

The Neonatal Transport Project

Lady Ridgeway Hospital, Colombo



Introduction

Sri Lanka has made significant strides in reducing infant and neonatal mortality over the past decade. Neonatal mortality, however, accounts for 72% of the infant mortality. Preterm birth is responsible for approximately 35% of the neonatal deaths. Anecdotal and single unit data expresses concern that the condition of newborn infants following inter-hospital transfer is poor with hypothermia and hypoglycemia being the main problems on admission to the Neonatal Intensive Care Unit (NICU).

The Perinatal Society of Sri Lanka identified the formulation of a comprehensive neonatal transport system as a key priority area in 2013. The President of the Perinatal Society, Dr. Ramya De Silva (Consultant Pediatrician, Lady Ridgeway Hospital, Colombo) invited a team from Oxford to advise, train and contribute to the development of a national policy of neonatal transport via a pilot project based at Lady Ridgeway Hospital (LRH) in Colombo. The team from Oxford comprised of Dr. Charlotte Bennett (Consultant Neonatologist and Transport Lead, John Radcliffe Hospital, Oxford, UK), Dr. Amit Gupta (Consultant Neonatologist, John Radcliffe Hospital, Oxford, UK) and Ms. Catherine Convery (Nurse at the London Neonatal Transport Service and formerly Matron at the Neonatal Unit at John Radcliffe Hospital, Oxford, UK)

Scope and objectives

The team spent 4 days in Sri Lanka from 4 to 9th of May 2013. Prior to arrival in Sri Lanka, the team had discussions over Skype and email to set out a clear set of objectives for the trip. Four key objectives were identified for the pilot project:

1. Hold discussions with stakeholders with a view to appraise the prevailing situation and formulate a strategic plan for the pilot project
2. Train a larger group of nurses and doctors from referring hospitals on key aspects of stabilization of an infant before transport
3. Train a core group of nurses and doctors from LRH in 'basic' transport skills.

4. To work with a telecom company as part of their Corporate Social Responsibility portfolio to develop a tablet based electronic patient record to be used for transport.

It was appreciated that 4 days were insufficient to undertake a detailed review of the system and train personnel in a comprehensive manner, but it was felt that a reasonable introduction to some of the underpinning principles could be made.

The Visit

Day 1: Team meeting with doctors and nurses at Lady Ridgeway Hospital.	<p>An understanding of the key concerns in relation to newborn transport and an appraisal of difficulties on the ground. Equipment appraisal (including the ambulance) was undertaken. Technical modifications were suggested which were then commissioned for action by the LRH team</p> <p>Discussions with the technical team from Mobitel. Agreement on aims and timelines achieved.</p>
Day 2: Visit to two referring (base) hospitals	<p>Detailed discussion with teams to appraise their current transport system. A training session on pre transfer stabilization of the newborn undertaken</p>
Day 3: Training day	<p>106 doctors and nurses trained in the essential skills related to an integrated newborn transport service during workshop held at LRH.</p>
Day 4: Training – Core team at LRH	<p>8 nurses and 3 doctors trained in basic transport skills. Further discussion with team at LRH. Future directions and objectives discussed.</p>

Current state

Sri Lanka has a comprehensive health care system provided free of charge to all citizens. In addition, some families choose to access private health care although the facilities are generally not as comprehensive as within the government hospitals.

Sri Lanka has 11 government hospitals categorized as ‘teaching’ hospitals, though only Lady Ridgeway Hospital in Colombo provides specialized pediatric surgical and cardiac facilities. In addition, there are provincial, base and district government hospitals in decreasing order of size and complexity of patients cared for. The majority of neonates across the country are cared for mainly in Premature Baby Units (PBUs), which are usually attached to Pediatric Wards. There are approximately 30 units across Sri Lanka which can provide assisted ventilation. However for the majority ventilation care days per year is limited and skill retention is a concern. Surfactant is available for infants over 1000g. .

The majority of high risk neonates are transferred ex-utero. Access to ‘step up care’ is restricted by the lack of a neonatal transport infrastructure, equipment or trained personnel to undertake the transfer. Capacity within the neonatal intensive care centers is often a limiting factor as repatriation of convalescing infants back to their local hospitals is also restricted.

In the current model, the referring team undertakes the transfer once they have identified a cot, which might involve phoning a number of units. As access to appropriate ambulances or neonatal transport equipment is restricted, despite the best endeavors of the team, the infants are frequently hypothermic, hypoglycemic and hypoxic on arrival at the receiving hospital with detrimental consequences to long term outcome. Safety in transport is also a concern as the team and ambulance will often travel at speed to get to the receiving hospital as quickly as possible, with no restraints, seat belts and not uncommonly the team standing up in the back of the ambulance hand bagging the infant for the entire duration of the journey.

The Perinatal Society is working towards developing a 'Network' model which would enable sicker infants to be transferred into facilities providing higher levels of care as required. The members recognize that key to the success of this project will be an integral transport service and outreach education programme. Their vision is that this will optimise stabilization in the referring institution, quality of care and safety in transfer as well as creating an opportunity to repatriate infants back to their local units when appropriate to free up capacity in the lead units. They suggested that a pilot project should be undertaken out of Lady Ridgeway Hospital with the potential 'roll out' across other lead centres once proof of concept had been endorsed.

Data Capture

The team undertook a review of admissions to Lady Ridgeway hospital in 2012. Detailed data was not available for the month of December 2012. Overall, 402 infants were admitted to the NICU in 2012 and data for 378 admissions (Jan to Nov) were analyzed. Infants were admitted from other government hospitals (53%), transferred from other departments (26%), outpatient departments (15%) and other private institutions (10%).

1. 38% of infants were between 28 and 34 weeks gestation at birth.
2. 40% of infants were 1500g or below at birth. 95% of infants were 2.5 kg or lower at birth suggesting that a significant proportion were small for gestational age (by UK standards).
3. Data on admission refusals is recorded but was not available to the team at the time of analysis although reported to be high.
4. 42% of infants were transported to the LRH in an 'incubator'.
5. Temperature on admission was available in 272 infants. 48% of infants were $<37^{\circ}\text{C}$ on admission. It was not possible to ascertain which infants had temperatures in the hypothermic range ($<36^{\circ}\text{C}$) but discussion with team members suggested that a significant proportion of these infants were significantly hypothermic.

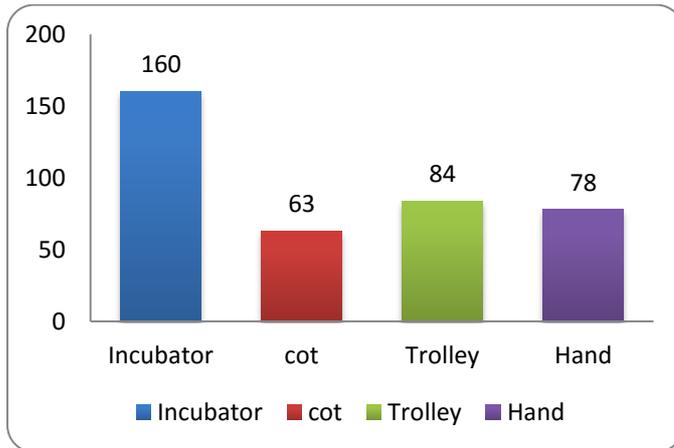


Figure 1 Method of transport.

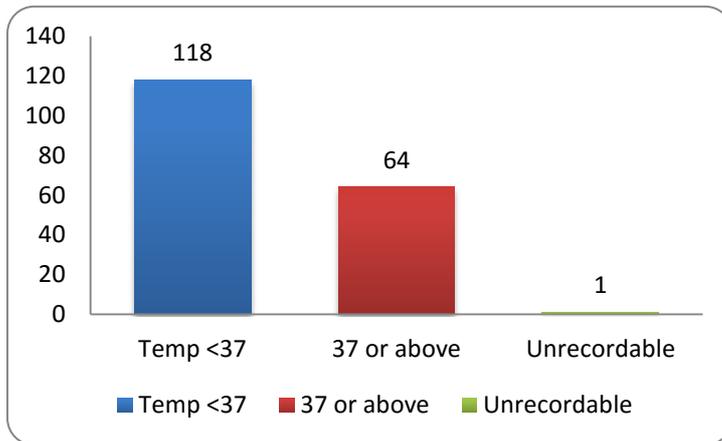


Figure 2 Admission Temperatures

Key issues identified at LRH

- 1. Capacity:** LRH has 5 ventilated cots. It is therefore much more common for the LRH team to refuse rather than accept referrals. There is no regional stratification or a triage system of referral pathways. This leads to an inefficient use of cot space with the region and nationally. Patients are referred to the LRH from all round the country.
- 2. Transport ventilator:** There was no transport ventilator used (nationally) and all infants were hand ventilated which increases the risk of uneven and variable ventilation. In addition, hand ventilation would essentially entail the keeping of the transport incubator door open which would

almost certainly lead to hypothermia over a period of time as well as placing the team at considerable risk.

3. There was a linked issue related to the lack of a facility/mechanism to back transfer infants to their referring units. Staff at LRH identified an issue with significant parental distress and psychological problems arising from prolonged separation from their families as a result of mothers spending a protracted period of time in Colombo for their convalescing infant despite their being cot space in units at or closer to home.
4. Hypothermia: This is key concern identified both by the team at LRH and the base hospitals visited. Discussions suggest that other teaching hospitals face a similar issue.
5. Safety of transfers is also a concern: There was a need for instituting safety measures for transfers. No processes to ensure that the stretchers are secured within the ambulance, the incubator secured to the stretcher, the infant secured within the incubator or seat belts for the team. In addition, vehicle frequently travel at undue haste due to the perceived urgency of the transfer.

Blueprint for action

The following paragraphs explore key issues identified by the team and a plan of action is discussed.

Hardware

1. The transport incubator in its current state could not be secured to the ambulance. A modification to the securing clamps was undertaken following instructions by the team, which meant that the incubator could be securely fixed to a stretcher, which, in turn, could be secured and immobilized to the ambulance wall. The transport incubator could be flexibly removed from the stretcher surface to allow easy manual transport into buildings where lifts were not available.
2. Discussions took place to ensure that the monitor could also be secured to the stretcher.

3. The hospital management and secretary of health supported the project by actioning the acquisition of two transport ventilators.
4. Representatives from Ceylon Oxygen agreed to fund one of these ventilators. The equipment does not need battery power to run and has a reliable track record in the field. In addition the company also promised the supply of size specific air cylinders.
5. Once these ventilators are acquired, they would have to be fixed onto the stretcher. Discussions were held with the technical team who understand the location and fixing of the ventilator on the stretcher.

Training

A core team of 8 nurses and 4 doctors were trained in small groups on all elements relating to safe newborn transfers. Preterm manikins were used to demonstrate and train via simulation.

Documents that are used for transferring newborns in the UK were copied and handed over to the LRH team. A separate set of documents was tasked to 4 teams created from the group of doctors and nurses trained.

Development of the mobile transport tablet

It was decided that the team at Oxford would work with Mobitel to develop an Electronic Patient Recording System for Neonatal Transport. The broad specifications for this system are discussed below.

The Device

1. This is to be a tablet-based system with a keyboard to make data entry easy. A pen entry or touch screen entry system would be present for an alternative interface. All data to be entered in English- although training tools may be available in Sinhala.
2. It would be desirable that battery power lasts for 6 to 8 hours on a full charge
3. Device to be encased in protective coverings (rubber based encased – for example) to tolerate falls and have grip-friendly edges.

4. Wi-Fi enabled printing of transfer documents related to a patient episode.
An ultraportable device linked printer may help generating a paper print for patient records in the peripheral hospital.

Software

1. Data to be stored on a remote server with provision for different levels of access to team members. Data to be protected using industry standard security details.
2. Access to data entry and review to be via passwords or touch key data card systems.
3. Following data capture – information to be stored live on the Mobitel server. Provision to review a limited number of patient journey episodes.
4. In case of a device being lost – provision for remote wiping of device-stored data.
5. In the rare case of unexpected device failure – enabling of retrospective entry of data using paper records.

Electronic Patient Journey

There are 4 types of events/data episodes that would need to be captured for a journey

1. Baseline Document
 - a. Demographics
 - b. Transport Call times etc.
 - c. Clinical Details.
2. Repatriation
 - a. Pre journey check list for equipment and a record of clinical condition of patient before journey
 - b. Record of condition at handover – documentation shared at handover
3. Clinical record of transfer – including nursing and medical observations.
4. Retrieval
 - a. Pre journey check list – equipment and record of clinical condition of patient at referring site.

- b. Clinical condition on arrival
- c. Interventions at site if any
- d. Departure checklist

Time lines

Action	Time	Responsibility	Item essential or desirable before 1 st transfer by team	Comments
Equipment				
Securing of the monitor to stretcher	End May 2013		Essential	
Installation of the transport ventilator	Unclear - suggested 1 July 2013	LRH team	Desirable	
Installation of a battery in the ambulance. The LRH team would have to explore how the ambulance battery system could be used to charge the battery (via the cigarette lighter connection. If charging the battery at the back of the ambulance were not feasible, then ambulance battery would have to be intermittently charged by removing it.	15 June 2013	LRH team	Desirable	The Oxford team has explored this option and has been assured that the line from the cigarette lighter could be safely extended to the patient area of the ambulance to charge a battery. Desirable before first transfer is

				undertaken
<p>Loading and unloading of the transport system. At present the stretcher would be manually uploaded and unloaded from the ambulance. The ambulance driver and assistant would have to practice a safe routine for this process to occur</p>	15 June 2013	LRH team	Essential	
The team				
<p>A team (LRH Transport Team – LRHTT) of nurses and doctors would be created and will be formally recognized</p>	1 June 2013	LRH team in association with the Family Health Bureau	Essential	
<p>A nursing team leader would be identified</p>	15 June 2013	LRH Team	Essential	
<p>LRHTT would work towards a flatter structure of command and execution. Nurses would form the core of the team and an environment fostering empowerment of individual team members would be encouraged.</p>	Ongoing developmental process	All team members		
<p>Finalizing documentation – four teams were created and tasked to report back with documentation to the transport team</p>	15 June 2013 for finalizing the 4 patient journey episodes	LRH Team	Essential	
<p>Documentation to be shared with Oxford team to begin the process of incorporating this information with the software team at Mobitel.</p>	1 July 2013	LRH team	Desirable	
<p>Creation of a Standards Operating Procedure Booklet incorporating sections on equipment, policies and procedures and appendices holding relevant documentation.</p>	1 October 2013	LRH team and Oxford Team		

First version of the tablet device to be trialed in field	1 January 2013	LRH team and Oxford Team		
Undertaking transfers				
Initially, the team would do non-ventilated back transfers to referring units. These infants would have remained at LRH thereby blocking the admission of sicker infants.	Proposed first transfer by 1 July 2013			
During this period, documentation relating to transfers would be discussed, put to a panel of stakeholders and refined.	Ongoing process			
Following a period where confidence in using the new equipment configuration and was built, ventilated transfers would be undertaken.	Ongoing process			
Data from patient transfers will be discussed at the monthly unit team meetings where transport will be a standing item.	Ongoing process			
Supporting roll out				
Two neonatal transport nurses to make a return visit to Sri Lanka in Autumn 2013 to support roll out of project subject to availability of funding streams	Autumn 2013	LRH and Oxford Team		

Risks

The following risks were identified:

1. Difficulties in releasing nurses to create a core team of nurses and doctors who are able to undertake transfers without creating a critical shortfall of workers on the neonatal unit.
2. Non-availability of equipment such as transport ventilators.
3. Overall waning of enthusiasm over a period of time due to personnel and/or equipment issues or unforeseen policy changes

Measuring outcomes

It was decided that the following performance indicators would be used

1. Incidence of hypothermia reduced to less than 25% of admissions over a period of 6 months for all transfers undertaken by the LRHTT.
2. Log of patient days in hospital for all infants transferred back to their local units to recorded 'time saved' in tertiary centre
3. Ongoing log of the number of admissions refused to estimate future modeling requirement for NICU capacity.
4. A narrative of experiences gained during the pilot project will be captured and used for further discussion and planning.
5. A prototype of the electronic device would be created.
6. Data will be presented at the 2014 Annual Perinatal Congress in Sri Lanka

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7. Dr. Ramya De Silva. President of the Perinatal Society of Sri Lanka

