking events from birth to term or scan 2. Data were analyzed using generalized estimating equation modeling adjusting for clinical confounders such as illness severity, morphine exposure, brain injury, and surgery.

Results: After comprehensively adjusting for multiple clinical factors, greater neonatal procedural pain was associated with reduced white matter FA ($\beta = -0.0002$, $p = 0.028$) and reduced subcortical gray matter NAA/choline ($\beta = -0.0006$, $p = 0.004$). Reduced FA was predicted by early pain (before scan 1), whereas lower NAA/choline was predicted by pain exposure throughout the neonatal course, suggesting a primary and early effect on subcortical structures with secondary white matter changes.

Interpretation: Early procedural pain in very preterm infants may contribute to impaired brain development.

Neonatal procedural pain analgesia

	Procedures	Side effects
Opioid	Tracheal intubation Venipuncture, arterial puncture, IM or SC injection, LP in some cases Post operative in NICU	-Respiratory depression -Risk was increased by preterm birth and intercurrent comorbid conditions
Paracetamol	Ineffective: heel lancing	Overdose and hepatotoxicity
Regional analgesia EMLA	Venipuncture, arterial puncture, IM or SC injection, CVC insertion, LP Ineffective: heel lancing	Local reactions.
Non pharmacological analgesia	Venipuncture, arterial puncture,, CVC insertion, LP	

Non pharmacological pain relief: sucrose

- Sucrose has been widely recommended for routine use in procedural pain in newborns.
- Mechanism of action: not precisely understood, maybe the sweet taste increase endorphines release.

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- Advantages: no side effects, easy to use.
 - Disadvantages: less effective in prolonged/ more intensive pain procedures.
 - **Reduce acute effects of pain** (behavior responses); long- term effects: not precisely understood.



Cochrane
Library

Cochrane Database of Systematic Reviews

Sucrose for analgesia in newborn infants undergoing painful procedures (Review)

Stevens B, Yamada J, Ohlsson A, Haliburton S, Shorkey A.

Sucrose for analgesia in newborn infants undergoing painful procedures.

Cochrane Database of Systematic Reviews 2016, Issue 7. Art. No.: CD001069.

DOI: 10.1002/14651858.CD001069.pub5.

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Figure 4. Forest plot of comparison: 6 Heel lance: Sucrose (24%) + NNS vs. water + NNS, outcome: 6.2 PIPP 30 s after heel lance (term and preterm infants).

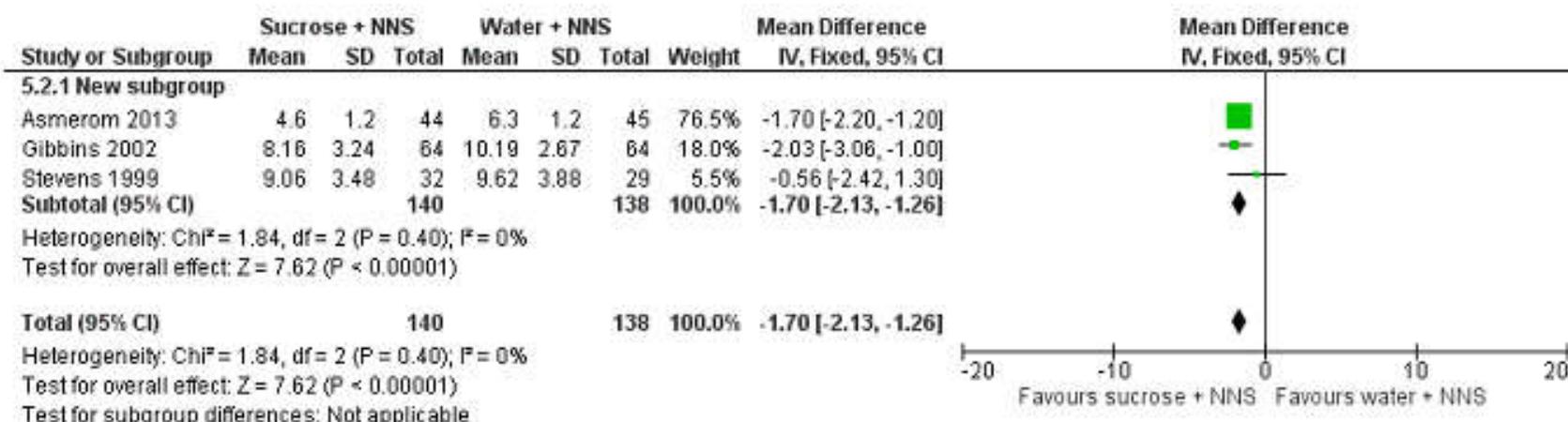


Figure 5. Forest plot of comparison: 6 Heel lance: Sucrose (24%) + NNS vs. water + NNS, outcome: 6.3 PIPP 60 s after heel lance.

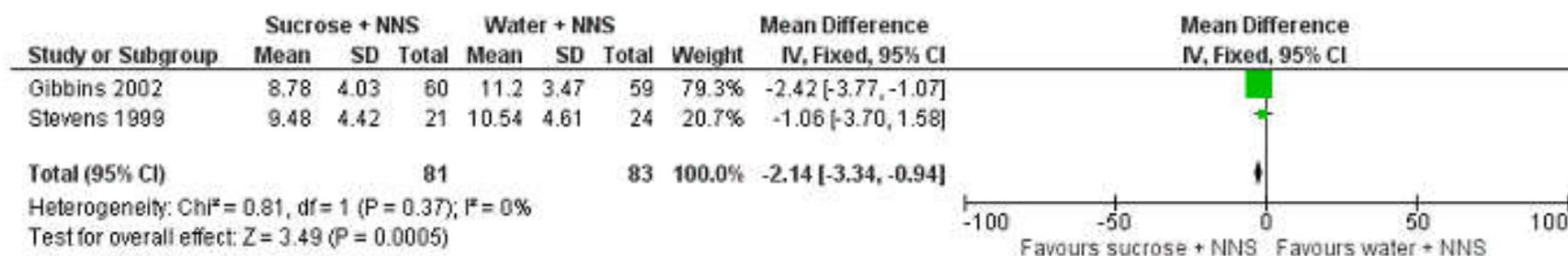


Figure 6. Forest plot of comparison: 18 Venipuncture: sucrose (24% to 30%) versus control (sterile water or no treatment), outcome: 18.1 PIPP score during venipuncture.

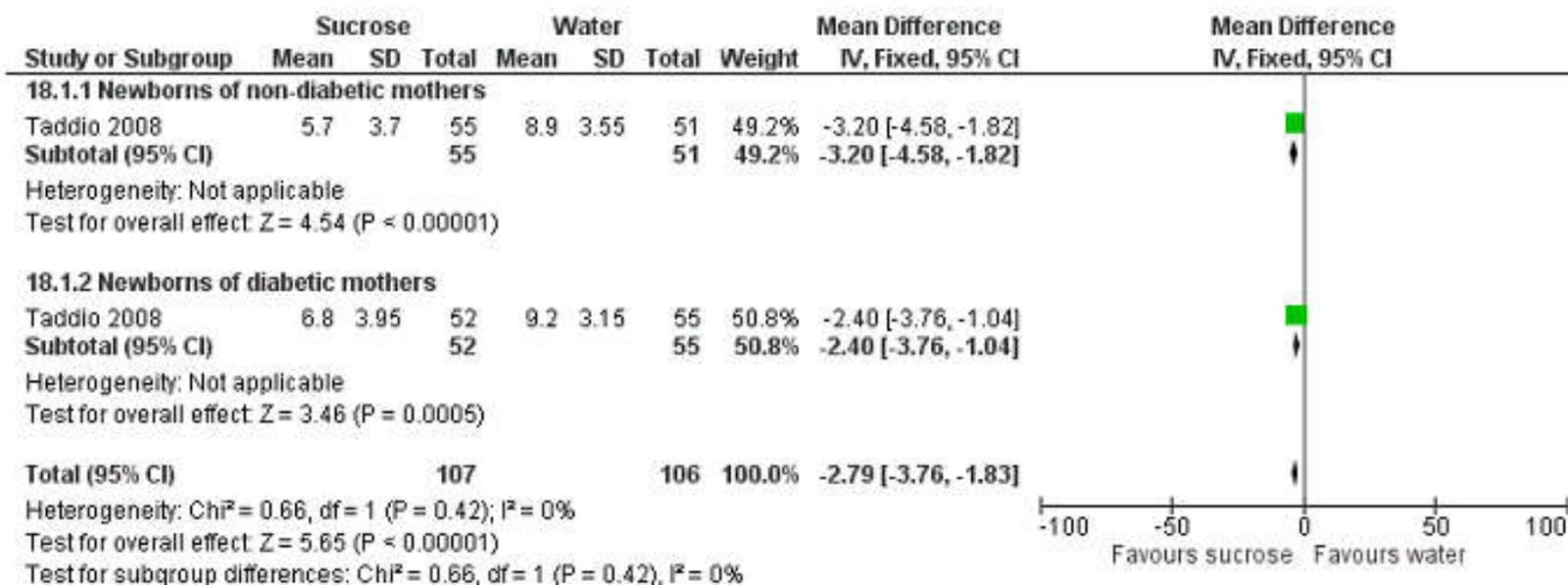


Figure 7. Forest plot of comparison: 23 Intramuscular injection (term infants): Sucrose (20-25%) vs. water or no intervention, outcome: 23.2 PIPP during IM injection (term infants).

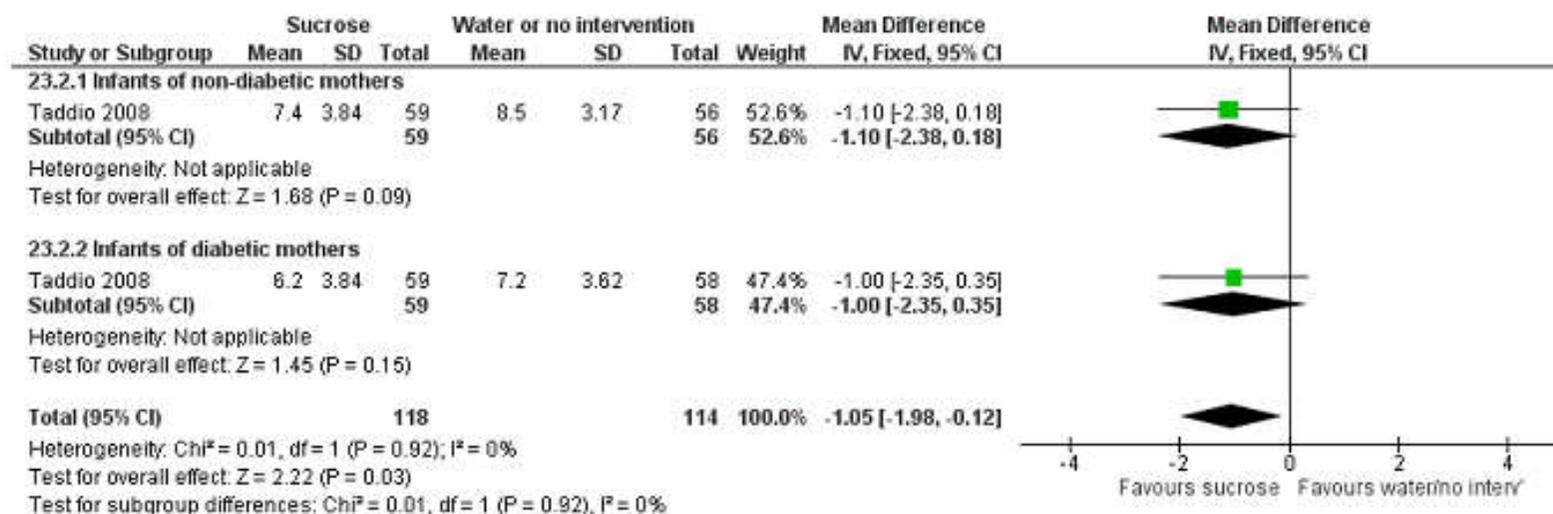
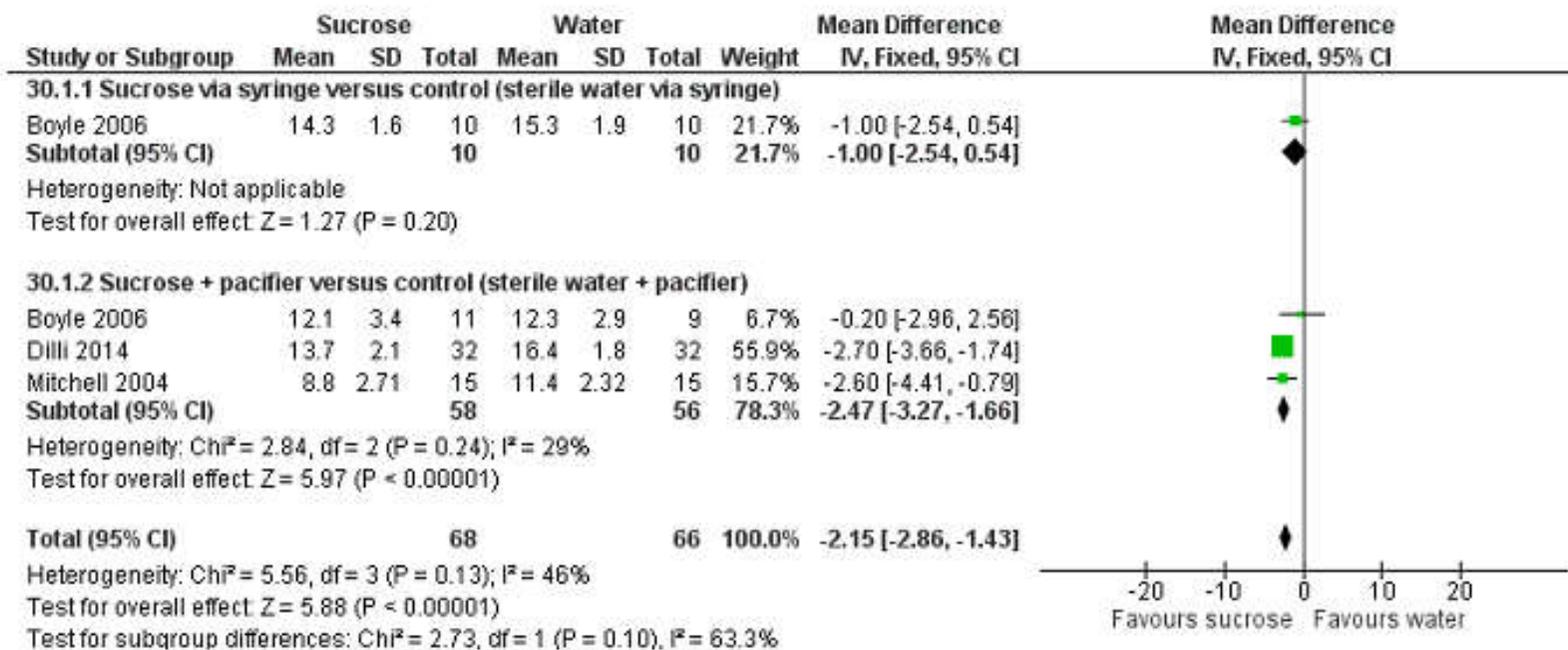


Figure 8. Forest plot of comparison: 30 ROP examination: sucrose (24% to 33%) (sucrose or sucrose + NNS) versus control (water or water + NNS), outcome: 30.1 PIPP score during eye examination.



Neonatal department and NICU- Children Hospital No2

Qua giám sát lâm sàng, 93% điều dưỡng tuân thủ thực hiện giảm đau khi CDTS, 26% có giảm đau khi chích động – tĩnh mạch và 29% lấy máu xét nghiệm. Tất cả các trường hợp đặt sonde dạ dày và lấy dextrostix đều không được giảm đau, 89% khi thay băng, 50% khi đặt catheter, 23% không giảm đau khi đặt NKQ. Tỷ lệ điều dưỡng tuân thủ thực hành kiểm soát giảm đau cho trẻ chiếm 30,3% .

[Conclusion]

- Sucrose: effective analgesia in some neonatal painful procedures.
- Increase using pharmacological (regional analgesia: EMLA) and non-pharmacological (sucrose) during some painful procedures in newborns, esp preterms.

[References]

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- S Brummelte. (2012). Procedural pain and brain development in premature newborns. *Ann Neurol*, 71(3), 385-396.

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- A decorative graphic consisting of a thick horizontal line in a light olive green color. On the left side, a large black square bracket '[' is positioned vertically, overlapping the line. On the right side, a large yellow square bracket ']' is positioned vertically, also overlapping the line.
- Stevens, J Yamada, A Ohlsson, S Haliburton, A Shorkey. (2016). Sucrose for analgesia in newborn infants undergoing painful procedures (Review). *The Cochrane Library*, 7.
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 - Lương Thị Ánh Thùy, Đặng Thị Mỹ Tánh, Lê Nguyễn Nhật Trung. Kiến thức và thực hành điều trị giảm đau khi thực hiện thủ thuật ở trẻ sơ sinh của điều dưỡng tại khoa Sơ sinh và Hồi sức sơ sinh bệnh viên Nhi Đồng 2