

## Bedside Laparotomy in the Extremely Low Birth Weight Baby: A Plea to Bring the Surgeon to the Baby

Dan Arbell MD<sup>1</sup>, Eitan Gross MD<sup>1</sup>, Avia Preminger MD<sup>2</sup>, Yaron Naveh MD<sup>2</sup>, Raphael Udassin MD<sup>1</sup> and Ilan Gur MD<sup>2</sup>

<sup>1</sup>Department of Pediatric Surgery, Hadassah-Hebrew Medical Center and <sup>2</sup>Neonatal Intensive Care Unit, Bikur Cholim Medical Center, Jerusalem, Israel

**Key words:** extreme prematurity, bedside laparotomy, bowel perforation

### Abstract

**Background:** Babies born with extreme prematurity and low birth weight (< 1000 g) present a unique treatment challenge. In addition to the complexity of achieving survival, they may require surgical interventions for abdominal emergencies. Usually, these infants are transferred to a referral center for surgical treatment. Since 2000 our approach is bedside abdominal surgery at the referring center.

**Objectives:** To evaluate whether the approach of bedside abdominal surgery at the referring center is safe and perhaps even beneficial for the baby.

**Methods:** We retrospectively reviewed our data since 2000 and included only babies weighing < 1000 g who were ventilated, suffered from hemodynamic instability, and underwent surgery for perforated bowel at the referring neonatal unit. Results were analyzed according to survival from the acute event (> 1 week), survival from the abdominal disease (> 30 days), and survival to discharge.

**Results:** Twelve babies met the inclusion criteria. Median weight at operation was 850 g (range 620–1000 g) and median age at birth was 25 weeks (range 23–27). Eleven infants survived the acute event (91.7%), 9 survived more than 30 days (81.8%), and 5 survived to discharge.

**Conclusions:** Our results show that bedside laparotomy at the referring hospital is safe and feasible. A larger randomized study is indicated to prove the validity of this approach.

*IMAJ 2007;9:851–852*

Improvement in neonatal care has brought with it an abundance of babies who were previously non-survivors. It is not rare today to encounter extremely low birth weight babies who were born weighing less than 1000 grams. Although there are neonatal intensive care units in peripheral hospitals, pediatric surgeons who can care for such babies are usually located in referral hospitals in the center of the country. Therefore, when an ELBW baby has a surgical emergency such as perforated bowel, he or she is transferred to the central hospital for surgical care. The transportation of ELBW babies is hazardous since they are prone to temperature changes and are frequently dependent on sophisticated ventilation modalities [1]. Dislodgement of endotracheal tubes and venous lines may be catastrophic. Also, the timing of the transfer may be delayed depending on available space in the neonatal surgical intensive care units. Moreover, the continuation of care is disrupted, and the new team has to become acquainted

with the complex needs of these babies. So, while surgery in the referral center offers the best surgical conditions for the surgeon and anesthetist, it does not necessarily benefit the patient.

Bedside operations on ELBW babies have become popular, with procedures such as tracheostomy, patent ductus arteriosus ligation, peritoneal drainage and even laparotomy performed routinely in the neonatal unit [1,2]. Usually however, they are performed at the referral center. Our approach in recent years is to bring the surgical team over to the referring neonatal intensive care unit at the referring hospital and to perform the procedures in the unit, thereby avoiding having to transport the baby. We retrospectively gathered the data on these operations to evaluate whether this approach is safe and perhaps even beneficial to the baby.

### Patients and Methods

Data on all babies with clear evidence of bowel perforation at a single peripheral center were accrued retrospectively from 2000 to 2006. Inclusion criteria were weight < 1000 g at surgery, hemodynamic instability and the need for ventilation. Instability was defined as the requirement for inotropic medications and major volume and blood transfusions, with overt signs of sepsis. Perforated bowel was ascertained by a consultant pediatric surgeon preoperatively by evidence of free air on a plain abdominal film or evidence of bowel necrosis. This service was provided by one of five consultant surgeons from a single tertiary center.

The data were analyzed as follows: survival from the acute episode – more than one week following surgery; survival from the abdominal event – more than 30 days following surgery; and survival to discharge, including death from unrelated diseases. Intraventricular hemorrhage, heart disease and other systemic illness did not exclude the babies from the study.

All the operations were performed bedside in the neonatal intensive care unit by a consultant pediatric surgeon with the help of the local operating room staff. The area around the incubator is arranged so as to allow sufficient space for the surgeon and assistant, operating room nurse and anesthesiologist. The provision of adequate overhead lamps or headlight is essential. Anesthesia was provided by a consultant anesthesiologist and a consultant neonatologist from the referring hospital. Following the operation, daily care was provided by the neonatal physicians with daily visits by the surgeon during the first week after the operation. After 1 week the surgeon visited weekly or more frequently if required.

ELBW = extremely low birth weight

## Results

From 2000 onward we identified 12 babies meeting the inclusion criteria. The median weight at operation was 850 g (range 620–1000 g). The median age at birth was 25 weeks (range 23–27). Two babies had a peritoneal drain inserted and the rest had a laparotomy with resection of necrotic bowel with stoma formation. Eleven babies survived the acute episode (91.7%). One child died on day 4 following a laparotomy with resection of a necrotic duodenum. At 30 days there were 9 survivors (81.8%); one baby died from complications of heart disease at day 11 after surgery and the other died from sepsis at day 28. Five children survived to discharge (41.7%); the other four died on days 52–108 after surgery. Three of these deaths were unrelated to the abdominal episode; one was due to liver failure from prolonged total parenteral nutrition.

## Discussion

Neonatal care has improved markedly during the last few decades. As a consequence of this improvement, the neonatal population has changed – with survival of infants born at very early weeks and weighing less than 1000 g. These babies constitute a major treatment challenge since they are more prone to suffer from severe diseases such as intraventricular hemorrhage, respiratory insufficiency and necrotizing enterocolitis. As these babies are very small and without adequate reserves, minor changes such as temperature, location of endotracheal tube, and placement of venous lines may be critical. The survival of these infants is low with 11% survival for those born at 23 weeks, 26% for those born at 24 weeks, and 44% for those born at 25 weeks [3]. These babies often need surgical interventions, making the complex situation even more difficult. Since the surgical care of these babies usually requires specialist care, the baby is often transferred to a central referral hospital for the operation. The transport of an ELBW baby is hazardous and costly [1]. Some procedures such as tracheostomy, ligation of patent ductus arteriosus and peritoneal drainage are performed bedside, but many times at the central hospital. Bedside laparotomy has not yet gained acceptance since an optimal operating room ambience is considered critical for success. The perioperative care for these babies is usually given by neonatologists or intensive care physicians at the referral hospital and does not vary widely from the capabilities of the referring hospital.

Since 2000 our department has adopted the policy of treating unstable premature babies at the local hospital. This obviates the need to transfer the baby, avoids the delay in procuring an appropriate intensive care bed, and allows the continuity of care by the neonatologists who know the babies' special needs. The care provided consists of participating in the diagnosis and performing the operations – including laparotomy – at the local neonatal unit. In this series we retrospectively studied whether the care provided is equivalent to that of the standard practice of transporting the child to a referral center.

The series focuses on ELBW ventilated babies in unstable hemodynamic condition with perforated bowel – i.e., those who are unlikely to survive transfer. Recent published series

on this condition report a survival rate after the acute event of 71.2–91.7% [2,4,5]. Survival rate from the acute episode in our series was 91.7%, equivalent to the best reported result. Survival from the abdominal insult is reported as 55.1–65% [6,7]. In the present series we found that the survival rate at 30 days after operation was 81.8%. Survival to discharge in our series was 41.7%, in agreement for the rates for ELBW babies [3,8].

Our series includes only 12 babies and therefore does not carry significant statistical strength. It is centered on a very specific population and in one peripheral neonatal unit but without a selection bias. The series also includes children with severe non-abdominal conditions such as cardiac malformations and intraventricular hemorrhage, conditions that are averse to survival. In our opinion therefore, our results, albeit from a very small series and from a single center, demonstrate that bedside laparotomy for perforated bowel in an unstable ELBW baby in a well-equipped and prepared neonatal intensive care unit is at least as safe as transfer to a central referral center. As this approach gains wider acceptance, accrual of information may lead to more significant results

## Conclusions

Bedside laparotomy for unstable ELBW babies is feasible and safe at the referring hospital. This approach may be inconvenient for the surgeon but avoids the hazards and delays of transfer and may be beneficial for the baby.

## References

1. McKee M. Operating on critically ill neonates: the OR or the NICU. *Semin Perinatol* 2004;28:234–9.
2. Noble HGS, Driessnack M. Bedside peritoneal drainage in very low birth weight infants. *Am J Surg* 2001;181:416–19.
3. Marlow N, Wolke D, Bracewell MA, Samara M. Neurological and developmental disability at six years of age after extremely pre-term birth. *N Engl J Med* 2005;352:9–19.
4. Hall NJ, Curry J, Drake DP, Spitz L, Kiely EM, Pierro A. Resection and primary anastomosis is a valid surgical option for infants with necrotizing enterocolitis who weigh less than 1000 g. *Arch Surg* 2005;140:1149–51.
5. Blakely ML, Lally KP, McDonald S, et al. Postoperative outcomes of extremely low birth-weight infants with necrotizing enterocolitis or isolated intestinal perforation: a prospective cohort study by the NICHD Neonatal Research Network. *Ann Surg* 2005;241:984–9.
6. Sharma R, Tepas JJ 3rd, Mollitt DL, Pieper P, Wludyka P. Surgical management of bowel perforations and outcome in very low-birth-weight infants (< or =1,200 g). *J Pediatr Surg* 2004;39:190–4.
7. Moss RL, Dimmit RA, Barnhart DC, et al. Laparotomy versus peritoneal drainage for necrotizing enterocolitis and perforation. *N Engl J Med* 2006;354:2225–34.
8. Blakely ML, Tyson JE, Lally KP, et al. Laparotomy versus peritoneal drainage for necrotizing enterocolitis or isolated intestinal perforation in extremely low birth weight infants: outcomes through 18 months adjusted age. *Pediatrics* 2006;117:1407.

**Correspondence:** Dr. D. Arbell, Dept. of Pediatric Surgery, Hadassah Medical Center, P.O. Box 12000, Jerusalem 91120, Israel.  
Phone: (972-2) 677-6965, Fax: (972-2) 644-6483  
email: arbell@hadassah.org.il