IMPACT OF INHALED NITRIC OXIDE STEWARDSHIP PROGRAM IN A NEONATAL INTENSIVE CARE UNIT

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BACKGROUND

Persistent pulmonary hypertension of the newborn (PPHN) is a serious neonatal emergency that can result in hypoxemic respiratory failure (HRF) and death. Primary treatment of PPHN relies on the selective dilation of the pulmonary vasculature, with inhaled Nitric Oxide (iNO) being an appropriate option.

Therapy with iNO provides a simple, safe treatment option for PPHN. Adverse effects of iNO may result from its direct inhibitory effects on platelet function, resulting in significant bleeding, or through its formation of reactive products. The risk of these adverse effects necessitates that iNO be delivered at the lowest effective dose possible for as short a duration as possible.

Significantly varied compliance to iNO initiation and weaning protocols was identified within the Neonatal Intensive Care Unit (NICU) at The Centenary Hospital for Women and Children, Canberra Hospital. This is a commonly observed situation across similar units. Prolonged treatment, or incorrect weaning procedure, can have serious patient safety implications, with the potential to cause unnecessary harm. The variation in use, namely prolonged duration, has significant financial repercussions both to the hospital and health care system.

Variations in medical care, resulting from human or system related causes, can be reduced through the implementation of stewardship programs. Stewardship programs are targeted interventions that seek to improve protocol adherence, minimise variations and unnecessary resource expenditure whilst promoting better, safer practices that maximise patient outcomes.

AIMS

- To determine compliance to revised, standardised protocols which promote nurse-led care
- To report on the resulting impact on iNO therapy use in the NICU setting through utilisation of a stewardship program
- To reduce the risk of patient harm and safely reduce unnecessary costs within the NICU through increased protocol compliance

METHODS

Review of available evidence and published iNO protocols led to the establishment of both revised initiation of therapy and weaning protocols for NICU use, as shown in Figures 1 and 2, which promote nurse led care with the nurse-in-charge of care being able to wean iNO within set protocol limits. Compliance to the protocol was deemed that doses and durations were within the limits specified, including any instances of weaning criteria failure and subsequent reversion to previous dosage.

A stewardship program for iNO use within the NICU commenced on 01 March 2016 to monitor compliance to the revised protocols.

A combined prospective and retrospective cohort study was conducted utilising a deidentified data set. Study inclusion criteria was all neonates who received iNO, initiated at the NICU or on retrieval, during the study period 01 March 2014 and 28 February 2018. The study period was divided into a pre-stewardship cohort (01 Mar 2014 – 29 Feb 2016) and a post-stewardship cohort (01 March 2016 – 28 Feb 2018).

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RESULTS

Compliance to the new protocols was measured at the end of both the first and second year, with compliance increasing from 61% in the first year to 88% in the second year.

Total iNO use was decreased from 1595 hours (n = 20 courses) pre-stewardship to 774 hours (n = 24 courses) post-stewardship. In the pre-stewardship cohort, 18 patients received a total of 20 courses of iNO, compared to 21 patients receiving a total 24 iNO courses in the post-stewardship cohort.

The analysis between cohorts of iNO utilisation within the NICU by total time, time per patient, time to first wean and time from first wean to withdrawal are shown in Table 1. This analysis of weaning times included 19 pre-stewardship courses (95%) and 21 post-stewardship courses (88%). Comparison between the two cohorts displayed:

- a significant decrease in the total hours of iNO administered, from a median of 67.9 hours/iNO course (41.7-94.8) pre-stewardship to 33.5 hours/iNO course (27.0-40.3) post-stewardship (p=0.0014)
- a significant reduction in median time to wean from iNO initiation to first wean in the post-stewardship cohort was also shown (p<0.0001)

Under currently iNO costing, the total price of iNO therapy was reduced from $125,345.60 to $53,653.60 in the post-stewardship period, equating to a 57.2% cost reduction.

CONCLUSION

Changes in the utilisation rates of iNO within the NICU are likely attributed to increased awareness of the protocol by all staff, the protocol being displayed beside patients undergoing treatment and the empowerment to wean iNO by the nurse-in-charge of care. A shift from clinician-led to nurse-led weaning based on set criteria enhanced protocol compliance.

This study concludes that the safe implementation of a stewardship program can lead to an overall reduction in total iNO usage and costs, without evidence of increased harm, enhancing the quality of health care and promoting nurse-led care.

Table 1: iNO usage within NICU

NA, not applicable † Data presented as the median value and interquartile range			
	Pre-stewardship	Post-stewardship	p value
Courses of iNO given	19	21	NA
Hours/course†	67.9 (41.7-94.8)	33.5 (27.0-40.3)	0.0014
Hours from initiation of therapy to first wean†	38.7 (26.3-63.3)	13.4 (7.3-22.6)	<0.0001
Hours from first wean to discontinuation†	12.8 (9.0-27.6)	14.5 (10.9-26.1)	1.0
Oxygenation Index prior to commencement of iNO†	26.4 (18.6-36.4)	37.5 (24.6-55.9)	0.207
Oxygenation Index at first wean†	9.3 (7.1-12.1)	12.7 (5.6-14.5)	0.433
Total cost of iNO in AUD$	125,345.60	53,653.60	NA

Figure 1: Inhaled Nitric Oxide initiation of therapy protocol

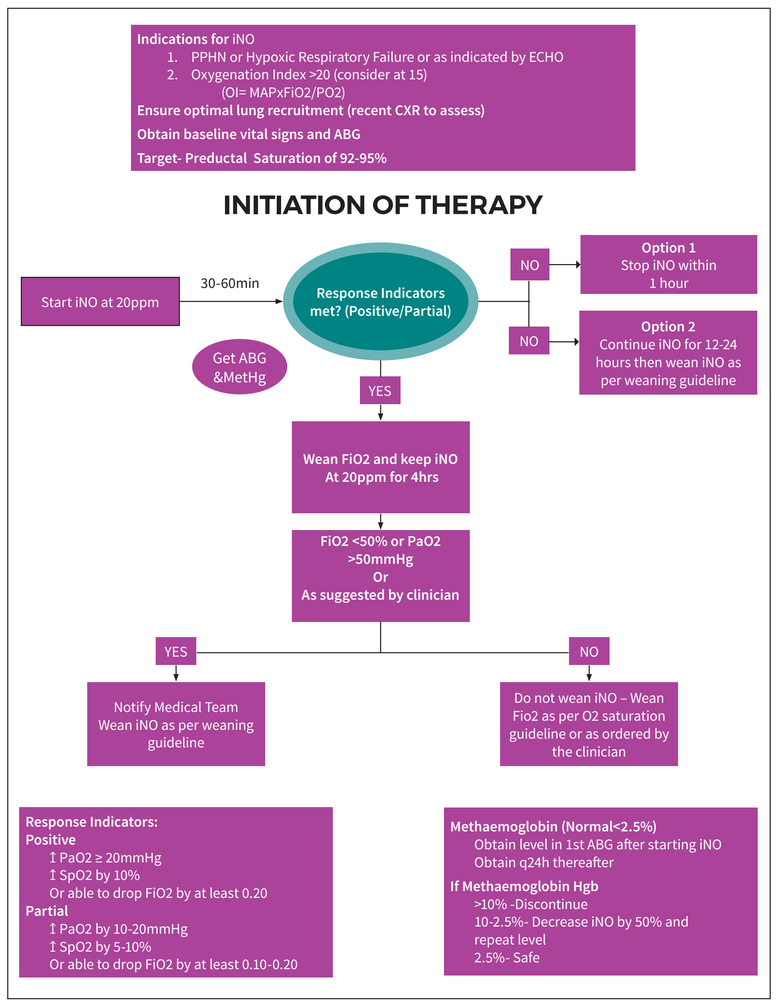

Figure 2: Inhaled Nitric Oxide weaning protocol