

Pain management in Canadian level 3 neonatal intensive care units

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Objective: To determine current practices in neonatal intensive care units (NICUs) of managing postoperative pain, pain associated with nonsurgical procedures and disease-related pain.

Design: Retrospective, self-administered descriptive mail survey.

Setting: Level 3 NICUs in Canada.

Participants: The head nurses of the 30 Canadian level 3 NICUs in February 1992; 26 (87%) responded.

Main outcome measures: Five-point Likert scale of Always (in 100% of cases), Often (in 75% to 99%), Usually (in 25% to 74%), Rarely (in 1% to 24%) and Never (in 0%). Selected items were validated through a chart review.

Results: Opioids were used postoperatively always or often in 93% (13/14), 88% (15/17) and 65% (11/17) of the NICUs that cared for neonates having undergone cardiac, major and minor surgery respectively. Most of the NICUs did not use paralysis or sedation alone for postoperative pain management. Local anesthesia was used always or often for emergent chest tube placement in 16% (4/25) of the NICUs, for elective chest tube placement in 48% (12/25) and for lumbar puncture in 12% (3/24). An analgesic was rarely or never used for insertion of a tracheal tube in emergent situations in 88% (23/26) of the NICUs and in elective situations in 84% (21/25); the corresponding figures for sedative use were 85% (22/26) and 73% (19/26). Only 22% (5/23) used opioids regularly in cases of nonsurgically managed necrotizing enterocolitis. Physicians alone determined the rate of opioid weaning in 54% (13/24) of the NICUs. Opioids were usually described as being weaned as tolerated.

Conclusions: Analgesic use for the management of postoperative pain in neonates having undergone cardiac and major surgery is frequent but continues to be infrequent in the postoperative care of patients having undergone minor surgery in some NICUs. Procedural and disease-related pain is frequently untreated or undertreated. Guidelines for establishing a protocol to manage pain in NICUs are given.

Objectif : Déterminer les pratiques en vigueur dans les unités néonatales des soins intensifs (UNSI) pour traiter la douleur postopératoire, la douleur liée à des interventions non chirurgicales et la douleur liée à la maladie.

Conception : Sondage postal descriptif rétrospectif à remplir soi-même.

Contexte : UNSI de niveau 3 au Canada.

Participantés : Infirmières en chef des 30 UNSI de niveau 3 du Canada en février 1992; 26 (87 %) ont répondu.

Principales mesures de résultats : Échelle Likert en 5 points : toujours (dans 100 % des cas), souvent (dans 75 % à 99 % des cas), habituellement (dans 25 % à 74 % des cas),

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rarement (dans 1 % à 24 % des cas) et jamais (dans 0 % des cas). On a validé certaines questions en examinant des dossiers.

Résultats : On a utilisé des opioïdes postopératoires toujours ou souvent dans 93 % (13/14), 88 % (15/17) et 65 % (11/17) des UNSI qui ont traité des nouveau-nés ayant subi une intervention chirurgicale cardiaque, majeure et mineure respectivement. La plupart des UNSI n'ont pas eu recours à la paralysie ou à la sédation seulement pour traiter la douleur postopératoire. On a utilisé l'anesthésie locale toujours ou souvent dans les cas d'installation d'urgence d'un drain thoracique dans 16 % (4/25) des UNSI, d'installation non urgent d'un drain thoracique dans 48 % (12/25) des unités et dans les cas de ponction lombaire dans 12 % (3/24) des unités. On a utilisé un analgésique rarement ou jamais pour insérer d'urgence une sonde endotrachéale dans 88 % (23/26) des UNSI et, dans les situations non urgentes, dans 84 % (21/25) unités. Les chiffres correspondants relatifs à l'utilisation de sédatifs étaient de 85 % (22/26) et 73 % (19/26). Seulement 22 % (5/23) ont utilisé des opioïdes régulièrement dans des cas d'entéocolite nécrosante traitée sans chirurgie. Ce sont les médecins seulement qui ont fixé le taux de sevrage des opioïdes dans 54 % (13/24) des UNSI. Habituellement, le sevrage des opioïdes s'est fait selon la tolérance.

Conclusions : On utilise souvent des analgésiques pour traiter la douleur postopératoire chez les nouveau-nés qui ont subi une intervention chirurgicale cardiaque et majeure, mais l'usage demeure peu fréquent dans le soin postopératoire de patients qui ont subi une intervention chirurgicale mineure dans certaines UNSI. La douleur liée aux interventions non chirurgicales et à la maladie demeure souvent non traitée ou mal traitée. On présente des lignes directrices sur l'établissement d'un protocole de traitement de la douleur dans les UNSI.

There is unequivocal evidence that neonates, even those born prematurely, experience pain.^{1,2} The metabolic and hormonal responses to pain in neonates are profound^{3,4} and may surpass adults in intensity.⁵ The provision of adequate analgesia intraoperatively attenuates the stress response^{6,7} in both term and premature neonates and probably affects clinical outcome.⁸⁻¹¹ Previous standards in pediatric care have allowed for clearly inadequate pain management in both older children¹²⁻¹⁴ and neonates.¹⁵

Subsequent stress responses to pain experienced by neonates are potentially detrimental,^{8,16} and knowledge about the management of neonatal pain has advanced past the belief that neonates lack the capacity to experience pain or that they somehow feel pain differently than others.¹⁷ Despite this recognition, a British study in 1986 showed that although 85% of polled anesthetists accepted that neonates felt pain, only 5% actually gave an analgesic to their patients.^{18,19}

This study was undertaken to survey current practices in Canadian level 3 neonatal intensive care units (NICUs) in the management of postoperative pain, pain associated with nonsurgical procedures and disease-related pain. Also, we wished to identify which sources of pain continue to be undertreated in our NICUs.

Methods

In February 1992 a 36-item questionnaire was mailed to the head nurses of 30 Canadian level 3 NICUs. The questionnaire comprised five categories: demographic characteristics of the staff members and patients, postoperative pain management, procedural pain management, disease-related pain management and weaning of neonates from opioïdes.

Questions were in the form of "Which answer most closely describes your unit?" The following interval variable was used for reply: Always (100%), Often (75% to 99%), Usually (25% to 74%), Rarely (1% to 24%) and Never (0%). Unless otherwise specified, the results describe the proportion of units reporting a particular response rather than the proportion of neonates within each unit.

To validate selected items from the survey (including opioid use in postoperative patients and means of its administration) a chart review was undertaken of all 141 patients in our NICU who required an anesthetic in the year preceding the mailing of the survey (February 1991 to February 1992); 32 patients were excluded because they went to the pediatric intensive care unit postoperatively (e.g., they had undergone major complex cardiac surgery), did not have an indication for postoperative analgesia (e.g., dental impressions before cleft palate repair or cardiac catheterization) or were miscoded.

The remaining 109 charts, representing 155 procedures, were reviewed. The use of opioïdes in cardiac surgery (24/27), major surgery (59/66) and minor surgery (17/62) correlated closely with the survey results, as did the frequency of mode of opioïd administration (continuous infusion was more frequent than use as needed, which was more frequent than regular doses).

Results

Demographic characteristics

Of the head nurses at the 30 eligible level 3 NICUs 26 (87%) responded to the questionnaire. All of the 26 units were staffed by neonatologists, 88% (23/26) had residents, mainly those in pediatrics or anesthesia, and

62% (16/26) had fellows. Three of the units had a consultant pain service, but one never used it, and the other two used it only rarely.

The median annual number of admissions per unit was 690 (range 150 to 1200), most having a daily census of 11 to 30 patients. This represented approximately 18 000 admissions annually. Admissions for surgery accounted for a median number of 70 patients per year (range 10 to 300). Sixteen of the NICUs had patients who were born at the hospital or elsewhere, six had only neonates born elsewhere, three had only those born at the hospital, and one did not report. Fourteen (54%) of the NICUs cared for postoperative cardiac patients and 18 (69%) for neonates who had undergone major surgery (e.g., laparotomy) and minor surgery (e.g., inguinal hernia repair).

Fentanyl and morphine were the preferred analgesics and were used with the same frequency. One unit used pethidine as the main systemic opioid analgesic. The NICU staff wrote the postoperative analgesic orders in most of the units.

Postoperative pain

Postoperative pain management consisted of opiate use always or often in 93% (13/14) of the NICUs that cared for cardiac surgery patients, in 88% (15/17) of the NICUs that cared for patients having undergone major surgery and in 65% (11/17) of the units that cared for those having undergone minor surgery (Table 1). One of the 18 NICUs that cared for neonates having undergone major and minor surgery did not respond to this question. Continuous infusion was the method of choice always or often for opioid delivery in 11 of the 17 NICUs, regular bolus in 5 of the 17 and as necessary in just 1.

Inadequate pain control was managed always or often with an increase in the continuous infusion rate in 10 of the 16 NICUs that completed this subsection of the question and with a bolus and then an increase in the continuous infusion rate in 5. Nine of the 17 head nurses replying to the last subsection of this question stated that the bolus dose and the frequency would be increased to manage inadequate pain control. In 10 of 16 units a second analgesic would not be used if the first was felt to be inadequate.

Paralysis was never or rarely used without analgesia in the postoperative management of patients in 17 of 18 NICUs. Half of the 18 head nurses reported that sedation without analgesia was occasionally used.

Procedural pain

The use of topical, local and systemic analgesics was examined for commonly occurring procedures and associated pain. Topical anesthesia is not licensed for use in infants less than 6 months of age. Twenty-two of 25 head nurses reported that topical anesthesia was rarely or never used for elective procedures and 24 of 25 that it was never or rarely used for emergent procedures.

Local anesthesia for chest tube placement was used always or often in emergent situations in 4 of 25 NICUs and under elective conditions in 12 of 25 units (Table 2). Four units never used local anesthesia for chest tube placement electively. Central lines were reported to be inserted always with local anesthesia in 6 of 22 NICUs but never or rarely in 12. Local anesthesia for lumbar puncture was rarely or never used in 19 of 24 NICUs.

A systemic opioid analgesic was rarely or never used for intubation in emergent cases in 23 of 26 NICUs or in elective situations in 21 of 26 NICUs (Table 2). Three units always or often used an opioid for such purposes in elective cases. Similarly, sedation was reportedly rarely or never used in 19 of 26 NICUs for intubation in elective cases (Table 2). Paralysis without opioids or sedation was rarely or never used for elective or emergent intubation in 21 of 25 NICUs.

Disease-related pain

Five of 23 head nurses reported that opioid analgesia was used always or often and 16 of 23 that it was used rarely or never in neonates with nonsurgically managed necrotizing enterocolitis. Opioid analgesia was used in patients who required mechanical ventilation for a nonsurgical indication (i.e., respiratory distress syndrome) always or often in 8 of 23 NICUs and rarely or never in 9 of these units.

In more than half of the NICUs hepatic and renal failure, hypotension, seizures and prematurity were factors that decreased the dose of opioids or the frequency with which they were used.

Table 1: Use of opioid analgesics postoperatively in 17 of 26 level 3 Canadian neonatal intensive care units (NICUs),* by type of surgery

Type of surgery	Use of opioid analgesics†					Total
	Always	Often	Usually	Rarely	Never	
Major	11	4	2	0	0	17
Minor	6	5	4	2	0	17

*Eight units do not provide postoperative care, and one did not respond.
 †Often = in 75% to 99% of cases, usually = in 25% to 74% and rarely = in 1% to 24%.

Opioid discontinuation

Physicians were responsible for the rate of weaning from opioids in 13 of 24 NICUs that answered this question. The responsibility was a collaborative effort between physicians and nurses in a further eight NICUs. In three nurses were primarily responsible for determining the rate.

Six of 18 head nurses reported cases of iatrogenic opioid withdrawal in the previous year, with an average of two cases per unit annually.

In 10 of 13 NICUs opioid use was never stopped abruptly. Opioids were weaned as clinically tolerated always or often in 14 of 20 NICUs and usually in a further 5 units. However, 6 of 14 head nurses replying to this subsection stated that a "prescribed" weaning (e.g., "decrease by 0.1 mL/h every 4 hours") was used often or always.

Discussion

Our findings suggest that over 85% of Canadian NICUs surveyed use opioid analgesia for the management of pain after cardiac and major surgery. The postoperative management of pain has apparently evolved since the description 11 years ago by Beyer and associates²⁰ of the discrepancy between adult and pediatric analgesic use. In part, this change may be attributable to a better understanding of opioid pharmacokinetics²¹ and to fentanyl's beneficial effects in stabilizing pulmonary circulation postoperatively.²² That 35% of the NICUs in our study did not routinely use analgesia after minor surgery is disappointing.

Both sedation and paralysis blunt the recognition of behavioural responses to pain without affecting nociceptive input and consequent physiologic changes. Despite this, sedation was used occasionally in place of analgesia

for postoperative pain management in 50% of the NICUs and paralysis without analgesia postoperatively in one NICU. Almost 75% of the NICUs reportedly use sedation if pain management with opioids was inadequate.

Topical anesthetics are not currently recommended for infants less than 6 months of age. Local anesthetics have dose-related side effects that are well defined, and safe use is possible. However, 79% of the head nurses that answered this question reported that local anesthetics were never or rarely used for lumbar puncture, although evidence suggests a significant benefit in terms of physiologic stability in neonates²³ and no decrease in the success rate of the procedure.²⁴ In our study a local anesthetic was never or rarely used for the placement of chest tubes in emergent or elective cases in most NICUs. A local anesthetic was used for central line placement always or usually in 45% (10/22) of the NICUs. These practices would be regarded as unacceptable in adults and older children.

Elective intubation, and even emergent intubation in conscious patients, would rarely be considered in adults or older children without sedation or analgesia but was still being performed without either in more than 75% of the NICUs. Paralysis, although sometimes important in airway management, was being used alone as a method of facilitating intubation in 20% of the NICUs.

The study by Bauchner, May and Coates²⁵ paralleled ours in terms of the reported frequency of analgesic use for central line and chest tube placement and for lumbar puncture. They found a higher general use of analgesics in pediatric intensive care units than in NICUs for the same invasive procedures.

Even when ordered, opioids are not always used optimally from a pharmacokinetic point of view. We found that over 60% of the NICUs frequently managed inadequate pain control by simply increasing the infu-

Table 2: Use of analgesics and sedatives for pain associated with nonsurgical procedures

Procedure	Use of drugs;* no. of NICUs (and no. of nonrespondents)					Total
	Always	Often	Usually	Rarely	Never	
Local analgesic						
Chest tube placement						
Emergent	0	4	7	6	8	25 (1)
Elective	4	8	1	8	4	25 (1)
Central line placement	6	0	4	2	10	22 (4)
Lumbar puncture	0	3	2	3	16	24 (2)
Systemic analgesic						
Tracheal intubation						
Urgent	0	1	2	4	19	26 (0)
Elective	1	2	1	8	13	25 (1)
Sedation						
Tracheal intubation						
Urgent	1	0	3	3	19	26 (0)
Elective	2	4	1	8	11	26 (0)

*Designations as in Table 1.

sion rate instead of increasing the serum drug levels by administering a bolus and then increasing the infusion rate.

It is surprising that only physicians were responsible for determining the rate of opioid weaning in more than 50% of the NICUs. We believe that nurses are generally in a much better position to recognize inadequacy of pain control. Few cases of iatrogenic opioid withdrawal were recognized, which may reflect either a better understanding of neonatal abstinence syndrome and its prevention²⁶ or the attribution of opioid withdrawal signs to other illnesses. The latter may be more the case, since more than 30% of the NICUs reportedly weaned their patients from opioids at a prescribed rate, which increases the risk for poor pain management and the risk for neonatal abstinence syndrome.

Finally, opioids were used sparingly in nonsurgical conditions that clearly may be associated with pain (e.g., the peritonitis of necrotizing enterocolitis) or for procedures that may cause distress (e.g., mechanical ventilation for respiratory distress syndrome).

Although we relied on retrospective recall, we feel that our findings are representative, since selected items were validated within our institution and since most of the NICUs in Canada were included. If anything, our results more than likely overestimate the recalled use of analgesics, since lack of intervention is more likely forgotten. Reasons for the lack of universal provision of pain relief in neonates postoperatively and the infrequent use of opioids for other sources of pain are myriad and attributable to mistaken beliefs about addiction potential, poor recognition of symptoms of pain, and inadequate knowledge of opioid pharmacokinetics and true risks of side effects, such as respiratory depression.¹⁸

Despite these risks, we have a responsibility to manage the pain experienced by neonates as a consequence of our care or pursuant to a disease process and to monitor them appropriately in order to avoid adverse side effects.

Recommended guidelines for managing neonatal pain

Guidelines for managing both expected and unexpected pain must be developed from a humanitarian and a beneficial medical standpoint in NICUs of all levels. We believe that recommendations for these guidelines should include the following.

- Indications for which neonates must receive analgesia, including postoperative circumstances and procedures such as chest tube or central line placement and lumbar puncture.
- Provision of at least sedation before attempts to insert a tracheal tube, unless the patient is near death.
- Designation of a narcotic analgesic (morphine and fentanyl are the best studied and most frequently used) to be used by each institution, with appropriate

dosing guidelines for initiating therapy, managing breakthrough pain and side effects and weaning patients from the analgesic.

- Designation of oral and intravenous alternatives for the management of pain as well as appropriate pharmacokinetic information and dosing guidelines.

- A mechanism to assess the adequacy of pain control by both nurses and physicians (pain assessment tools are being evaluated^{27,28}).

- Provision of analgesia to neonates with disease-related pain regardless of whether the disease is surgically managed.

- A mechanism to ensure the education of physicians and nurses in the use of these guidelines as part of the standard of care of the NICU. Each health care professional charged with the care of a neonate must be that neonate's advocate for adequate pain control.

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Mar. 23-26, 1994: North Pacific Society of Neurology, Neurosurgery and Psychiatry 55th Annual Meeting
Vancouver

North Pacific Society of Neurology, Neurosurgery and Psychiatry, 1440 N Highland, Tacoma, WA 98406; tel (206) 752-0853

Mar. 24-25, 1994: The Dementias — Diagnosis and Implications for Management (cosponsored by the Rotman Research Institute of Baycrest Centre for Geriatric Care and the Alzheimer's Disease Center, University of California, Los Angeles)

Toronto

Education Department, Baycrest Centre for Geriatric Care, 3560 Bathurst St., Toronto, ON M6A 2E1; tel (416) 789-5131, ext. 2365; fax (416) 785-2378

Mar. 28-31, 1994: 17th International Annual Ain Shams Medical Congress — Gastroenterology, Endoscopy and Laparoscopy

Cairo, Egypt

Official language: English

Hamdy M. Abdalla, congress secretary general, Clinical and Scientific Society, Faculty of Medicine, Ain Shams University, Abbassia, Cairo, Egypt; tel/fax 011-202-285-5441

Mar. 29, 1994: Kellogg Nutrition Symposium (sponsored by Kellogg Canada Inc.)

Toronto

Alison King, Media Profile, 400-579 Richmond St. W, Toronto, ON M5V 1Y6; tel (416) 366-8464, fax (416) 366-4042

Apr. 2, 1994: International Symposium on Neurofibromatosis (cosponsored by the International Neurofibromatosis Association)

Hong Kong

Ms Francine Morris, National Neurofibromatosis Foundation, Ste. 7-S, 141 5th Ave., New York, NY 10010-7105; tel (212) 460-8980, fax (212) 529-6094

Apr. 14-16, 1994: 3rd Canadian Congress on Utilization and Quality Management: Quality Breakthroughs in Hard Times (cosponsored by the Canadian Hospital Association, the CMA, the Canadian Nurses Association, the Hospital Medical Records Institute and the MIS Group)

Montreal

Guest speakers: Stephen Lewis and Nancy Betkowski

Professional Services, Canadian College of Health Service Executives, 402-350 Sparks St., Ottawa, ON K1R 7S8; tel (800) 363-9056 or (613) 235-7218, fax (613) 235-5451

Du 14 au 16 avr. 1994 : 3^e congrès canadien sur l'utilisation et la qualité de l'information de gestion : Assurer la qualité en période difficile (coparrainé par l'Association des hôpitaux du Canada, l'Association des infirmières et infirmiers du Canada, l'AMC, le Hospital Medical Records Institute et le Groupe MIS)

Montréal

Conférenciers invités : Stephen Lewis et Nancy Betkowski

Services professionnels, Collège canadien des directeurs des services de santé, 402-350, rue Sparks, Ottawa, ON K1R 7S8; tél (800) 363-9056 ou (613) 235-7218, fax (613) 235-5451

Apr. 16-19, 1994: Society of American Gastrointestinal Endoscopic Surgeons 1994 Scientific Session and Postgraduate Course

Nashville, Tenn.

SAGES, 101-11701 Texas Ave., Los Angeles, CA 90025; tel (310) 479-3249, fax (310) 479-9744

Apr. 17, 1994: 6th Annual Symposium on Treatment of Headaches and Facial Pain

New York

Dr. Alexander Mauskö, director, New York Headache Center, 301 E 66 St., New York, NY 10021; tel (212) 794-3550

Apr. 18-21, 1994: T-Cell Receptor Use in Human Autoimmune Diseases (cosponsored by the Arthritis Foundation)

San Diego

Geraldine Busacco, conference director, New York Academy of Sciences, 2 E 63rd St., New York, NY 10021; tel (212) 838-0230, fax (212) 838-5640

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