Improvised Neonatal Care–Realizing the Gaps in a Disaster Zone

Joseph Mendlovic, MD, MHA;[1,2] Dov Albukrek, MD, MHA;[1] David Dagan, MD;[1] Ofer Merin, MD;[1,3] Giora Weiser, MD[1,3]

1. Medical Corps, Israel Defense Forces, Tel Hashomer, Israel
2. Ministry of Health, Government of Israel, Jerusalem, Israel
3. Shaare Zedek Medical Center, Jerusalem, Israel

Correspondence:
Giora Weiser, MD
Pediatric Emergency Department
Shaare Zedek Medical Center
12 Shmuel Bait Street
Jerusalem, Israel 93722
E-mail: gioraweiser@gmail.com

Conflicts of interest: The authors have no conflicts of interest or financial disclosure to report.

Keywords: disaster; neonate; pre-term; resuscitation; transfer

Abbreviations:
CPAP: continuous positive airway pressure
IDFFH: Israeli Defense Forces Field Hospital
UV: umbilical vein

Received: March 5, 2015
Revised: July 8, 2015
Accepted: July 18, 2015

Online publication: December 9, 2015

doi:10.1017/S1049023X15005403

Event: Super Typhoon Haiyan (known as "Yolanda" by locals)
Event Onset Date: November 6, 2013
Location of Event: The mainland of Central Philippines
Geographic Coordinates: latitude 11°13m N, longitude 125°1m E; elevation: 3 meters
Response Dates: November 13, 2013-November 27, 2013
Response Type: Medical Relief

Abstract: The treatment of newborns in a disaster zone can be extremely challenging. The effects of the disaster combine with local health care disparity to give these neonates little chance of survival in the event of even minor complications. Rescue teams arriving at such locations must be prepared to handle and to aid these difficult situations using improvisation and ingenuity to overcome many of the unexpected hurdles. A discussion of the difficulties faced in the Philippines following a typhoon and recommendations for future teams are presented.

Mendlovic J, Albukrek D, Dagan D, Merin O, Weiser G. Improvised neonatal care–realizing the gaps in a disaster zone. *Prehosp Disaster Med*. 2016;31(1):111-113.

Introduction

On November 6, 2013, super-typhoon "Haiyan" (or as called by locals, "Yolanda") hit the mainland of central Philippines. In its aftermath, over 6,000 were killed, 30,000 were injured, and 1.9 million people remained homeless.[1] The overwhelmed medical system was staffed minimally, and sometimes it was left with damaged basic infrastructure such as running water and electricity. The care given was partial at best.

The Israeli Defense Forces (State of Israel) Field Hospital (IDFFH), invited to help with relief efforts, spread its facilities next to a primary-level district hospital in the city Bogo, on the island of Cebu, and operated in an integrative mode together with the local staff.[1] The IDFFH was based on equipment for treating previous disaster zones (Haiti, Japan, and Turkey).[2] Manpower included overall 148 staff members, of which 64 were medical personnel with 24 physicians, four of whom were pediatricians. The latter were in charge of treating the hundreds of children seeking medical assistance as well as taking care of newborns at the local hospital. During our deployment, we faced several challenges in treating complex cases. In this report, we describe both our improvised solutions as well as our recommendations for future events.

Case Presentations

Case 1

Three days following our arrival, the local delivery team alerted the IDFFH pediatric staff regarding a premature newborn awaiting examination in the delivery room. This newborn male, estimated at 31 weeks gestation (based on maternal information and physical findings), was born four hours earlier, weighing 1,520 grams. On initial exam, the child was cold but vigorous with a good pulse and spontaneous breathing. However, within 30 minutes, quick deterioration led to bradycardia and apnea.

Case 2

A term, small for gestational age baby was born following a cesarean section due to lack of progression. His birth weight was 2,000 grams and he required little assistance following the delivery. Later, the child was found to be lethargic; a finger sugar test showed the baby to be hypoglycemic.

Figure 1. Improvisation Example: A Makeshift Incubator for Transfer of a Neonate.

Improvised Interventions

Airway Management

Although in premature infants there is a trend towards using less invasive ventilation and more continuous positive airway pressure (CPAP) devices, such a device was not available at either the local hospital or within our field hospital. This necessitated endotracheal intubation.

The respirator the IDFFH used was equipped only with adult tubing which caused a much greater than expected dead space. In addition, pressure control ventilation mode was the only available option as the respirator's minimal volume setting was above the premature child's requirement.

Realizing difficulty with his ventilation (higher than normal pressure support values), an assumed diagnosis of Respiratory Distress Syndrome of the newborn led to the administration of surfactant. With no chest film available at the time to aid in evaluating response, the newborn was given two lower than usual doses, 12 hours apart.

Hypoglycemia

The local hospital held glucose at either 5% or 10% concentration. The higher concentration needed was created using a 50% concentrated solution brought by the IDF diluted to 25%.

Vascular Access

Vascular access posed a great difficulty as we did not arrive with standard umbilical vein (UV) or umbilical artery lines. In both cases, expecting high calorie and fluid needs, an eight French naso-gastric tube was inserted, using ear, nose, and throat surgical equipment, as a UV line and sutured to the skin. Positioning of the UV line was based on blood return as no markings on the tube or imaging were available to guide depth.

Fluids

Fluids were given as a 10% dextrose base, as mentioned. In addition, sodium bicarbonate 8.4% (1 meq/ml) was added as a source of sodium.[3]

Figure 2. A Diesel-operated Generator Secured to an Ambulance on a Wooden Crate for Additional Electrical Source.

Laboratory

Laboratory abilities were minimal, and therefore we limited the use of blood gases and electrolytes which were taken infrequently.

Antibiotic Treatment

Antibiotic treatment, with no option for cultures of any sort and wanting to avoid administering gentamicin without knowing the child's kidney functions, was given with Ampicillin and Cefotaxime. A single dose of Vancomycin was given following the UV insertion.

Patient Transfer

Transferring the premature baby in Case 1 presented a significant challenge as the need for immediate transfer was delayed in an attempt to minimize the danger of intraventricular hemorrhage. This also led to avoiding the use of heparin in the fluids given through his UV.[4]

A transfer incubator was prepared by inserting a Styrofoam box into a cardboard box lined with a blanket. The inner surface was at a 30 degree angle for optimal head positioning. Holes were made to insert tubing. A blanket was used as a mattress. Heating pads reacting to water taken from premade meals were used to add heat and humidity.

https://doi.org/10.1017/S1049023X15005403 Published online by Cambridge University Press

Fearing tube dislodgement and difficulties in the event of intubation during transfer, we constructed a bubble CPAP device using a nasal cannula attached to an oxygen source on the one end, with the other end inserted into five centimeters of bottled water, thus creating a positive end expiratory pressure of five cm H_2O[5] (Figure 1).

Transfer time was estimated at three hours, minimum, keeping in mind that the respirator battery held only an hour of activity. The ambulances available did not have electrical output, necessitating an improvisation that was executed by our rescue unit which connected a generator to the back of the ambulance using a makeshift wooden crate (Figure 2).

All these actions and improvisations led to the successful survival of these neonates, although added significant burden on our staff that was already overwhelmed by many patients in need.

Lessons Learned and Possible Recommendations

Arriving at the site of a natural disaster requires resourcefulness and a sense of improvisation. In addition to the impact of the disaster itself, rescue teams may be confronted to minimal abilities available locally. Thus, we were exposed to the wounded and sick resulting not only from the storm, but to the basic medical resources in the region as well.

We realized quickly that our ability to aid the many seeking help would require improvisations. This was especially true with sick neonates for whom we were ill-equipped to handle at intensive care levels.

This situation is not only detrimental to the patient but is very stressful for the rescue team who, at times, is unable to offer help.

Early recognition of the local level of health care, along with identifying available referral facilities, is the key to overcoming some of these difficulties.

Foreign medical teams arriving in disaster area sites should be prepared not only to deal with common disaster injuries, but also should expect confronting other unrelated medical issues. This should be discussed and planned, pre-deployment, while choosing the equipment to be brought along.

Specifically, we recommend the following equipment: umbilical line insertion kits; basic total parenteral feeding formulas; mobile incubator(s); and neonatal CPAP device.

We hope that through our experiences other teams arriving at future disaster zones will be better equipped and prepared to improvise the necessary treatment the local population depends on.

Acknowledgements

We would like to thank the entire staff of the IDFFH, and especially the pediatric nursing staff, who made our work possible. We commend the staff of the Severo Verallo Memorial District Hospital (Bogo City, Philippines) for their tireless work under impossible conditions. We thank the staff at the Vicente Sotto Memorial Hospital in Bogo City, Philippines for their accepting us and the patients we transferred and offering them a chance for life.

References

1. Merin O, Kreiss Y, Lin G, Pras E, Dagan D. Collaboration in response to disaster–Typhoon Yolanda and an integrative model. *N Engl J Med*. 2014;370(13):1183-1184.
2. Farfel A, Assa A, Amir I, et al. Haiti earthquake 2010: a field hospital pediatric perspective. *Eur J Pediatr*. 2011;170(4):519-525.
3. Usher R. Reduction of mortality from respiratory distress syndrome of prematurity with early administration of intravenous glucose and sodium bicarbonate. *Pediatrics*. 1963;32:966-975.
4. McCrea HJ, Ment LR. The diagnosis, management, and postnatal prevention of intraventricular hemorrhage in the preterm neonate. *Clin Perinatol*. 2008;35(4):777-792.
5. Koyamaibole L, Kado J, Quvo JD, Colquhoun S, Duke T. An evaluation of bubble-CPAP in a neonatal unit in a developing country: effective respiratory support that can be applied by nurses. *J Trop Pediatr*. 2006;52(4):249-253.