

## Original Article

## Mortality and Short Term Outcome of Very Low Birth Weight (VLBW) Infants at a Tertiary Care Center in Saudi Arabia: 9 Years' Data

Badr Sobaih, Adnan Hadid, Amull Fariss, Rozina Banoo, Turki AlKharfi, Khalid AlFaleh  
Neonatal Intensive Care Unit, Department of Pediatrics, King Saud University, Riyadh, Kingdom of Saudi Arabia

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### ABSTRACT

**Objectives:** To assess the mortality and major morbidity rates of very low birth weight (VLBW) infants delivered at King Khalid University Hospital (KKUH) over a nine-year period. The secondary objective was to benchmark our data to the National Institute of Child and Health Development (NICHD) neonatal research network published figures.

**Design:** Retrospective analysis of prospectively collected data

**Setting:** Neonatal Intensive Care Unit, KKUH, Riyadh, KSA

**Subjects:** All VLBW infants born alive at KKUH with birth weights less than 1500 g and gestational age of 32 weeks or less during the period from 1999 to 2007.

**Interventions:** Data were collected from NICU database and follow-up clinic database and then analyzed by the use of Microsoft Excel program. Mortality and various morbidities in this group of infants were evaluated and results were

compared with international figures.

**Main Outcome Measures:** Mortality and major morbidity rates

**Results:** A total of 468 VLBW infants were included in this study. The infants had a mean gestational age of 27.5 weeks and a mean birth weight of 992 g. Mortality rate was 11.2% (survival rate of 88.8%). Survival varies dramatically per gestational age. The commonest morbidity was respiratory distress syndrome (95.2%), followed by retinopathy of prematurity (34.5%), and bronchopulmonary dysplasia (BPD) (27.4%). Early neonatal sepsis was documented in 11% of infants.

**Conclusion:** The survival of VLBW infants at KKUH is high and comparable to international figures. Although short term outcomes were quite satisfactory, the high rate of sepsis is alarming and requires urgent intervention.

KEY WORDS: gestational age, neonatal morbidity, preterm birth, survival of infants

### INTRODUCTION

Survival of very low birth weight (VLBW) infants continues to improve, particularly of infants less than 1000 g at birth, mainly due to advances in prenatal care including the use of antenatal corticosteroid therapy, and postnatal surfactant replacement therapy<sup>[1]</sup>. Despite this improvement, there has been minimal change in the boundaries of viability and in the number of infants surviving without significant neonatal morbidity<sup>[2]</sup>. Poor growth in early childhood is common in extremely preterm children. Improving early growth must be a priority for clinical care<sup>[3]</sup>. The contribution of preterm birth to population disability rates has often been discussed with the implication that increasing survival at extremely low gestational

age simply increases the burden of disability in the population as a whole. Being born prematurely is not a normal event, despite its routine nature today. Although a lot of work had been done to prevent or reduce prematurity, the main duty of neonatologists remains to work on dealing with morbidities of these infants and trying to prevent or minimize long term adverse neurodevelopmental outcome which could be optimally conducted by the use of proper long-term follow-up programs designed to deal with such group of infants and their families<sup>[4-6]</sup>. Knowledge of local data augment clinicians ability to provide appropriate counseling to parents, plan resources and benchmark local data to international standards.

#### Address correspondence to:

Dr. Bader Sobaih, Assistant Professor and Consultant, Department of Pediatrics and Neonatology, King Khalid University Hospital and College of Medicine, King Saud University, Riyadh, PO Box 2925, Riyadh, 11461, Kingdom of Saudi Arabia. Tel: 966-505453580, Fax: 966-14672395, E-mail: drbhsobaih\_01@hotmail.com (new) bsobaih@ksu.edu.sa ; drbsobaih@yahoo.com



Few published studies from Saudi Arabia reported the rates of mortality and morbidity outcomes in such tiny newborns<sup>[7-14]</sup>. However, most of these studies were single centered and did not reflect the magnitude of prematurity and its complications at the national level.

Our main objectives were to assess the mortality and major morbidity rates of VLBW infants delivered at King Khalid University Hospital (KKUH) over a nine-year period. Our secondary objective was to benchmark our data to the National Institute of Child and Health Development (NICHD) neonatal research network published figures.

## SUBJECTS AND METHODS

A retrospective analysis of prospectively collected data at KKUH in Riyadh, Saudi Arabia was conducted. Data were collected from year 1999 to 2007. VLBW infants born alive with a birth weight less than 1500 g and 32 weeks gestation or less were included. Data were collected after careful review of the medical records. The Institutional Ethics Review Board (IERB) at KKUH approved our study.

Baseline demographic data included maternal history, maternal age, parity, use of antenatal steroids, antenatal antibiotics, gestational age, birth weight, sex, mode of delivery, Apgar score, as well as need for mechanical ventilation, and surfactant administration.

Our primary outcome was mortality defined as death prior to hospital discharge. Other neonatal morbidities were also included as secondary outcomes. Intraventricular hemorrhage (IVH) was detected routinely by head ultrasound performed during the first four weeks of life, and IVH was graded according to Papile's classification, from 0 - 4<sup>[15]</sup>. If multiple ultrasounds were done in the first four weeks, then the worst grade was recorded. Periventricular leucomalacia (PVL) refers to periventricular echogenicity detected on head ultrasound done at any time during the NICU stay. Respiratory distress syndrome (RDS) was diagnosed, if the infant needed supplemental oxygen along with a chest radiograph consistent with RDS. Pneumothorax was considered to be present, if the infant had extra pleural air diagnosed by chest radiograph or needle aspiration. Patent ductus arteriosus (PDA) was diagnosed *via* echocardiography with evidence of left-to-right shunting. Necrotizing enterocolitis (NEC) was diagnosed clinically with abdominal distension and intolerance to feed or bloody stool, in addition to an abdominal radiograph showing pneumatosis intestinalis, pneumoperitoneum, or gas in the biliary tree. Bell's classification was used for staging<sup>[16]</sup>. Retinopathy of prematurity (ROP) was detected on routine retinal examination and was recorded utilizing the International Classification of ROP<sup>[17]</sup>. Bronchopulmonary dysplasia (BPD) was

defined as oxygen requirement at 36 weeks corrected age<sup>[18]</sup>. Sepsis was considered, if a blood culture or a cerebrospinal fluid culture was positive with a bacterial pathogen and early sepsis was defined as positive culture in the first 72 hours of life.

We present our descriptive data as median and range for continuous variables and frequency and percentages for categorical data. Our data for mortality was further subcategorized according to mortality by gestational age. To benchmark our data and performance, we performed a direct comparison with NICHD data published in 2007<sup>[19]</sup>.

Table 1: Maternal and infants baseline characteristics

Infant Characteristics	Mean $\pm$ (Standard deviation)
Birth weight (g)	992.7 (287)
Mother age	28.9 (6.1)
Parity $\pm$	1 (0-11)
Apgar score 1 min	5 (2.0)
Apgar score 5 min	7.4 (1.5)
Admission temperature	35.7 (1.0)
Days on oxygen	57 (53.9)
Length of hospital stay	71 (53.2)
Day feeding started	1 (1-32)
Age full feed $\pm$	39.4 (51.1)
Weight on discharge (g)	2357.4 (739.5)

## RESULTS

A total of 468 eligible infants were included for the study period (1999 - 2007). Included infants had a mean birth weight of 992 g. Majority of mothers were Saudis (93%), and around 70% of them were booked at our hospital. There was equal gender distribution. Four hundred and fifteen infants survived to discharge, with survival rate of 88.8%. Maternal and infants demographic data are shown in Table 1. Survival rate per gestational age showed a dramatic improvement of survival beyond 25 weeks gestation. Infants born at 23 and 24 weeks gestation had a survival rate of 61 and 65% respectively. Only one infant at 22 weeks gestation was included and it died (Table 2). Of note, extreme low birth weight infants born at our institution

Table 2: Survival rates based on gestational age

Gestational age in weeks	Survived / Total	Survival rate %
22	0 / 1	0
23	11 / 18	61.0
24	26 / 40	65.0
25	28 / 33	84.8
26	63 / 70	90.0
27	44 / 49	90.0
28	58 / 62	93.6
29	54 / 59	91.5
30	77 / 78	98.7
31	39 / 43	91.0
32	15 / 15	100
Total	415 / 468	88.8



**Table 3:** Baseline and survival data at King Khalid University Hospital (KKUH) compared with National Institute of Child Health and Human Development (NICHD) 2007

Characteristics	KKUH (468)	NICHD (18,150)
Birth weight, g (range)		
Mean (range)	992 (500 -1483)	1033 (998 -1066)
Standard deviation	287	289
Other parameters (%)		
Antenatal steroids	77.5	79
Antenatal antibiotics	33.8	70
Membrane rupture > 24hrs	3.5	24
Multiple births	29.6	26
Small for gestational age	12.5	21
Mode of delivery (%)		
SVD	52.2	42
Cesarean section	47.8	58
Delivery room resuscitation (%)		
Endotracheal intubation	75.4	53
Resuscitation drug	3.4	5
Survival rate (%)	88.8	85

SVD = spontaneous vaginal delivery

were offered full resuscitation, if they were born with a weight of 500 g or more. Antenatal steroids were administered to 77.5% of mothers (Table 3).

RDS was present in 95.2% of infants. Surfactant treatment was given to 80% of infants, and around 28% of infants received postnatal steroids for evolving BPD, which developed in 27.4% of infants. PDA was diagnosed in 31% of infants; 48.3% out of these received indomethacin therapy and 12.4% underwent surgical ligation. Cranial ultrasound was performed in 90% of infants and showed IVH in 13.9% of infants; of these; 2.7% were grade I IVH, 3.4% grade II IVH, 4.4% grade III IVH, and 3.4% grade IV IVH. Only 1.3% of infants with IVH were diagnosed with PVL. Of note, our institution utilized indomethacin prophylaxis strategy for IVH and PDA for all infants born at less than 1000 g. ROP of all stages was diagnosed in 34.5% of infants (Table 4).

We observed a high rate of early and late onset sepsis at our institution affecting 48% of infants. Around one quarter of all cases of sepsis were labeled as early (within the first 72 hours of life). NEC was diagnosed in 15.6% of infants.

The baseline characteristics of our subjects including mean birth weight, antenatal steroids utilization, rate of cesarean section (CS) deliveries, were quite comparable to NICHD data. As for the short term neonatal morbidities, the rate of RDS and delivery room endotracheal intubation in our unit was double the number reported in the NICHD data possibly due to different definitions and delivery room practices utilized. Our rates of early and late onset sepsis far exceed the rates reported by NICHD. The rates of severe IVH (grade III and IV) were almost half the reported figures in the NICHD data probably due

**Table 4:** Short term outcomes at King Khalid university hospital (KKUH) compared with National Institute of Child Health and Human Development (NICHD) 2007

Morbidity	KKUH %	NICHD, %
Respiratory distress syndrome	95.2	44
Surfactant therapy	80	58
Postnatal steroids	27.9	17
Pneumothorax	5	5
Bronchopulmonary dysplasia	27.4	22
Patent ductus arteriosus (PDA)	31	29
Indomethacin for PDA	48.3	79
Surgery for PDA	12.4	19
Sonogram done	90	93
Grade I IVH	2.7	11
Grade II IVH	3.4	4
Grade III IVH	4.4	7
Grade IV IVH	3.4	5
Periventricular leukomalacia	1.3	3
NEC Proven	15.6	7
Early onset sepsis	11.0	2
Late onset sepsis	37.2	22
ROP all stages	34.5	59

ROP = Retinopathy of prematurity, IVH = Intraventricular hemorrhage, NEC = Necrotizing enterocolitis

to utilization of indomethacin prophylaxis strategy in our unit.

## DISCUSSION

In this study, we report our institutional short-term outcome data of VLBW infants. Our data showed a similar survival rate in addition to major short term outcomes when compared to international figures. Although we had no survivals at 22 weeks (those born above 500 g), the survival rate of infants born at 23 weeks was surprisingly high. A recent report from a high quality tertiary care unit showed no survival at this age<sup>[14]</sup>. This could partially be explained by accuracy of gestational assessment since 30% of our mothers were un-booked.

The high rate of RDS in our unit is quite puzzling compared to international figures. The retrospective nature of our data makes it difficult to pinpoint a clear explanation to this observation. However, we believe that the high rate of un-booked mothers makes it difficult to anticipate and prepare for such high risk deliveries, to administer full course antenatal steroids, and have the infant born with the presence of an experienced neonatal team. It is also not clear to us why 75% of cases got intubated in the delivery room and what were the criteria utilized for such an aggressive practice.

Despite having a higher rate of RDS and possibly sicker infants compared to NICHD report, we observed almost half the rate of severe IVH in our population. This observation is most likely due to our inherited practice of indomethacin prophylaxis for infants born less 1000 g at birth. Our practice for many reasons did



not decline post the publication of the TIPP trial as observed in the international arena.

It is well known that both early and late onset sepsis decreases the survival of VLBW infants and increases their risk of long-term neurocognitive impairment<sup>[20]</sup>. We have observed a very high rate of sepsis in our unit compared to international standards. The increased rates of early onset sepsis could be explained by the increased rate of un-booked mothers and lack of proper preparatory action prior to delivery. However, it is not quite difficult to explain the high rate of late onset sepsis. Lack of vigilance in observing proper hand washing, extremely low rates of exclusive breast feeding, over crowding in improper NICU design are all possible contributory factors.

Although our study represents one of the largest cohorts of VLBW infants in the country, the retrospective nature of our data collection, in addition to the heterogeneity in the resource availability and neonatal practices hamper our ability to generalize our data to a national level. Therefore, accurate, representative and prospective data of survival and major morbidities of VLBW infants in Saudi Arabia are still needed.

## CONCLUSION

The survival of VLBW infants at KKH is high and comparable to international figures. Although short-term outcomes were quite satisfactory, the high rate of sepsis is alarming and requires urgent intervention.

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**Competing interests:** None to declare

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