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A Pilot Study to Determine if Nurses Trained in Basic Neonatal Resuscitation Would Impact the Outcome of Neonates Delivered in Kampala, Uganda

by B. A. O'Hare,[a] M. Nakakeeto,[b] *and* D. P. Southall[c]
[a]*University Hospital Wales, Cardiff & Vale NHS Trust and Child Advocacy International*
[b]*Department of Paediatrics, Mulago Hospital, Kampala, Uganda*
[c]*North Staffordshire NHS Hospital, UK and Child Advocacy International*

Summary

Aims and Objectives: To determine if a team dedicated to basic neonatal resuscitation in the delivery ward of a teaching hospital would impact the outcome of neonates delivered in Kampala, Uganda.
Methods: A five-member team of nurses, trained in basic neonatal resuscitation attended 1046 deliveries over a thirty-one day pilot period. They were available in the delivery ward twenty-four hours each day. Outcomes studied included the number of stillbirths recorded on the delivery ward, the number of neonates admitted to the special care baby unit (SCBU), the number of babies admitted to SCBU who died and the mortality in the different weight categories. APGAR scores before and after intervention was also compared. Admission diagnoses between the two groups were also compared. Outcome data collected during this pilot period was compared with historic controls from the previous 31 days in the same unit.
Patients and Setting: A delivery ward, 22 000 deliveries per year.
Results: The stillbirth rate and admission rate to the SCBU were unchanged. Basic neonatal resuscitation in this setting decreased the incidence of asphyxia (defined as failure to initiate and sustain breathing or an APGAR score of <7 at 5 min), improved APGARS and a decrease in the mortality of babies weighing more than 2 kg.
Conclusion: The resuscitation team reduced the incidence of and mortality from asphyxia and improved the outcome of babies greater than 2 kg. This pilot study provides evidence of the beneficial effect of basic neonatal resuscitation in this setting.

Introduction

The World Health Organization (WHO) estimates that globally, between four and nine million newborns suffer birth asphyxia each year. Of those, an estimated 1.2 million die and almost the same number develop severe consequences. Each year 4 million babies die in the first 28 days of life. In the 42 countries where 90% of the 11 million deaths in children <5 years occurred, 33% was due to neonatal causes. There is paucity of information about the causes of neonatal deaths in low income countries but it has been estimated that 24% are due to severe infections, 29% due to birth asphyxia, 24% due to the complications of prematurity and 7% due to tetanus [1]. The American Academy of Pediatrics estimate that in general, 10% of newborns need some assistance to begin breathing at birth but only 1% need extensive measures to survive [2]. Basic neonatal resuscitation alone would improve the outcome for hundreds of thousands of babies.

In Uganda the infant mortality is 83/1000 live births and under 5 mortality is 124/1000 live births [3]. Birth asphyxia may account for 24–29% of neonatal deaths in a resource poor setting [1, 4] and neonatal deaths account for approximately half of infant deaths in Africa [5]. Reducing birth asphyxia would have a significant impact on the Ugandan neonatal, infant and the <5 year mortality rates. It was with this in mind that we undertook this pilot study.

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Correspondence: B. A. O'Hare.
E-mail <bernadetteohare@doctors.org.uk>.

Aims and Objectives

We proposed that a team skilled in basic neonatal resuscitation and available to attend all deliveries might reduce the morbidity and mortality due to

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birth asphyxia in an extremely busy delivery suite in Mulago Hospital, Kampala, Uganda. We planned to use resuscitation equipment that could readily be purchased, used and easily maintained in any hospital in a low-income country. There are no ventilators or surfactant so we did not expect to improve the outcome of the more premature neonates, but we did expect that more of them would reach the special care baby unit and possibly survive.

Methods

Five members of the nursing staff undertook a five-day classroom course followed by five days of supervised training on the delivery suite. The topics studied included airway management, bag and mask ventilation and cardiac massage. After reviewing the theory of each lesson, baby manikins were used to demonstrate and to practice skills.

The students were trained to document all antenatal and intrapartum risk factors and to sterilize equipment between each use. They were trained to educate mothers about breast feeding, care of the umbilical cord and the importance of keeping their baby warm. They were taught to administer intramuscular vitamin K to each newborn and provide Vitamin A to all mothers [6].

Study

After training, the team participated in a shift system in the main delivery ward. They were provided with 10 neonatal masks of different sizes, two self-inflating 250 ml bags, bulb suction devices, a clock, a stethoscope and sterilizing equipment. Oxygen was generally available in a cylinder. At each shift change, an inventory was completed.

They attended as many deliveries as possible. When there was more than one delivery they attended to the baby most in need of resuscitation. They used the single oxygen source on the baby judged to be most in need. When there was no oxygen they resuscitated using bag and mask ventilation alone and recorded the lack of oxygen.

The pilot project was undertaken between 18th December 2001 and 18th January 2002. Cots were available to allow observation of infants with respiratory distress before the decision about admission to the neonatal unit was made.

The special care baby unit (SCBU) staff and the labour ward staff are independent of the resuscitation team. The labour ward staff record all still births and the SCBU staff record all admissions to SCBU, their reasons for admission, their weights, APGAR scores and their outcomes in an admissions book. This method of record keeping did not change with the arrival of the resuscitation team. We used the SCBU records and compared admissions from the month prior to the establishment of the team with the month when the team were in place. The Statistical Package for the Social Sciences (SPSS) was used to analyse the data from the two months.

Results

There was no significant difference in still birth rate before and after the introduction of the resuscitation team, see Table 1. There was no difference between the percentage of babies, 20 and 21.8%, who required admission to SCBU, see Table 1. We analysed the admissions to SCBU during the two months by comparing only the admissions that had outcome data available, a total of 420 records. There was no difference in the average weight of babies admitted during the pilot and historic control, $p = 0.265$. There was no significant difference in the mortality between the historic control and the pilot in mortality: 20.8% of the historic control died and 17.3% of the pilot died, see Table 1. (Pearsons Chi-square is 0.809, $p = 0.368$)

We looked at the outcome in the two groups in the different weight categories, see Table 2, and looked at babies weighing <2 kg and >2 kg. In the historic control group, 30.2% of babies weighing <2 kg did not survive compared to 39.7% in the pilot group. This difference was not significant ($p = 0.253$). However for babies weighing >2 kg there was a significant difference in outcome with a much higher

TABLE 1
Demographics of the two groups

	Historic control	Pilot
Number of deliveries	1296	1046
Stillbirths (% of total deliveries)	56 (4.3%) 95%CI; 3.2–5.4%	50 (4.8%) 95%CI; 3.6–6%
Number of admissions to SCBU (% of total deliveries)	261 (20%)	229 (21.8%)
Outcome data available	212	208
Percentage of babies admitted to SCBU who died	20.8%	17.3%
Of the SCBU admissions delivered by CS	70 (26.8%)	60 (26.2%)
Mean birth weight for all admissions kg	2.67	2.57
Mean birth weight for all admissions that were delivered vaginally in kg	2.52	2.41

percentage surviving in the pilot group ($p = 0.006$), see Table 3.

The mean Apgar score in the control group was 7.19 and in the pilot group 7.97. This difference is significant, $p < 0.005$.

Table 4 illustrates the most common admission diagnosis and the outcome in those infants admitted to SCBU before and after the introduction of the team. The asphyxia and low APGAR groups have been combined. There was significantly less admissions during the pilot with asphyxia or low APGARS, $p < 0.05$. There was not a significant difference in the outcome of those admitted with asphyxia and/or low Agars, $p = 0.064$. There was significantly more admissions with prematurity during the pilot and a significantly higher mortality among the premature babies admitted during the pilot, $p = 0.041$.

TABLE 2
Neonatal admissions to SCBU and mortality in the different birth weight categories

		Historic control			Pilot		
		Total	Alive	Dead	Total	Alive	Dead
<1kg	Count	10	1	9	15	2	13
	%	100.0%	10.0%	90.0%	100.0%	13.3%	86.7%
1.01–1.50 kg	Count	18	14	4	15	10	5
	%	100.0%	77.8%	22.2%	100.0%	66.7%	33.3%
1.51–2.00	Count	35	29	6	38	29	9
	%	100.0%	82.9%	17.1%	100.0%	76.3%	23.7%
2.01–2.50	Count	22	20	2	27	25	2
	%	100.0%	90.9%	9.1%	100.0%	92.6%	7.4%
2.51–3.00	Count	50	38	12	37	33	4
	%	100.0%	76.0%	24.0%	100.0%	89.2%	10.8%
3.01–3.50	Count	47	38	9	41	38	3
	%	100.0%	80.9%	19.1%	100.0%	92.7%	7.3%
>3.51	Count	30	28	2	35	35	0
	%	100.0%	93.3%	6.7%	100.0%	100.0%	0%
Total	Count	212	168	44	208	172	36
	% weights	100.0%	79.2%	20.8%	100.0%	82.7%	17.3%

TABLE 3
Comparison of outcomes between babies weighing less and more than 2 kg

	Historic control			Pilot		
	Total	Alive	dead	Total	Alive	dead
Birth weight <2 kg	63	44	19	68	41	27
	100.0%	69.8%	30.2%	100.0%	60.3%	39.7%
Birth weight >2 kg	149	124	25	140	131	9
	100.0%	83.2%	16.8%	100.0%	93.6%	6.4%

Table 4
Most frequent admission diagnoses

	Historic control			Pilot		
	Total	Alive	Dead	Total	Alive	Dead
Asphyxia	53	33	20	15	12	3
Low APGARs	0	0	0	9	8	1
Respiratory distress	17	15	2	11	9	2
Grunty	7	7	0	30	27	3
Premature	62	49	13	55	34	21
Sepsis/febrile	19	19	0	17	17	0

Discussion

Basic neonatal resuscitation in this setting decreased the incidence of asphyxia, improved APGARS and improved the outcome of babies weighing more than 2 kg. The increased numbers of premature neonates being admitted and dying in SCBU may reflect better resuscitation for the smaller and premature neonates enabling them to survive long enough to reach SCBU. To improve the outcomes for the more premature neonates, more resources in the special care baby unit would have been needed.

The impact of the resuscitation team was felt in a number of areas but particularly the SCBU. The daily death toll of asphyxiated, hypothermic term babies was reduced and the morale of the staff improved dramatically. Most admissions now came adequately swaddled and less hypothermic; they were labeled with their names and birth weights using masking tape and a piece of string. They had been given vitamin K and came accompanied by good antenatal and perinatal histories. In these settings the incidence of birth asphyxia and prematurity is higher due to poor maternal health and poor antenatal care [7]. There was an increased accountability for the intrapartum management.

Birth asphyxia is a common cause of perinatal mortality in resource poor countries, and is estimated to cause 10 deaths per 1000 live births [8] which is similar to our findings during the control of 16 deaths per 1000 live births. Mortality is 34.5 times higher among asphyxiated neonates than non-asphyxiated [9]. In low-income countries, babies who survive asphyxia, 45% are dead by one year and 18% have a major disability. An estimate of the prevalence of neurological impairment attributable to birth asphyxia in this setting is 1/1000 [10]. Asphyxia also negatively influences the survival of low birth weight babies in this setting [11].

There is very limited evidence of effect available for interventions, which address causes of death in the neonatal period, including newborn resuscitation. Reduction in the numbers of neonatal deaths has only recently been identified as a global priority and there is urgent need for further research in this area [12]. There is also sparse information about the causes of neonatal deaths in low – income countries. This paper adds weight to the evidence of the beneficial effect of basic neonatal resuscitation and provides information about the causes of death in the neonatal period in low income countries.

After the pilot study, funding was secured for the team to continue its operations and indeed continues until the present day. Further funding was obtained to train more teams of health professionals from hospitals and health-care facilities around and remote from Kampala. Very few hospitals in low-income countries would have the volume of deliveries to warrant a full time team. However this model could be used in major teaching hospitals to act as a focus for training teams from smaller units. The reduction in the incidence of asphyxia and in the improved survival of heavier babies may justify the replication of such a programme in similar settings.

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