

**NEO FOR
NAMIBIA**
HELPING BABIES
SURVIVE



AUTHORS

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Lucerne, 21.04.2020

MISSION REPORT

Mission 2019 – 3

November 16, 2019 – December 18, 2019

NEO FOR NAMIBIA
HELPING BABIES SURVIVE

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1. INTRODUCTION

The 9th mission of NEO FOR NAMIBIA – Helping Babies Survive lasted from November 16 to December 17, 2019. Again, unpredictable last minute “turbulences” required some flexibility. The Air Namibia flight from Frankfurt to Windhoek was cancelled following a runway incident (the Air Namibia plane touched a Korean Airways plane while taxiing, ripping off the plane’s left winglet) at Frankfurt Airport. Following an overnight stay at a Frankfurt Airport Hotel, we were able to catch the Air Namibia flight the next day, arriving in Windhoek on Monday, November 18, 2019.

Following a short and memorable trip to the Skeleton Coast (Fig. 1–4), we arrived in Rundu on November 24, 2019. Once again, it felt like coming home!

Fig. 1. Driving up north along the South Atlantic Ocean.



Fig. 2. Amazing landscape in the Skeleton Coast National Park.



Fig. 3. Skeleton Coast:
pictures from another world.



Fig. 4. Ever changing scenery
at the Skeleton Coast.



2. MAIN MISSION GOALS

This time, the main mission goals were:

1. To document the quality of care at Rundu State Hospital by updating statistical data from the Prem Unit
2. To introduce a new CPAP device (MTTS Dolphin®) at Rundu State Hospital
3. To work hand-in-hand with the local health care professionals at Rundu State Hospital
4. To train the visiting team from Oandjokwe in the proper use of Bilimeter® 3, a bilirubin POCT (point of care testing) device
5. To train the visiting team from Katima Hospital in basic neonatal care following our on-site visit

3. EQUIPMENT

Thanks to the ongoing support of various sponsors, we were able to donate the following pieces of equipment:



13 Pumani® CPAP devices



1 MTTs Dolphin® CPAP device



24 Masimo® pulse oximeters



10 Wallaby® warming tables



8 Colibri® LED PTx Units



19 LifeKit® infant cot beds

Rundu State Hospital

- 1 MTTs Dolphin® bubble CPAP device
- 1 Bilimeter 3D (newest model) with consumables

Onandjokwe State Hospital

- 1 Bilimeter 3 with consumables (device previously used at Rundu State Hospital)
- 2 Masimo® Rad-8 pulse oximeters (incl. patient cables and sensors)

Katima Hospital

- 2 Pumani® bubble CPAP devices (including consumables)
- 2 Masimo® Rad-8 pulse oximeters (incl. patient cables and sensors)
- 1 Wallaby® open warmer
- 1 Colibri® phototherapy device
- 4 MTTs LifeKit® infant cot beds

Once again, we would like to highlight the fact that the equipment donated by NEO FOR NAMIBIA – Helping Babies Survive (Fig. 5–8) has stood the test of time. Thorough instruction on its use and careful handling are key to guarantee durability. Of course, a steady supply of consumables must be ensured and requires adequate financing.

Overview of donated equipment (consumables not listed)

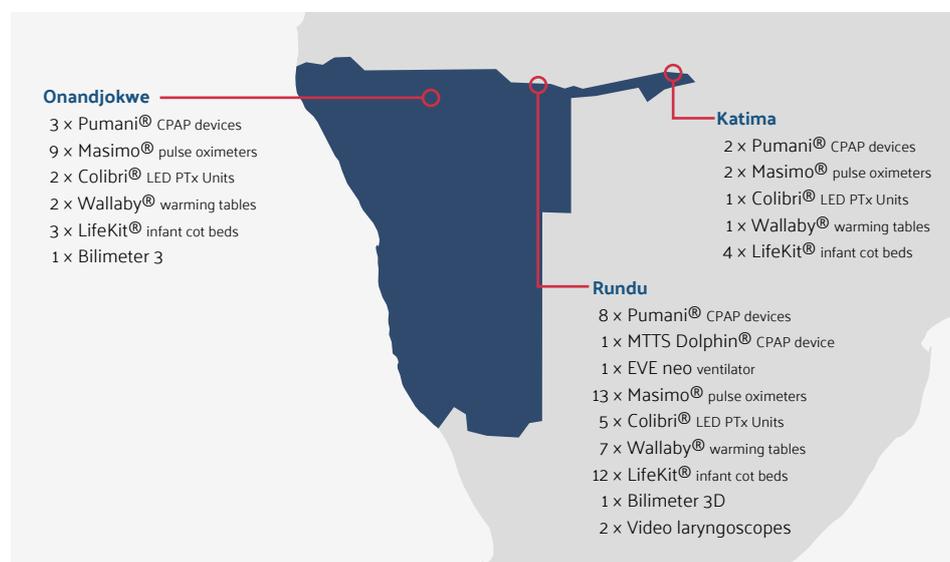


Fig. 5. Overview of donated equipment and hospitals supported by NEO FOR NAMIBIA – Helping Babies Survive (2017–2019).

Fig. 6. Extremely low birth weight infant supported with bubble CPAP: without this type of respiratory support, the mortality rate of such patients would approach 100%.



Fig. 7. Monitoring of sick babies with pulse oximetry has become standard of care.



Fig. 8. Ensuring an uninterrupted supply of consumables (e.g., nasal cannulas, taping material, intravenous catheters, etc.) is of utmost importance.



4. TRAINING

4.1 Visit by team from Onandjokwe

As requested, a team from Onandjokwe visited during our stay in Rundu to participate in daily routines and to get instructions for the use of a bedside bilirubin measurement device (Bilimeter 3, Pfaff Medical, Germany). Dr. Tshijiba Munyoka, nurse Helena Amukongo and nurse Rosa Maria Ambambi stayed with us for one week (Fig. 9, 10).



Fig. 9. Teaching rounds with Dr. Mapanga, Dr. Ashipala and the visiting team from Onandjokwe.



Fig. 10. Sabine Berger working at the bedside, allowing for one-to-one teaching of the local nursing staff.

4.2 Visit by team from Katima

Following our first visit to Katima Hospital (see below), we were very happy to welcome a delegation from that hospital (one doctor, five nurses) for training at Rundu State Hospital. Headed by Dr. Xiomara Gonzalez Dodov, the team spent five days with us. We hope that they will be able to implement some of the observed strategies and daily routines, such as proper thermoregulation, obtaining daily weights to calculate and prescribe adequate fluid and nutrition therapy, as well as monitoring oxygen saturations of babies who require respiratory support. We plan to return to Katima on our next mission to assess any progress made.

4.3 Mechanical ventilation – additional training

Invasive mechanical ventilation of neonates was introduced at Rundu State Hospital in July 2019. According to the local staff, the EVE neo ventilator has proven to be life-saving on a number of occasions. Unfortunately, prospective statistical data has not been collected; therefore, we do not know how many patients have been treated and how many of them have survived. Lack of data or poor data quality are ongoing issues that need to be addressed in 2020 (see below).

During several refresher training sessions (Fig. 11, 12), we were pleased to note that most nurses and doctors are quite familiar with the machine. Of course, many significant challenges remain. Lack of premedication for intubation and the fact that no blood gas

analyses can be obtained are two of the major issues for which there will be no easy solution.



Fig. 11. Dr. Ashipala, Dr. Mapanga and Dr. Banza (front to back) attentively follow the EVE neo ventilator refresher training.



Fig. 12. Prof. Berger explains one of the Prem Unit nurses how to change the settings on the EVE neo ventilator.

4.4 MTTs Dolphin® bubble CPAP device

Based on our own observations and as requested by the local health care professionals at Rundu State Hospital, we planned to introduce a new CPAP device that uses heated and humidified gas. We have documented that the Pumani® bubble CPAP device has greatly improved survival chances of infants with respiratory distress. The device is robust and reliable.

However, the machine has two major flaws. First, the inspiratory gas mixture is neither heated nor humidified, and normal saline drops must be instilled into the nostrils hourly to provide some humidification. Nasal obstruction due to dried secretions does still occur, particularly during prolonged CPAP runs (i.e., several days). Second, the Hudson-type prongs used as the patient interface interfere with patient positioning; for example, prone positioning is not possible.

A more expensive device, the MTTs Dolphin® bubble CPAP machine could be an attractive alternative to treat the smaller patients who tend to have prolonged CPAP requirements. We therefore purchased one machine to test it at Rundu State Hospital. It was a pleasure to train the local colleagues (Fig. 13, 14): given their prior experience with CPAP, they very rapidly learned how to use the new device, and before long, the first patient was treated with the new machine (Fig. 15).

Fig. 13. Prof. Thomas M. Berger and Dr. Kundai Mapanga studying the setup of the new MTTs Dolphin® bubble CPAP machine.



Fig. 14. Nurses of the Prem Unit listen to the description of the features of the new MTTs Dolphin® bubble CPAP machine.



Fig. 15. Sabine Berger soothing the first MTTs Dolphin® bubble CPAP patient at Rundu State Hospital.



5. IMPACT ANALYSIS – UPDATE

5.1 CPAP registry data

By mid-December 2019, 377 patients had been treated with the Pumani® bubble CPAP device (Rundu State Hospital: 284, Onandjokwe State Hospital: 93), totaling 1294 CPAP days. The median duration of CPAP support is short (2 days) with a range of 1–20 days. The survival rate for all treated patients was 78%, now exceeding the published survival rate from the initial study in Malawi (71%) (Fig. 16).

CPAP registry data – August 2017 to December 2019



Pumani® CPAP device

Fig. 16. CPAP registry data: growing experience and increasing success rates.

Total number of patients recorded	377
Median birth weight, g (range)	1790 (600–4700)
CPAP days (median, range)	1294 (2, 1–20)
Survival rate	78% (n=295)

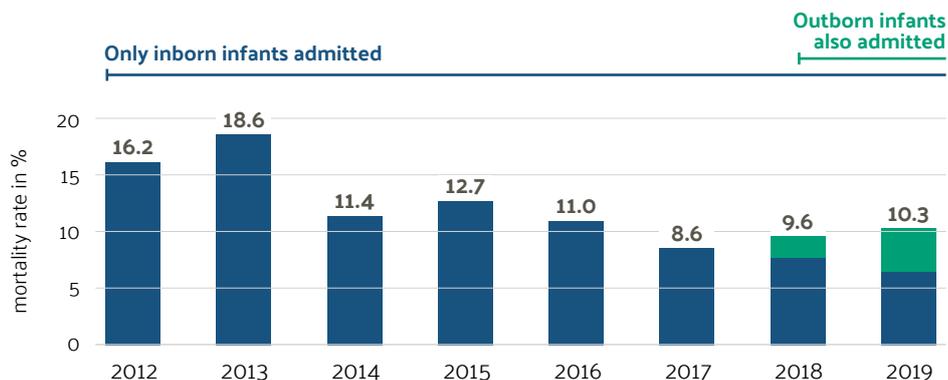
The survival rate was 76% (213/284) and 87% (82/93) at Rundu State Hospital and Onandjokwe State Hospital, respectively. A likely explanation for the observed difference in survival rates between the two hospitals is the fact that patients who fail CPAP support can be treated with invasive mechanical ventilation in Onandjokwe; this option has only become available in Rundu in July 2019.

It is interesting to note that from January 1, 2019 to November 30, 2019, 28.5% of all patients admitted to the Prem Unit at Rundu State Hospital were treated with bubble CPAP. Obviously, this form of respiratory support has become a routine intervention, and a “use CPAP early” approach has been adopted. During the same time period, 51% of all infants, who ultimately died, had at some point been supported with CPAP. Without a more detailed analysis of all deaths, it is impossible to know how many patients had died of respiratory failure despite the use of CPAP, and how many had died of other causes.

5.2 Prem Unit statistics – Rundu State Hospital

We have shown in previous mission reports that the mortality rate of babies admitted to the Prem Unit had decreased from 16.2% and 18.6% in 2012 and 2013 to 8.6% and 9.6% in 2017 and 2018. From January 1 to November 30, 2019, there were 61 deaths among 590 admissions (mortality rate 10.3%) (Fig. 17).

Fig. 17. Mortality rates of infants admitted to the Prem Unit at Rundu State Hospital from 2012 – 2019 (note: since September 2018 outborn infants have also been admitted to the Prem Unit).

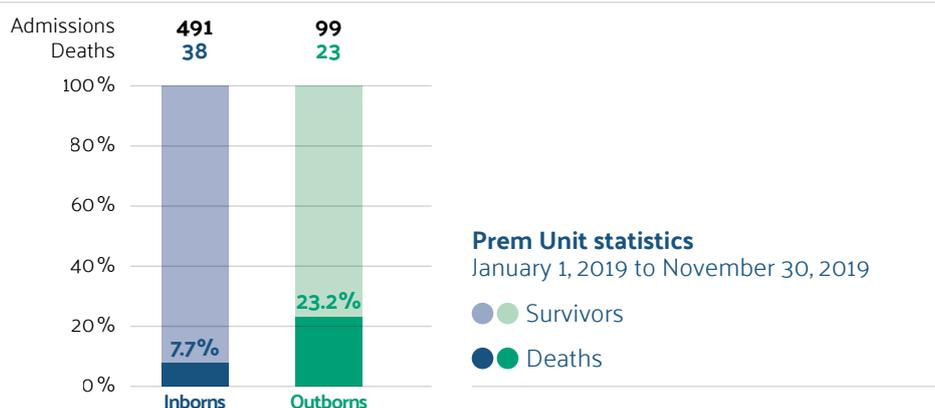


The observed moderate increase in mortality rates from the lowest value of 8.6% in 2017 to 10.3% in 2019 can largely be explained by a change in the admission policy in September 2018: outborn infants were no longer admitted to the High Care Unit or the Pediatric Ward but to the Prem Unit. These infants constitute a high-risk population (see below).

Therefore, Prem Unit admission book data from January 1 to November 30, 2019 was reviewed in more detail by analyzing admissions and deaths of inborn and outborn infants separately. During the 11-month-period, 83.2% of all admissions were inborn (491) and 16.8% were outborn (99). The mortality rate of inborn infants was 7.7% (38/491), much lower than the mortality rate of 23.2% (23/99) among outborn infants (Fig. 18).

Two important conclusions can be drawn from this analysis. First, improved mortality rates of inborn infants have been sustained at around 8% for the years 2017–2019, down from an average of 14% for the years 2012–2016; these improvements coincide with the introduction of various interventions by NEO FOR NAMIBIA – Helping Babies Survive. Second, mortality rates of outborn infants are three times higher (23.2% versus 7.7%) than those of inborn infants. To improve the prognosis for outborn infants will require interventions at the regional level (see below).

Fig. 18. Prem Unit statistics January 1, 2019 to November 30, 2019: improved mortality rates of inborn infants have been sustained; in contrast, mortality rates of outborn infants are very high.



5.3 On-line registries

The statement made in the Mission Report 2019-2 is still valid: “...more reliable statistical data must be collected to better understand the scope of the various challenges. Deaths should be analyzed in more detail so that potential strategies can be developed to prevent at least some of these deaths.”

The implementation of an on-line registry has thus far failed for various reasons (e.g., hiring staff for data entry, clarification of legal and ethical concerns). This is an important issue that needs to be addressed in the near future.

6. FIRST VISIT TO KATIMA HOSPITAL

After a two-day trip (staying overnight at the Mobola Lodge near Divundu), we arrived in Katima Mulilo. This town is situated in the Caprivi strip and is the capital of the Zambezi Region, Namibia's far northeast extension into central Southern Africa.

6.1 Meeting the hospital leadership

At the hospital, we were warmly welcomed by Mrs. Agnes Mwilima, the Zambezi Regional Health Director, and Dr. Noel Siame, the Chief Medical Officer. We learned that Katima Regional Hospital serves a population of 100'000 people. Apart from the hospital, there are 3 health centers where only vaginal deliveries are possible. At Katima Hospital, there are 8 medical doctors, but only one of them (Dr. Xiomara Gonzalez Dodov, a Cuban doctor) is a pediatrician. There are about 300 deliveries per month, and the Cesarean section rate is 10%. We then were guided through the hospital's facilities.

6.2 Baseline observations

The Neonatal Ward is nested within the labor & delivery ward but lacks most of the equipment that would be needed to care for sick babies. There are several types of incubators (used without humidification), no open units and only a few cot beds (Fig. 19). The two pulse oximeters are only equipped with reusable adult sensors. Oxygen is administered via face mask from wall oxygen sources (Fig. 20). Babies are not positioned well. Nasogastric tubes are used as umbilical venous catheters. Daily progress notes are largely absent, and orders are rudimentary. In total, as many as 12 neonates can be cared for in this room. Usually, there is 1 nurse per shift to look after them.



Fig. 19. The Neonatal Unit at Katima Hospital.

Fig. 20. Currently, the level of neonatal care available at Katima Hospital is very low: respiratory support with unblended face mask oxygen without monitoring.



It rapidly became obvious that the current level of neonatal care was very low. Babies are probably kept warm (in various types of incubators), and they are breastfed if they are strong enough (Fig. 21) or receive expressed breast milk by cup or through a nasogastric tube. Everything else seemed to be missing:

- Scissors to cut tape
- Nasal cannulas to administer oxygen
- Pulse oximeters (no neonatal sensors)
- Umbilical venous catheters
- IV sets to use the IV pumps
- Functioning phototherapy units
- Human milk fortifier
- Caffeine

Fig. 21. A term infant recovering from neonatal infection is breastfeeding well.



In summary, this is comparable to the situation at Rundu State Hospital in 2015, or likely worse because there is only 1 pediatrician.

6.3 Neonatal Unit statistics

The following statistical data could be extracted from the admission book. From December 1, 2018 to November 30, 2019, there had been 219 admissions to the Neonatal Unit. Of these, 73 infants died, resulting in a staggering mortality rate of 33%. For comparison, this is three times the mortality rate of patients admitted to the Prem Unit at Rundu State Hospital over the same time period (Fig. 22). Not unexpectedly, complications of prematurity (21%), neonatal sepsis or pneumonia (11%) and perinatal asphyxia (8%) appeared to have been the leading causes of death.

Mortality rates

● **Katima Hospital**
73 deaths among 219 admissions

● **Rundu State Hospital**
77 deaths among 661 admissions

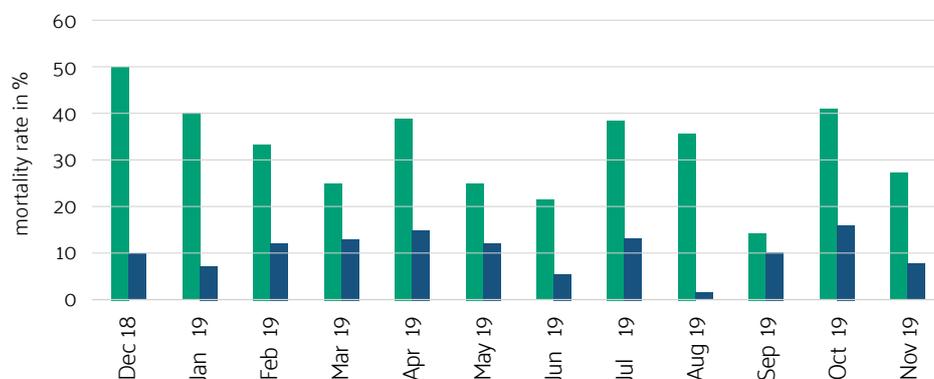


Fig. 22. Monthly mortality rates (December 1, 2018 to November 30, 2019): Neonatal Unit at Katima Hospital and, for comparison, Prem Unit at Rundu State Hospital.

6.4 New equipment

Given the unit's current situation, the new equipment was more than welcome. Together with the local nurses, we first cleaned the ward and disposed of broken or otherwise useless equipment (Fig. 23). We then assembled the new equipment and designated appropriate spaces in the unit (Fig. 24).



Fig. 23. While cleaning the unit, broken pieces of equipment and unused resuscitation manikins, for which no instruction had ever been provided, appeared.



Fig. 24. The new equipment (open warmer, bubble CPAP device) is ready for the first patients.

6.5 Teaching sessions

As best as we could, we instructed as many nurses as possible in the use of the Wallaby® open warmer, the Colibri® phototherapy unit, the Pumani® bubble CPAP machine and the Masimo® Rad-8 pulse oximeters.

As outlined above (section 4.2), a team headed by the Cuban pediatrician, Dr. Xiomara Gonzalez Dodov, visited the Prem Unit at Rundu State Hospital to get additional training.

6.6 Next steps

We plan to visit Katima Hospital again during our next mission. In the meantime, we will receive monthly updates on admission numbers and mortality rates, as well as details of patients treated with CPAP.

7. ONGOING AND NEW CHALLENGES

While significant progress has been achieved at Rundu State Hospital over the last two years, some challenges have persisted and must be addressed. As outlined in previous Mission Reports, unreliable supply chains (the term “out of stock” is still commonly used in this context and mostly accepted as a definitive answer), nosocomial infections, lack of parenteral nutrition for the smallest patients with resulting postnatal growth failure, unsatisfactory communication between nurses, midwives and physicians from the Department of Obstetrics and Gynecology and the Department of Pediatrics, and staff shortages remain serious concerns.

Once again, we attempted to address the unsatisfactory performance of the laboratory services of the Namibia Institute of Pathology (NIP). We met with Mrs. Regina from NIP and had a fruitful conversation. It was agreed that if blood samples arrive in the laboratory before 06:00 o'clock, results will be made available by 09:00 o'clock. This would greatly facilitate decision making on rounds and reduce the risk that results are overlooked. It was agreed that a letter of understanding will be drafted and signed by January 31, 2020. Even the possibility of getting access to lab results via computer was discussed and considered feasible. We asked Dr. Chibwe to discuss this possibility with the hospital's IT.

In addition, it is unfortunate that, although some additional work has been done in the new Labor & Delivery, Maternity and Neonatology Units, it is still not clear when they will be opened.

8. A TRIBUTE TO THE NURSES AND MOTHERS OF THE PREM UNIT

Fig. 25. The nurses in the Prem Unit at Rundu State Hospital have become very reliable and skillful partners of NEO FOR NAMIBIA- Helping Babies Survive.

We would like to take a moment to thank all the nurses of the Prem Unit at the Rundu State Hospital for their amazing work. To see how they have been able to advance the care for the sick newborn infants admitted to their unit is extremely gratifying (Fig. 25, 26). We realize that they are chronically understaffed, and yet they keep up their positive attitude and do their level best. NEO FOR NAMIBIA – Helping Babies Survive is fortunate to have come across such a wonderful team. Thank you!



Fig. 26. Nurses from the Prem Unit proudly show the laminated reminders that have helped to improve neonatal care and to support a uniform approach (unité de doctrine).



Fig. 27. Mothers are taught different techniques to feed their babies (gravity feeding through an NG tube, syringe feeding, cup feeding).

Mothers also play a vital role in the care of the babies admitted to the Prem Unit. They have to follow the instructions of the nurses and are responsible to feed their babies around the clock (Fig. 27 – 29). We try to support them as best as we can by bringing food and beverages on an almost daily basis. We admire their stoic calm and love to see their smiles when they realize that their babies are improving (Fig. 30).



Fig. 28. A mother carefully checks the amount of milk she is going to give to her baby.



Fig. 29. Mothers clean the utensils used for feeding their infants.



Fig. 30. Smiling doctors, nurses and mothers in front of the Prem Unit.



9. SPECIAL PATIENTS

9.1 Neuromuscular disorder

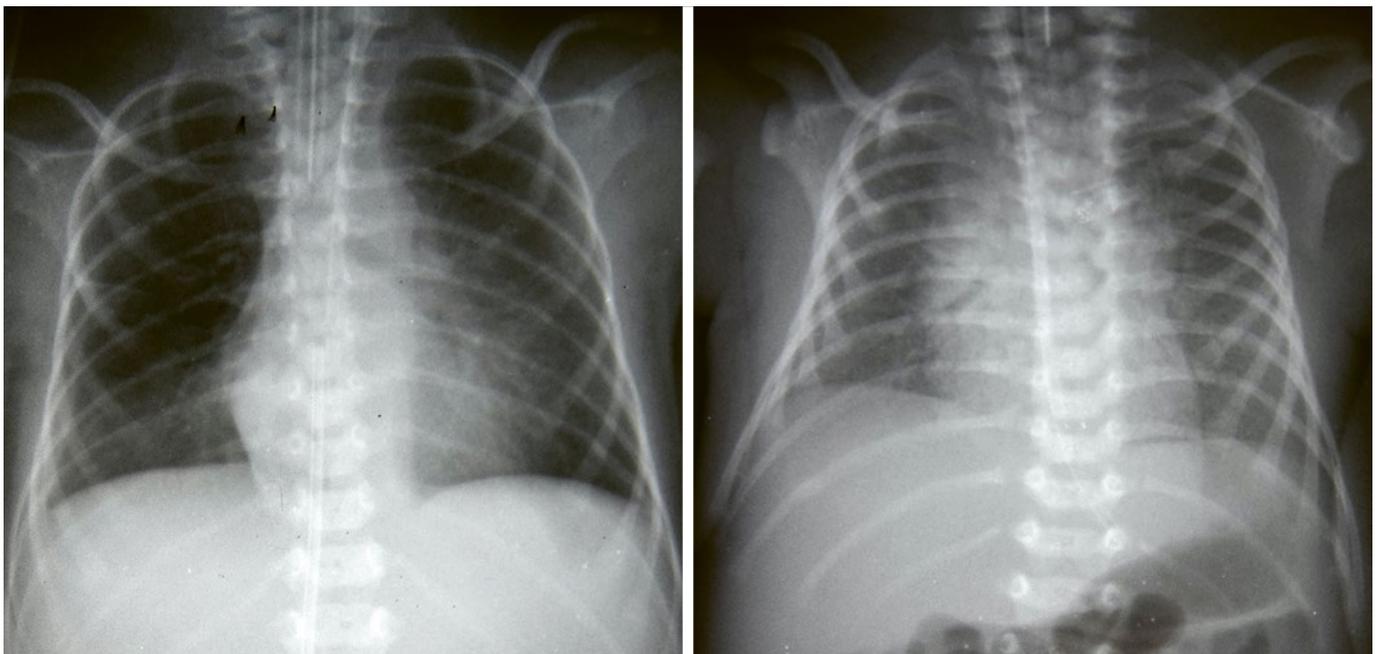
Returning from Katima, we encountered a male near-term infant (birth weight 1800g) on invasive mechanical ventilation (Fig. 31). He had been intubated on day of life 2 after failing CPAP support. A preliminary diagnosis of hypoxic-ischemic encephalopathy stage II-III had been made based on poor muscle tone and poor respiratory effort. On day of life three, he had failed an extubation attempt and had been reintubated.

Fig. 31. Infant with suspected neuromuscular disease on invasive mechanical ventilation.



Fig. 32. Chest X-ray of infant with suspected neuromuscular disease (left): note the very thin ribs; for comparison, chest X-ray of an infant with normal ribs (right).

The infant was on moderate ventilator settings with adequate tidal volumes and an FiO_2 of 60%. He seemed to be awake with open eyes, but there were hardly any spontaneous movements with only a weak respiratory effort. On review of the chest X-rays, we noted very thin ribs (Fig. 32).



Given the infant's poor muscle tone, combined with the fact that there was a history of polyhydramnios, we suspected a congenital (neuro)muscular disorder. With the help of an interpreter, Prof. Berger asked the mother about her other 6 children (all healthy), the circumstances of two additional abortions and the current pregnancy. Interestingly, she confirmed that this baby had never moved much in utero.

Three days later, the infant desaturated on the ventilator and poor chest movement was noted. The doctor on call was advised over the phone to exclude a blocked endotracheal tube. When suctioning did not improve the situation, the baby was extubated and put on CPAP. Given a likely grim prognosis, a decision was made not to reintubate the patient; he died a few hours later. A postmortem muscle biopsy was obtained and sent to Windhoek for examination.

9.2 Home delivery

This infant had been born at home. During labor and delivery, the mother had reportedly been alone without any assistance. According to the available information, the grandmother arrived only after the baby had been born; she cut the cord and delivered the placenta.

On admission, very peculiar lesions were noted (Fig. 33): two holes in the anterior neck region, surrounded by bruised skin (ecchymoses). A tracheal injury was excluded by instillation of sterile normal saline into the two holes to see if there was any bubbling. The wounds were thoroughly cleaned but not sutured, and the infant was treated with antibiotics. There was an uneventful recovery, and the baby was discharged home 10 days later. Although we were convinced that these lesions were traumatic in origin, the family always denied using any instruments or force.

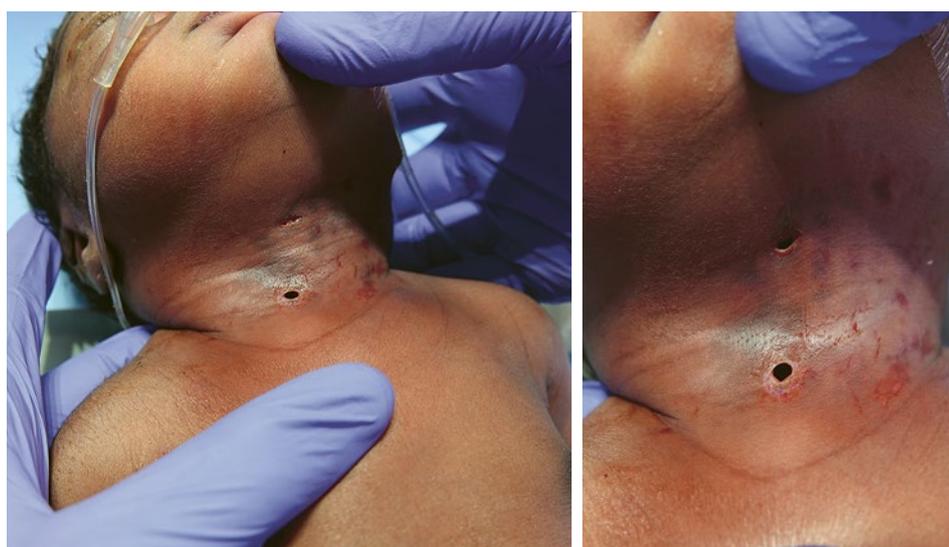


Fig. 33. Unexplained traumatic neck lesions in a term infant after unattended home delivery.

9.3 Traditional medicine intoxication

This term infant had been born in Andara and was discharged home on day of life three. She was readmitted on day of life seven with seizures and marked opisthotonos. Antibiotics were started for a preliminary diagnosis of neonatal sepsis with meningitis, and she was transferred to Rundu.

Her admission weight was 2400g, 600g below her birth weight of 3000g (weight loss of 20%). Laboratory results were remarkable for a negative CRP (0.3 mg/l), a sodium of 190 mmol/l, a potassium of 6.9 mmol/l, a blood glucose level > 20 mmol/l, and a creatinine of 690 μ mol/l. A diagnosis of severe hypernatremic dehydration was made. Upon further questioning the mother confirmed that the baby had received traditional medicine.

The patient was noted to be anuric. Suspected seizures were treated with phenytoin, the only available antiepileptic drug available at the time. Slow correction of the serum sodium concentration was achieved, and her neurological status improved (Fig. 34).



Fig. 34. Suspected traditional medicine intoxication: on admission with opisthotonos (left); after rehydration and correction of extreme hypernatremia (right). Note purple ribbons (neck, wrist, abdomen) often used by traditional healers.

There is only scant literature on traditional medicine intoxication, but it can lead to renal and hepatic failure.

9.4 Nicoteh

Once again, we met Nicoteh, a former 1150 g preterm infant, and her mother Elotelia Hamutenya. The two were accompanied by Nicoteh's grandmother who came to thank us for saving her grandchild's life (Fig. 35, 36). Nicoteh is obviously doing very well, and her mother is determined to go to nursing school. She would be interested to work for us and become involved in data collection at Rundu State Hospital.



Fig. 35. Meeting a former patient of ours (Nicoteh, ex-1150 g preterm infant): always wonderful to see such results.



Fig. 36. Three generations: Nicoteh, her mom Elotelia and her grandmother.

10. FUTURE DIRECTIONS

10.1 Mission 2020 – 1

We planned to return to Namibia in April 2020. However, because of travel restrictions due to the Coronavirus pandemic, our 10th mission had to be postponed. We will reschedule as soon as possible. Additional equipment ordered from VIA Global Health will still be delivered as planned.

On our next mission, we will spend most of our time at Rundu State Hospital, but we plan to also return to Katima to continue to support efforts to improve neonatal care at this hospital. If adequate staffing can be provided, we are confident that the care of neonates admitted to the Neonatology Unit can be significantly improved within 1–2 years.

We also plan to emphasize the importance of regular resuscitation training at referring hospitals and clinics, as well as establishing guidelines to ensure adequate triage of high-risk pregnancies and timely identification and referral of sick babies.

10.2 Namibian Minimal Neonatal Data Set (NMNDS), CPAP and MV patient registries

Thus far, we have not been successful to establish on-line patient registries. However, we will continue our efforts to record, collect and analyze more comprehensive patient data (including specific diagnoses, as well as causes and circumstances of deaths). We will have to clarify legal issues and find adequately qualified people to help with data collection.

10.3 Fundraising efforts

Since its foundation in September 2017, NEO FOR NAMIBIA – Helping Babies Survive has raised more than CHF 280'000.00 (approximately NAD 4'200'000.00). Most of this money has been invested directly to support hospitals in the northern region of Namibia. We have good data to prove that our program has been successful in helping babies survive. We would like to thank everybody who has contributed to this success! Obviously, ongoing fundraising efforts will be extremely important so that the program can continue.

Prof. Thomas M. Berger, MD
NEO FOR NAMIBIA
Helping Babies Survive

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