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The opinions of clinical staff regarding neonatal procedural pain in two Norwegian neonatal intensive care units

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Short title: Neonatal procedural pain

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Abstract

Andersen RD. Greve-Isdahl M. Jylli L. The opinions of clinical staff regarding neonatal procedural pain in two Norwegian neonatal intensive care units.

Aim: Neonates are subjected to numerous painful procedures without sufficient pain management. The aim of this study was to describe the opinions of Norwegian physicians, nurses and nurse assistants who care for neonates, regarding procedural pain in neonates.

Methods: A replication of a previous questionnaire study (Porter FL et al) was conducted in two Norwegian neonatal intensive care units (NICU's). The questionnaire aimed at evaluating procedure painfulness, the current use of pharmacological agents and comfort measures and the optimal use of both.

Results: Ninety members of the clinical staff participated, which is a response rate of 87%. Opinions on how procedural pain is currently and optimally managed differed significantly. Although most respondents rated a majority of the listed procedures as being more than moderately painful, pharmacological agents were rarely used, except for the insertion of a chest tube and endotracheal intubation. Comfort measures were also believed to be underutilized, but not to the same degree as pharmacological agents.

Conclusion: Procedural pain in neonates is not sufficiently managed and both pharmacological agents and comfort measures are underutilized, according to clinicians at two Norwegian NICU's.

Keywords: Pain in neonate, pain management, preterm infant

Continuous advances in perinatal care in the last 20-30 years have made it possible to treat more immature and seriously ill neonates than before. An increased use of invasive and often painful procedures is a consequence of more intensive treatment [1-4]. The immaturity of the neonatal nervous system causes a prolonged and enhanced pain experience compared to older children and make neonates more vulnerable to the deleterious effects of pain [5, 6]. International guidelines for the assessment and management of pain in neonates is based on critical evaluation of published evidence together with common clinical practice and gives detailed evidence based recommendations for 15 painful procedures. The consensus panel recommends routine assessment of pain and the use of specific comfort strategies and pharmacological interventions [7]. Comfort strategies like sweet tasting solutions and non-nutritive sucking , swaddling, containment and facilitated tucking together with a general reduction of environmental stresses are the foundation for all pain management [8]. Opioids, acetaminophen and/ or local anesthetics may be necessary to relieve more severe pain [9]. Combining several interventions may have synergistic effects [7].

Observations at two neonatal intensive care units (NICU's) in Southern Norway indicated that clinical practice was not in accordance with international guidelines [7]. This discrepancy has been confirmed in studies from other countries [2, 4, 10]. At the time the survey was conducted (2003) the units had no written guidelines regarding pain management and no available pain assessment tools. The purpose of our study was to describe the opinions of clinical staff (physicians, nurses and nurse assistants) regarding the painfulness of common procedures, how procedural pain is currently managed and what the respondents consider the optimal treatment of procedural pain in neonates to be.

Methods

Subjects and setting

One hundred and three of 111 clinical staff members were invited to participate (N=103).

Instrument

The survey is based on a questionnaire [10] which consists of a series of questions on pain and pain management in reference to twelve frequently performed procedures.

In our study, ten of the procedures were included (table I). Circumcision and arterial or venous cutdown were excluded as they are never performed in the units being studied. The responses are in a Likert scale format, ranging from zero to four and the participants were asked to grade the painfulness of the 10 different procedures, the frequency of the actual use of pharmacological agents and comfort measures, and the optimal use of such (table I).

The internal consistency was examined by computing Chronbach's α for each series of questions. The observed alphas ranged from .74 to .93, which demonstrates that the survey has a good reliability.

Procedure

Approval was obtained from the Regional Ethics Committee. The survey was conducted in 2003 during three staff meetings at each hospital and after the attendants had received oral information about the study. Participants were encouraged not to discuss the questionnaire between meetings. A comparison of the answers showed no significant differences.

Statistical analyses

Respondents were divided into groups based on profession. Differences between groups for the different procedures and for a sum score of each question have been calculated by the use of the Kruskal Wallis test. In cases where a significant difference between groups was found, a *post hoc* Mann Whitney U-test with Bonferroni correction was performed. Answers to the questions regarding current and optimal treatment of procedural pain were compared using the Wilcoxon paired groups test. $P \leq 0.05$ was considered statistically significant.

Results

A total of 90 questionnaires were completed, representing a response rate of 87%. Twenty physicians, 53 nurses and 17 nurse assistants responded. 40% of the nurses and physicians and 88% of the nurse assistants had more than 12 years of experience in caring for neonates.

Procedure painfulness

Eight of the ten procedures were rated as being at least moderately painful (median ≥ 2). The insertion of a chest tube, endotracheal intubation and lumbar puncture were considered to be the most painful procedures (median ≥ 3). When comparing the total sum score of all procedures, physicians ascribed significantly lower pain scores than the other groups (table II).

Current use of pharmacological agents

Pharmacological agents were considered to be used infrequently for most of the procedures. However, physicians and nurses considered that pharmacological agents were usually applied for the insertion of a chest tube and physicians also used it frequently for endotracheal intubation (Table III).

Current use of comfort measures

Comfort measures were considered to be used more often than pharmacological agents ($p < 0,001$). For one half of the procedures the indicated frequency of use exceeded “often” (median >2). Nurses rated the current use of comfort measures for the insertion of a peripheral intravenous device and heel stick significantly higher than the other groups (Table IV).

Optimal use of pharmacological agents

The most frequent use of pharmacological agents was considered during the most painful procedures. Physicians were significantly less inclined to use pharmacological agents for lumbar puncture and for the insertion of a chest tube, compared to the other groups (Table V). The difference of opinions on how procedural pain is currently and optimally managed, were significant for all ten procedures ($p < 0,001$).

Optimal use of comfort measures

Comparing the sum score of all procedures, nurse assistants would apply significantly less comfort than nurses (table VI). Both physicians ($p < 0,001$) and nurses ($p < 0,001$) considered that comfort measures should be used more frequently

than they currently are, while nurse assistants rated no significant differences except for the insertion of a gavage tube (p 0,015).

Discussion

This study is a replication of Porter and colleagues survey from 1997 [10] and describes the opinions of clinical staff regarding procedural pain in neonates. The respondents' answers indicated significant differences between the current and the optimal treatment of procedural pain. Although a majority of the listed procedures were rated as being more than moderately painful, pharmacological agents were rarely used, except for the insertion of a chest tube and for endotracheal intubation. Comfort measures were also believed to be underutilized, but not to the same degree as pharmacological agents.

Our results are in accordance with previous studies from different countries [4, 10, 11], but should be judged with caution, owing to a small sample size in some subgroups. It is likely that a certain degree of bias is present as the data are based on subjective measurement. A formal analysis of the non-responders has not been undertaken.

The respondents' view on the optimal treatment of procedural pain is mainly in line with international guidelines [7], but it seems that this knowledge is not enough to bring about changes in clinical practice. Several studies regarding pain management have shown that interventions designed only to enhance the participants' knowledge have a limited effect in changing pain management practice [12-16].

Analgesics were infrequently used for painful procedures, with the exception of endotracheal intubation and the insertion of a chest tube. The explanation may be the painfulness of these two procedures or that physicians are more comfortable administering opioids to neonates with ventilatory support.

Responses indicated a need for a more frequent use of pharmacological agents.

Physicians rated the overall painfulness and the optimal use of analgesics lower than nurses did. This discrepancy may be due to different roles and experiences in the care of neonates.

The limited use of comfort measures is in accordance with previous studies [10, 11, 17, 18]. Nurses were inclined to a more frequent use of comfort measures than the other groups. Comforting is considered the nurse's responsibility and physicians tend to limit their involvement in pain management to a pharmacological perspective. Surprisingly, nurse assistants considered the use of comfort measures satisfactory. The cause may be a lack of knowledge about the importance and effect of comfort measures, or to some degree, a lack of experience with some of the procedures.

One important question derived from this study is how clinical practice can be changed, as a lack of knowledge does not seem to be an explanation for the discrepancy between international standards and clinical practice.

Interventions that have been successful in improving pain management in older children and adults have treated the process of change as a personal, social and organisational phenomenon [19-22]. To our knowledge no such study regarding neonatal pain has been undertaken, and further studies should investigate the effect of a structured and multifaceted intervention to improve pain management in neonates.

Conclusion

Procedural pain in neonates is not sufficiently managed and both pharmacological agents and comfort measures are underutilized according to clinical staff in two Norwegian NICU's.

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Table I Infant Pain Questionnaire

The following procedures were evaluated

- Endotracheal intubation
- Insertion of chest tube
- Insertion of gavage tube
- Tracheal suctioning
- Lumbar puncture
- Intramuscular injection
- Insertion of umbilical catheter
- Insertion of peripheral intravenous line
- Heel stick
- Insertion of radial or tibial arterial catheter

Questions

- 1) Rate the painfulness of each procedure
- 2) Rate how often you believe each procedure is performed with pharmacological agents (e.g. paracetamol, opioids and/or local anesthetics)
- 3) Rate how often you believe each procedure is performed with comfort measures (e.g. containment and support during the procedure, reduction of stimuli, non-nutritive sucking, sweet-tasting solutions, warming of heel prior to heel stick and others)
- 4) Rate how often you believe each procedure should be performed with pharmacological agents
- 5) Rate how often you believe each procedure should be performed with comfort measures

Questions were answered by clinical staff according to the following scales

Question 1	Questions 2 to 5
0 = not painful	0 = never
1 = somewhat painful	1 = rarely
2 = moderately painful	2 = often
3 = quite painful	3 = usually
4 = very painful	4 = always

Table II. Procedure painfulness rated by physicians (n=20), nurses (n=53), and nurse assistants (n=17). Presented as the total response rate for each procedure, median and interquartile range (IQR). Statistical comparison between all three groups with Kruskal Wallis test (group). Mann Whitney U-test with Bonferroni correction for comparison in pairs.

Procedure	Total response rate		Physicians		Nurses		Nurse assistants		Group	Pairs
	N	(%)	Median	(IQR)	Median	(IQR)	Median	(IQR)	p value	p value
Insertion of chest tube	90	(100)	4	(4-4)	4	(4-4)	4	(3-4)	NS *	
Endotracheal intubation	90	(100)	3	(3-4)	4	(3-4)	4	(3-4)	NS	
Lumbar puncture	80	(89)	3	(2-3)	4	(3-4)	4	(3-4)	0,001	0,001†, 0,006 ‡
Heel stick	80	(89)	3	(2-3)	3	(2-4)	3	(2-4)	NS	
Insertion of peripheral intravenous line	90	(90)	2	(2-3)	3	(2-4)	3	(2-4)	0,006	0,009†, 0,01‡
Insertion of radial/ tibial arterial catheter	76	(84)	3	(2,75-3)	3	(2-4)	2	(2-3)	NS	
Intramuscular injection	78	(87)	3	(2-3)	3	(2-3)	3	(2-3)	NS	
Tracheal suctioning	100	(90)	2	(1-2)	3	(1,5-3)	3	(2-3,5)	0,037	NS
Insertion of umbilical catheter	77	(86)	1	(0-1)	2	(1-2)	2,5	(2-3)	0,001	0,001‡, 0,015§
Insertion of gavage tube	100	(90)	1	(1-2)	2	(1-2)	1	(1-2)	NS	
SUM ALL			24	(21,5-27)	28	(25-33)	28	(26-33)	0,019	0,018†

* NS indicates not significant

† significant difference physicians - nurses

‡ significant difference physicians – nurse assistants

§ significant differences nurses – nurse assistants

Table III. Current use of pharmacological agents rated by physicians (n=20), nurses (n=53), and nurse assistants (n=17). Presented as the total response rate for each procedure, median and interquartile range (IQR). Statistical comparison between all three groups with Kruskal Wallis test (group). Mann Whitney U-test with Bonferroni correction for comparison in pairs.

Procedure	Total response rate		Physicians		Nurses		Nurse assistants		Group	Pairs
	N	(%)	Median	(IQR)	Median	(IQR)	Median	(IQR)	p value	p value
Insertion of chest tube	85	(94)	3	(2-4)	3	(2-4)	2	(1-3)	NS*	
Endotracheal intubation	85	(94)	3	(2-3)	2	(1-3)	1,5	(1-3)	NS	
Lumbar puncture	84	(93)	1	(0-2)	1	(1-3)	1	(1-3)	NS	
Heel stick	89	(99)	0	(0-1)	0	(0-0,75)	1	(0-3)	NS	
Insertion of peripheral intravenous line	88	(98)	0,5	(0-1)	0	(0-1)	1	(0-2)	0,023	0,024§
Insertion of radial/ tibial arterial catheter	100	(90)	1	(0-1)	1	(0-1)	1	(0,5-2)	NS	
Intramuscular injection	88	(98)	1	(0-1)	0	(0-0)	1	(0,25-1)	0,001	0,045†, 0,001§
Tracheal suctioning	86	(96)	0	(0-1)	1	(0-1)	1	(1-2)	NS	
Insertion of umbilical catheter	85	(94)	0	(0-1)	0	(0-1)	1	(0-1)	NS	
Insertion of gavage tube	90	(100)	0	(0-1)	0	(0-0)	0	(0-1)	NS	
SUM ALL			10,5	(7-16,75)	9	(6,5-15)	12	(6,25-13)	NS	

* NS indicates not significant

† significant difference physicians - nurses

§ significant differences nurses – nurse assistants

Table IV. Current use of comfort measures rated by physicians (n=20), nurses (n=53), and nurse assistants (n=17). Presented as the total response rate for each procedure, median and interquartile range (IQR). Statistical comparison between all three groups with Kruskal Wallis test (group). Mann Whitney U-test with Bonferroni correction for comparison in pairs.

Procedure	Total response rate		Physicians		Nurses		Nurse assistants		Group	Pairs
	N	(%)	Median	(IQR)	Median	(IQR)	Median	(IQR)	p value	p value
Insertion of chest tube	87	(97)	1,5	(1-3)	2	(1-3)	1	(1-3)	NS*	
Endotracheal intubation	87	(97)	1	(0,25-2,75)	1	(0-2)	1	(1-3)	NS	
Lumbar puncture	85	(94)	2	(2-3)	3	(1,75-3)	3	(2-3)	0,031	NS
Heel stick	89	(99)	3	(2,25-3)	3	(3-4)	3	(1,25-3,75)	0,004	0,045§
Insertion of peripheral intravenous line	89	(99)	3	(2-3)	3	(3-4)	2	(1,25-3)	NS	
Insertion of radial/ tibial artherial catheter	82	(91)	3	(2-3)	3	(2-3)	2	(1-3)	NS	
Intramuscular injection	90	(100)	2	(1,25-3)	2	(1-3)	2	(1-2,5)	NS	
Tracheal suctioning	87	(97)	1	(1-2,75)	1,5	(1-3)	1	(1-2)	NS	
Insertion of umbilical catheter	87	(97)	1	(1-2)	2	(1-3)	2	(1-2)	NS	
Insertion of gavage tube	86	(96)	1	(1-2,75)	1	(0-2)	1	(0-1,75)	NS	
SUM ALL			19	(15-26)	20	(15-23,75)	20	(15-22,75)	NS	

* NS indicates not significant

§ significant differences nurses – nurse assistants

Table V. Optimal use of pharmacological agents rated by physicians (n=20), nurses (n=53), and nurse assistants (n=17). Presented as the total responses for each procedure, median and interquartile range (IQR). Statistical comparison between all three groups with Kruskal Wallis test (group). Mann Whitney U-test with Bonferroni correction for comparison in pairs.

Procedure	Total response		Physicians		Nurses		Nurse assistants		Group	Pairs
	N	rate (%)	Median	(IQR)	Median	(IQR)	Median	(IQR)	p value	p value
Insertion of chest tube	87	(97)	4	(3-4)	4	(4-4)	4	(4-4)	0,026	0,021†
Endotracheal intubation	83	(92)	3	(3-4)	4	(3-4)	4	(3-4)	NS*	
Lumbar puncture	86	(96)	3	(1,25-3)	4	(3-4)	4	(3-4)	0,001	0,001†, 0,021‡
Heel stick	86	(96)	2	(1-3)	1	(1-4)	2	(1-4)	NS	
Insertion of peripheral intravenous line	87	(97)	2	(1-3)	3	(1-4)	3	(1-3,75)	NS	
Insertion of radial/ tibial arterial catheter	82	(91)	3	(2-3)	3	(2-4)	2	(1-3)	NS	
Intramuscular injection	84	(93)	2,5	(1-3)	1	(1-3,25)	2	(1-3,25)	NS	
Tracheal suctioning	84	(93)	1	(1-2)	2	(1-3)	2	(1-3)	NS	
Insertion of umbilical catheter	100	(90)	1	(1-2)	2	(1-3)	2	(1,5-3)	NS	
Insertion of gavage tube	85	(94)	1	(1-2)	1	(0-1)	1	(0,75-1)	NS	
SUM ALL			24	(16,5-28,5)	26	(21-32)	24	(21,25-27,5)	NS	

* NS indicates not significant

† significant difference physicians - nurses

‡ significant difference physicians – nurse assistants

Table VI. Optimal use of comfort measures rated by physicians (n=20), nurses (n=53), and nurse assistants (n=17). Presented as the total response for each procedure, median and interquartile range (IQR). Statistical comparison between all three groups with Kruskal Wallis test (group). Mann Whitney U-test with Bonferroni correction for comparison in pairs.

Procedure	Total response rate		Physicians		Nurses		Nurse assistants		Group	Pairs
	N	(%)	Median	(IQR)	Median	(IQR)	Median	(IQR)	p value	p value
Insertion of chest tube	87	(97)	3,5	(2-4)	4	(2,5-4)	1	(0-4)	0,013	0,015§
Endotracheal intubation	85	(94)	3	(1-4)	4	(2-4)	1,5	(0-4)	0,037	0,045§
Lumbar puncture	87	(97)	3	(3-4)	4	(4-4)	4	(2-4)	0,009	0,012†
Heel stick	87	(97)	4	(3-4)	4	(4-4)	4	(1-4)	0,001	0,003† , 0,001§
Insertion of peripheral intravenous line	86	(96)	3,5	(3-4)	4	(4-4)	4	(2-4)	0,001	0,001†, 0,003 §
Insertion of radial/ tibial artherial catheter	84	(93)	4	(3-4)	4	(4-4)	3	(0,75-4)	0,003	0,003§
Intramuscular injection	87	(97)	3	(3-4)	4	(4-4)	3	(2-4)	0,015	0,033†
Tracheal suctioning	86	(96)	3	(2-4)	4	(3-4)	1,5	(1-4)	0,001	0,027†, 0,003§
Insertion of umbilical catheter	86	(96)	3	(2-4)	4	(3-4)	2,5	(0,75-4)	0,003	0,021†, 0,012§
Insertion of gavage tube	87	(97)	3	(2-4)	4	(3,25-4)	2	(1-4)	0,001	0,003†, 0,001§
SUM ALL			31	(25,75-40)	40	(32-40)	20,5	(12,75-36,75)	0,001	0,003§

† significant difference physicians - nurses

§ significant differences nurses – nurse assistants