

It Seemed Like a Good Idea at the Time: Reflecting on 35 Years of Clinical Practice in the NICU

Rob Graham, R.R.T., N.R.C.P.

I dedicate this column to the late Dr. Andrew (Andy) Shennan, the founder of the perinatal program at Women's College Hospital (now at Sunnybrook Health Sciences Centre). To my teacher, my mentor and the man I owe my career as it is to, thank you. You have earned your place where there are no hospitals and no NICUs, where all the babies do is laugh and giggle and sleep.

My love affair with all that is NICU started in the fall of 1988 with my clinical rotation as a student respiratory therapist in the Women's College Hospital (WCH) unit in Toronto. I witnessed a team approach to care that was inclusive and respectful, allowing members of each discipline to utilise their respective scope of practice fully.

Dr. Andrew Shennan's (the founder of the unit) philosophy is aptly described by an expression he used: "Why have a dog and bark too?" Nurses know how to nurse; pharmacists know medication; dietitians know nutrition; and last but not least, respiratory therapists know how to ventilate. While the physician in charge acted as a care coordinator, it was accepted that the knowledge and expertise each allied health sub-specialty brought to the table amounted to more than could be expected of any one member of the team, including physicians. The staff physicians and fellows received input from the team and acted as care coordinators. It is a model that has stood the test of time and continues today.

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Just as importantly, allied health is practiced with a great deal of autonomy. This autonomy is a key component of unit philosophy; it removes roadblocks that may hamper a clinician's ability to provide appropriate care promptly. Employee satisfaction improves work performance, and it improves when the job they are tasked with

can be done without interference.

My cocky attitude, typical of a fresh graduate (abundant in the relative comfort of my base hospital), faded quickly upon joining the WCH NICU, usurped for the next year by a state of perpetual terror. Regardless, I have never looked back. February 2024 marks the last month of my employment as a full-time RRT in the NICU at Sunnybrook Health Sciences Centre and the beginning of my semi-retirement. Having spent more than half my life in the unit (relocated in 2010 to the Bayview Campus of Sunnybrook Health Sciences Centre), there is far too much NICU blood in my veins to stop practicing; it is in my DNA.

Change is a part of life. Ideally, clinical practice evolves as knowledge and evidence to support it (or not) increases. While we all come to the table intending to do well for our patients, sometimes our actions miss the mark. As the saying goes, "The road to ruin is paved with good intentions." Here are some.

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Chest physiotherapy:

Hoping to mobilise and clear secretions, chest physiotherapy (CPT) was once routinely performed on ventilated infants. Some units used electric toothbrushes; at WCH, the masks from resuscitation bags were cupped in hand and "gently" tapped on the babies' chests. The evidence to support this practice is inconclusive (1), often not stratified by post-menstrual age (PMA), and various CPT methods may be utilised. A 1998 paper raised concerns about brain damage associated with CPT (2). Regardless, CPT remains a controversial therapeutic intervention, one not performed in the NICU at Sunnybrook in many, many years. One method that appears to be safe is Vojta reflex stimulation (3). A 2018 study found that prone positioning had a more significant benefit to lung function than CPT (4). Regardless of the method, CPT should be avoided during the first few days of life when the risk of brain

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bleeds is most significant and on those infants at high risk of intracranial bleeds (5).

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Resuscitation:

FiO₂ of 1.0 was often initially used to bring oxygen saturation up into the 90s as quickly as possible. At WCH, 0.60 was used, possibly because that is at the top of the blender dial. Regardless of activity and respiratory drive, virtually all infants <30 weeks PMA were intubated, and babies were rarely extubated before 30 weeks PMA.

PEEP:

Reminiscent of the Ford Model “T,” PEEP could be dialed into whatever level desired, as long as that was 5 cmH₂O. “PEEP-O-PHOBIA” was the order of the day. Worse than the arbitrary selection of pressure, pulmonary interstitial emphysema (PIE) was treated by decreasing PEEP, sometimes to zero. In the day, PIE was very often a death sentence.

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Non-Invasive Ventilation (NIV):

Before the availability of commercial NIV devices such as the Infant Flow System®, nasopharyngeal tubes (NPTs) (regular endotracheal tubes cut to a shorter length) were inserted to provide non-invasive support. Some units performed laryngoscopy to establish NPT length by advancing the tube and cutting it to the length visible past the soft palate. Aside from issues with discomfort (which was minimised if the NPT was advanced far enough and mitigated with acetaminophen), this system worked very well.

The biggest problem was how NIV support settings were set. The circuit wye was occluded, and the desired pressure (invariably PEEP at 5 cmH₂O and inspiratory pressure of 12 cmH₂O at 12/minute should a rate be desired) was set on the ventilator. Inspiratory time was usually 0.4–0.5 seconds. Unlike today’s ventilators, the machines of the day lacked mechanisms to compensate for leaks and maintain pressure. NIV would undoubtedly have been more successful if it was set based on delivered pressure. (Aside, we were delivering NIPPV decades before it gained favour with others.)

Invasive Ventilation:

Once intubated, all babies were placed on the ventilator at a rate of 40–60, initial inspiratory pressure of 20 cmH₂O, PEEP of 5 cmH₂O, and inspiratory time of 0.4–0.5 seconds. When weaning, the rate was always decreased before pressure. Exogenous surfactant was finishing clinical trials when I joined the NICU team, and this approach assured the babies got the “best” of both barotrauma and volutrauma. This ill-advised but well-intentioned approach notwithstanding, the unit at WCH still boasted some of the lowest chronic lung disease (CLD, or BPD as it was called then) numbers in the world.

Volumes/Pressures:

When the first ventilators to offer volume monitoring came into service, we were shocked to see how much volume babies were receiving, even at relatively low pressures. Inspiratory pressure had always been set based on chest movement, a very imprecise method. Even after we were able to see volumes in real-time, tidal volume selection was typically 5–8 or more mL/kg, and chest tubes were a much more common sight then than now. “Conventional” ventilation is now rarely used in the Sunnybrook NICU; instead, oscillation with volume targeting and high-frequency jet ventilation are first-line modalities.

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Blood gases and PaPCO₂ targets:

During the first week of life, babies were ventilated to “normal” blood gas values. It was not until after this time that orders might be written to “accept chronic blood gases.” Realistically, after bashing their poor little lungs for a week, there was little choice but to accept lower pH/higher PaCO₂. At the time, normal pH was considered to be 7.35–7.40 with PaCO₂ maintained at <45 mmHg, and pH of 7.3 and PaCO₂ 45–55 were acceptable chronic blood gas values. We now have no firm upper limit on PaCO₂, provided metabolic compensation exists to keep pH above 7.24, sometimes 7.20.

The frequency at which blood gases were drawn meant the most significant part of an RT’s workload was doing them. Babies

who were intubated had blood gases drawn every 4 hours if the ventilator rate was 40–60, every 6–8 hours if the rate was under 40, and every 12 hours if the baby was on NIV. Contrast this with current guidelines, which allow 48–72 hours between gases on stable, chronically ventilated babies. Babies receiving NIV have blood gases drawn only if there is a compelling reason to do so.

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Blood work:

When I started working at WCH, the laboratory staff did all routine blood work in the morning. A cacophony of babies screaming filled the air each morning, and bruised heels were the norm. The lancets used then were solid metal pieces with a sharp spike at one end. They were jabbed into the heel, and at one time, the bottom of the heel was used. Former premies were often recognisable by their odd walk – on tiptoes with arms outstretched wide as if they were intent on hugging whomever they approached. The bedside RN did non-routine blood work, which was not coordinated with RRTs.

Today all blood work is done by the bedside RN or the RRT, depending on whether blood gases are required or not, and the timing of the draw is coordinated with handling times to minimise disturbing the babies. The frequency of routine bloodwork has also been significantly decreased. Lancets are spring-loaded blades that slice at a controlled depth so quickly it is hardly noticed, and we know not to poke the bottom of the heel. Sucrose is also often given prior to puncture-derived blood work (see below).

Pain management:

Perhaps the darkest stain on the history of neonatology is the mistaken belief that infants do not feel pain. Until the late 1980s and beyond, despite the growing body of evidence to the contrary, this belief persisted, and analgesia was often not prescribed for babies. When it was, dosing was often insufficient (6). Rapid sequence induction (RSI) was rarely performed for intubating until the 2000s. Ground-breaking research by Dr. Sharyn Gibbons

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(formerly of WCH) on sucrose and pain management in premature infants changed all this (7). Today, RSI for intubation and sucrose for minor procedural pain are standards of care.

Circuit changes:

Since circuits were changed every 48 hours, a significant part of the daily workload for an RT consisted of changing circuits. During these circuit changes, one person was “dirty,” and the other was “clean.” The dirty person would remove the circuit, and the clean person would put on the new one while the bedside nurse hand-bagged the baby. Eventually, circuit changes were pushed to weekly, and today, circuits are not changed unless they fail or become visibly soiled.

Developmental care:

It was common to pin down the baby’s limbs like a frog being readied for dissection to reduce the chances of a baby removing its IV(s). (This practice contributed to the odd walk described above.) Incubators were not covered, light levels were very bright, and noise levels were very high. A boom box is often added to the

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din. Now, incubators are covered, light levels are lowered, and noise is minimal. Positioning aids assist in positioning babies in developmentally appropriate ways, and every effort is made to minimise disturbing babies.

“This process would also cause the baby to rise and fall on top of the mattress. Each fall startled the baby and spurred breathing, but it kept the baby from sleeping soundly. Even back then, we should have known this was not desirable.”

The “Bird Bed”:

The original “Bird” family of pneumatic/magnetic controlled ventilators was retired once more reliable electronically controlled ventilators such as the Sechrist® came to market. While the “Baby Bird” was no longer used for mechanical ventilation, it fit the bill for another therapy—persistent apnea. A glove was placed under the incubator mattress and secured to the end of a circuit connected

to a “bird.” A rate was set on the ventilator; each time the glove inflated/deflated, the mattress would rise and then fall. This process would also cause the baby to rise and fall on top of the mattress. Each fall startled the baby and spurred breathing, but it kept the baby from sleeping soundly. Even back then, we should have known this was not desirable.

Dexamethasone:

In the late 1980s–early 1990s, a seemingly miraculous drug, dexamethasone, came on the scene. Given to premature babies with evolving CLD, it seemed to work miracles and allowed them to be extubated, drastically reducing FiO₂ requirements. Soon, “dex” was being prescribed in NICUs everywhere with great regularity and in doses that might make Lance Armstrong blush.

“As we now know, [dexamethasone] is a double-edged sword, and concerns about catabolism and brain growth surfaced. For years dexamethasone fell out of favour until the “DART” protocol (tiered dosing at lower levels) was developed and is now accepted as an effective therapy in the treatment of CLD, the lower doses resulting in far fewer adverse effects.”

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Thirty-five years from now, someone peering back through the retrospectroscope at practices we currently think are good ideas will no doubt raise an eyebrow. Until then, we will try our best to identify practices that fall short of the mark.

References:

- 1 Judith L Hough, Vicki J. Flenady, Leanne Marie Johnston, Paul G Woodgate: Chest physiotherapy for reducing respiratory morbidity in infants requiring ventilatory support. The Cochrane database of systematic reviews, 2008,volume 3,CD006445. <https://api.semanticscholar.org/CorpusID:28234676>
- 2 Harding JE, Miles FK, Becroft DM, Allen BC, Knight DB. Chest physiotherapy may be associated with brain damage in extremely premature infants. J Pediatr. 1998 Mar;132(3 Pt 1):440–4. doi: 10.1016/s0022-3476(98)70017-4. PMID: 9544898.
- 3 Ana Igual Blasco, Jessica Pi, Francisco Javier Fernandez-Rego, Galaad Torr-Ferrero, Julio Perez-Lopez: Effects of Chest Physiotherapy in Preterm Infants with

Respiratory Distress Syndrome: A Systematic Review. Healthcare,2023,volume11. <https://api.semanticscholar.org/CorpusID:258124809>

- 4 Diwate A, Subhash M. Khatri, Sunil Natha Mhaske: The Effectiveness of Cardiopulmonary Physiotherapy Versus Prone Positioning on Respiratory Functions in Ventilated Neonates: A Randomized Controlled Pilot Study. International Journal of Physiotherapy,2018,volume 5. <https://api.semanticscholar.org/CorpusID:80052478>
- 5 Price, Fiona, Ronan, Christa: A Competence Framework and Evidence Based Practice Guidance for Physiotherapists Providing Respiratory Interventions for Preterm Infants in the United Kingdom. Association of Paediatric Chartered Physiotherapists, July 2014. https://www.csp.org.uk/system/files/documents/2018-11/neonatal_respiratory_competence_framework_2014.pdf
- 6 Elissa N. Rodkey, Rebecca Pillai Riddell: The Infancy of Infant Pain Research: The Experimental Origins of Infant Pain Denial. The Journal of Pain, Volume 14, Issue 4, P338–350, April 2013
- 7 Sharyn Gibbins, Bonnie Stevens: State of the art: Pain assessment and management in high-risk infants. Newborn and Infant Nursing Reviews, Volume 1, Issue 2, 2001, Pages 85–96, ISSN 1527-3369

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