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Short Term Survival of Extreme Preterm Newborns at 23–26 Weeks' Gestation in a Middle East Modern Referral Maternity Hospital

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Abstract

Background: Caring about ELBW newborns at the limit of viability is demanding with a high rate of mortality and long-term morbidity. Society expectations become high and persistent while health care coast inside NICU is very high.

Objective: The purpose of this study is to examine the short-term survival (till discharge) of extremely low birth weight (ELBW) newborns at limits of viability 23–26 weeks gestation (WG) age in a large tertiary maternity hospital.

Methods: A population-based retrospective study of babies born at 23–26 WG age over 3 years period.

Results: Over the study period 2016 to mid-2018, a total of 283 ELBW newborns were delivered in our institute. Of those, 250 were admitted to NICU (88%). The number of newborns who survived till discharge from NICU was 174 (61.5%) while the rate of delivery room death was 33 newborns (11.75%). The survival rates during 2016–2018 period were 35%, 64%, 73%, and 81.4% for 23, 24, 25, and 26 WG respectively. 76 newborns (26.9%) of NICU admissions died before discharge. Most deaths occurred during the first two weeks of life (64%). The main cause of death inside the NICU during the first 2 weeks was respiratory failure, followed by infection.

Conclusion: Counseling Parent using local data become more convincing and reflecting local experience. Short term survival rate of ELBW is comparable to those reported in the literature. The first two weeks are very crucial where the mortality rate is highest.

Keywords

Limit of Viability, Extreme Preterm, NICU, Survival Rate, Short Term Outcome, Qatar

Abbreviations

CS: Cesarean Section; ELBW: Extremely Low Birth Weight; NICU: Neonatal Intensive Care Unit; VD: Vaginal Delivery; WG: Weeks' Gestation; WWRC: Women's Wellness and Research Center

Introduction

Periviability is defined as the ability for a fetus to survive outside the uterus post-birth. With early intervention methods, an infant of 22–24 gestational age is considered in the lower end of fetal viability, in which virtually none below 22 weeks of gestational age will survive. Infants born at 26 weeks of gestational age and above are considered to have high extrauterine chances of survival [1-3]. The average daily cost of an NICU bed is around 1392 USD per day (excluding staff wages). An extremely premature baby costs an average of 62,000 USD during hospitalization in the WWRC depending on the gestational age. International figures are around the same amount [4,5].

Periviable newborn infants undergo embryological developmental changes that affect their normal functioning. The lack of normal development results in low chances of a periviable newborn meeting the extra-uterine requirements.

Gestational age (GA) is an influential factor that determines the extrauterine survival rate of premature infants. Proactive life support provided to periviable infants born of 22-24 weeks of gestational age has improved as a result of advanced intervention methods and prenatal/postnatal care. The mortality rates and levels of morbidity in many healthcare institutions pose critical questions related to the different factors that influence newborn survival rates inside a modern tertiary NICU unit. Several perinatal risk factors contribute to a death or severe morbidity in which around 68% of periviable newborns die within the first 2 weeks of life as demonstrated by Patel et al [3]. Environmental risk factors including delivery room conditions, proactive life support, and general NICU post-delivery care significantly contribute to the overall mortality rate. Earlier studies suggest that 90% of ELBW newborns' mortality occurs within the first 28 days while most occur within the first 72 hours after birth [1-3].

The delivery of a periviable newborn is a challenging procedure that requires pressing support from NICU special care. There are notable significant psychological, clinical, and administrative loads in the management of ELBW newborns among health care providers, neonatal physicians, and nurses [6]. The WWRC is a state-of-the-art tertiary referral maternity hospital where 40 to 50 deliveries occur daily. The WWRC accommodates 214 maternity beds and has 110 NICU cots distributed across two floors one of the floors is dedicated towards 23 to 28 weeks' gestation age. The WWRC is a referral hospital for five governmental and five private maternity services. In 2004 and 2005, 12 newborns at 23 WG were admitted to our NICU and only one baby survived to discharge (8%). Since then, the unit policy has discouraged admitting newborns of this gestational age to WWRC-NICU, as the cumulative survival rate over 10 years was less than 18%, with an average length of stay is 140 days for those who survived. In 2013 the unit introduced a health care package specifically designed to manage very premature babies in general. The package included delivery room golden hour, non-invasive ventilation, volume guarantee ventilation, early nutritional support, strict infection control guidance, early surfactants, and environmentally friendly policies. Along with this approach, the unit promoted an orientation of dealing with newborns of 23/26 WG age positively and proactively [7]. The literature lacks prompt description of this outcome in the Arab Gulf countries whom they share similar socioeconomic circumstances and similar health care facilities. The first aim of this current study is to assess and analyze the short survival rate (till discharge) of 283 ELBW newborns between 2016-2018 delivered at 23–26 WG in the WWRC. The second aim is to compare the outcomes with 9 reports from 7 regional and international countries.

Methods

This study is a population-based retrospective study; new resuscitation guidelines concerning the limits of viability for 23–26 WG age newborns were introduced in 2013 (golden hour) [7], along with a dedicated, well-equipped separate unit catering only ELBW newborns younger than 28 WG age. We evaluated the outcomes of ELBW newborns delivered at 23–26 WG in the WWRC following the implementation of these arrangements. We retrieved the patient's data from the medical records of each newborn, the Pearl-Peristat Maternal and Newborn registry, and the Vermont Oxford database related to our hospital. We included

cases who were born alive, or admitted to the NICU, at 23 weeks plus 0 days to 26 weeks plus 6 days. The estimation of gestational age was verified from the maternal ultrasound, in vitro fertilization dates, first-trimester ultrasound, and/or menstrual dating confirmed by second-trimester ultrasound. The study excluded confirmed intrauterine fetal death and newborns with significant anomalies. The rate of NICU admission, death before 2 weeks of age, and death before discharge were assessed. The patient data included gestational age, birth weight, sex, Apgar score, antenatal steroid, mode of deliveries, death in the delivery room, death inside NICU, hospital stay, chronic lung disease, and intraventricular hemorrhage. In this study, we also compared our outcome with outcomes of Nine reports from seven different developed countries and other members of Gulf Cooperation Council (GCC). Pearl newborn data registry has developed after ethical approval of the medical research center of Hamad Medical Corporation. WWRC is a member of the Vermont oxford database.

Data analysis was performed with SPSS software, V.26.0.0.2 (SPSS Inc., Chicago, IL, USA). Birth weight, gestation age and Apgar score, were presented as mean values ± standard deviation (SD). Categorical variables were presented as percentages. Sample distribution data are presented as a histogram with relative frequency in percentages. Survival rate was calculated as a function of the following variables: total deliveries and total NICU admissions and presented as percentages. The annual survival rate of limits of viability was calculated for 23–26 WG newborns from 2016 to 2018, presented as a histogram with relative frequency in percentages.

Results

Over the study period 2016-2018, a total of 3493 premature newborns 36 weeks and less were admitted to our NICU. A 283/3493 (8%) ELBW newborns of gestation age 23-26 weeks were delivered in our institute and included in the study (**Fig-1**). Of those, 250 were admitted to NICU. Mean gestation age was 23±3 days, 24±2 days, 25±3, and 26± 2 days. Mean birth weight was 635 ±85 grams, 699± 96 grams, 819 ±130 grams, and 904±144 respectively. The rate of delivery room death was 11.75% (**Fig-1**). The rate of antenatal steroids fluctuated between 55% and 91%. Active resuscitation was offered to 65% of 23 WG versus 100% of 26 WG newborns. Surfactant was offered to 100%, 98%, 84% and 62% of 23,24,25 and 26 WG respectively. Emergency cesarean section in 6% of pregnancies at 23 WG, and 60% at 26 WG pregnancies. Mean Apgar score in the first minute was 3±2 and 6±2 in the first and fifth minutes after birth. The delivery room intubation rate for 23 weeks gestation was 100% versus 80% for 24 weeks, 60% for 25 weeks, and 50% for 26 weeks gestation. The hospital length of stay was 99±20 days (**Fig-2**). The rate of chronic lung disease was 69% in 23 WG, 63% in 24 WG, 40% in 25 WG, and 33% in 26 WG. The number of newborns who survived till discharge from NICU was 174 (61.4%). The survival rate showed an average of 35%, 66%, 73%, and 81.4% in 23, 24, 25, and 26 WG respectively (**Fig-1**) (**Table-1**). Most deaths occurred during the first two weeks of life (64%) mainly due to respiratory failure, followed by infection (**Fig-3**).

Discussion

Over the last decade, perinatal mortality has been significantly reduced in the Arabian Gulf region particularly in the State of Qatar, in which the current perinatal mortality rate is 5.7% [8]. The significant decline witnessed is attributed to factors including the rationalization of human and financial resources, modern technological advancement regarding high-risk pregnancies, and lastly, an overall adjustment of national public health policies supported with a national antenatal follow-up program. The development of sophisticated, high-tech neonatal intensive care is effective in the survival of preterm newborns without a significant increase in later morbidity. Whether consciously or otherwise, modern NICUs measure their sophistication and affluence based on their ability to maintain ELBW newborn care effectively.

The World Health Organization places 22 WG age or 500 grams birthweight as the lower limit of birth viability for perinatal statistics. The international classification of diseases describes the perinatal period as that which starts at 22 completed WG. Survival and

outcome data on extreme preterm newborns, between 23 and 26 weeks has been widely reported and reviewed [9-16]. The question, with all its medical, legal, social, and financial implications, is how close are we, in Qatar as a whole, in this pursuit? As well, the urgent need to develop local data that reflect local experience when counseling the parents.

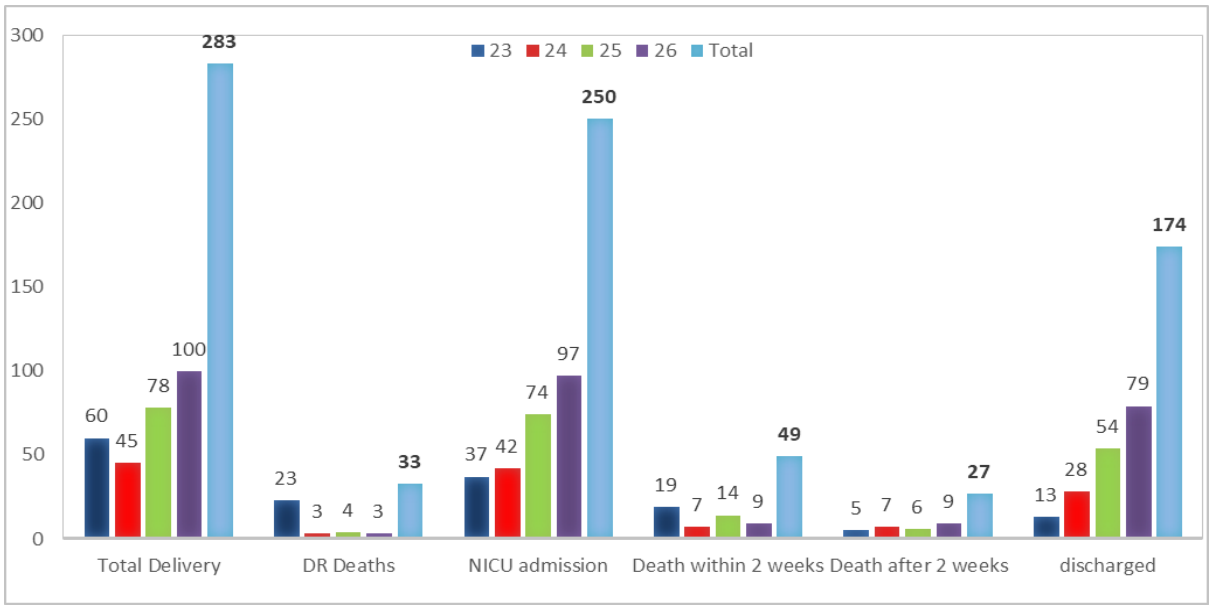

Fig-1:

Sample distribution of 283 of ELBW newborns between 2016-2018: total deliveries, DR deaths, number of NICU admission, newborns died within the first 2 weeks, newborns died after two weeks and newborns survived until discharge.

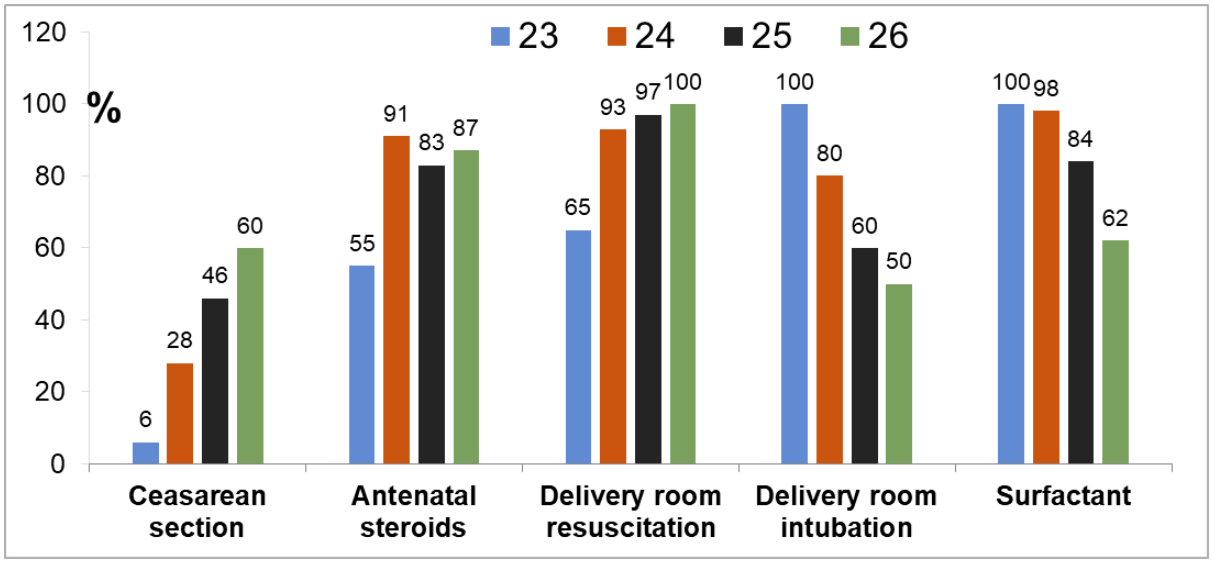

Fig-2:

Interventions and approach to Newborns Born at 23 to 26 Weeks' Gestation: 283 newborns

Table-1: Sample distribution of 283 of ELBW newborns between 2016-2018

	23 weeks	24 weeks	25 weeks	26 weeks
Survival out of total deliveries	13/60=21.7%	28/45=62.2%	54/78=69.2%	79/100=79%
Survival out of total NICU admissions	13/37=35%	28/42=66.6%	54/74=73%	79/97=81.4%

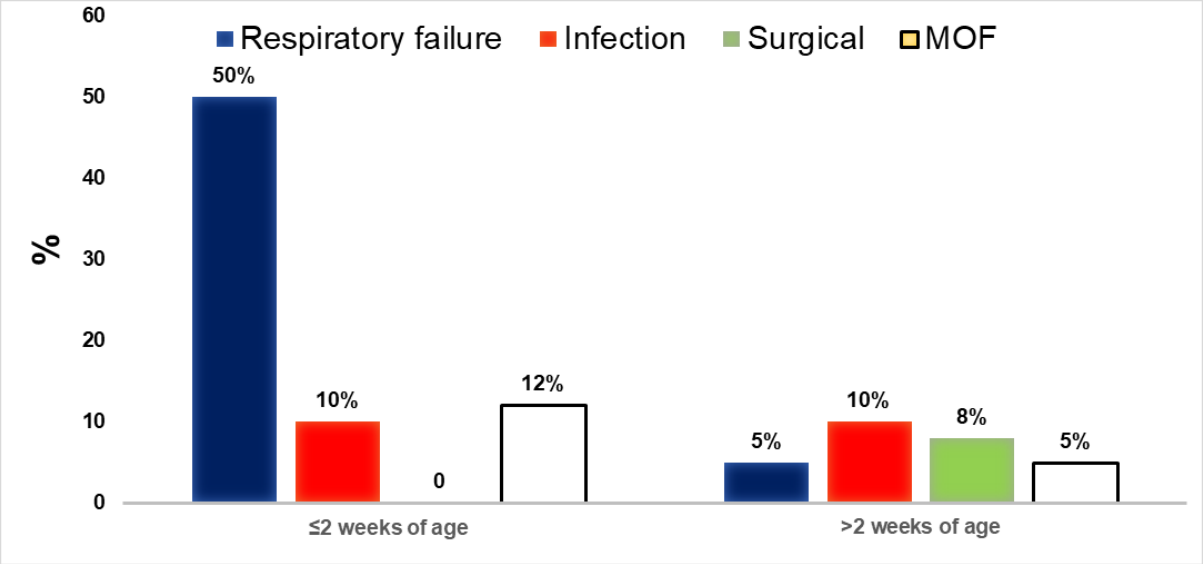

Fig-3:

Leading cause of death in 250 ELBW newborns admitted to NICU

MOF= multiorgan failure

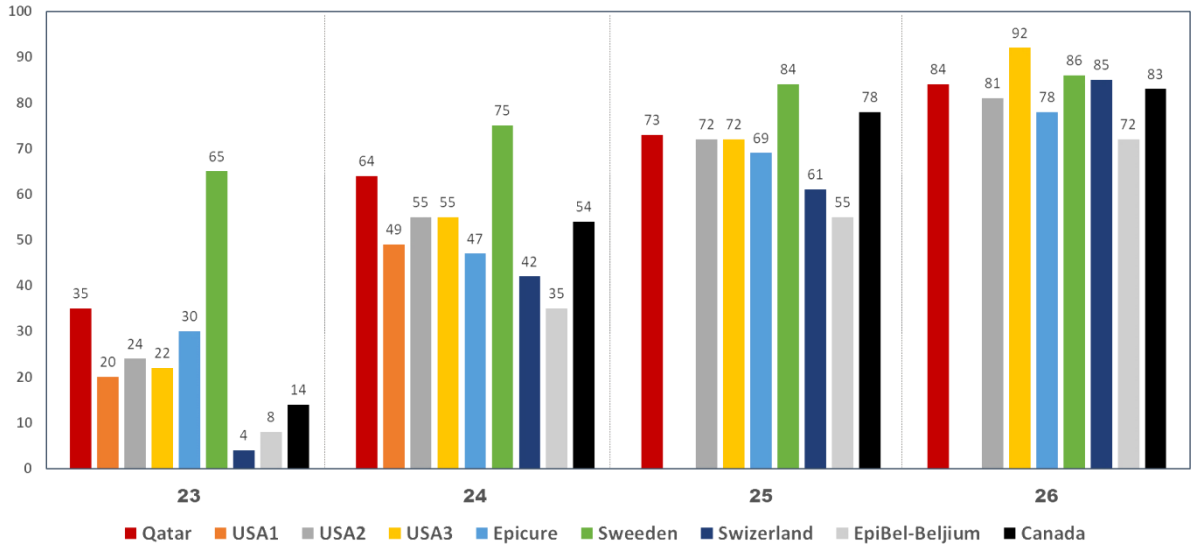

Fig-4:

International survival rate of limits of viability of newborns admitted to NICU

1. ★*In USA[1] survival report did not include 25- or 26-weeks' gestation.*
2. *Qatar-NICU survival rate over the last 3 years 2016-2018.*
3. *Country references (9-17).*

The rate of preterm birth in the State of Qatar is 9.1%, 8 % of such are ELBW 23-26 weeks of gestation age [18]. In WWRC-NICU, the overall short-term survival has shown significant improvement, particularly among 23–25 WG newborns however it remained at eighties percent for 26 WG (**Fig-4**). In this cohort study, we attempted to describe the short-term survivability of ELBW newborns born in Qatar over 3 years. The results obtained were compared to literature studies derived from North America and Europe.

The introduction of early surfactants, enforcement of the use of antenatal steroids, gentler ventilation techniques, non-invasive ventilation, strict infection control, delivery room golden hour program, adequate nutritional support for these age groups beside dedicating well equipped tiny baby unite to manage

only those vulnerable gestation ages are all added value in this regard. However, 23–24 WG survival lags those born at 25 weeks and later. The value of ethics comes in conflict with the socioeconomic factors, parents' expectations, health care policymakers, and society's developmental ranking [19,20]. Costello et al. compared the survival rates of ELBW newborns born between 1995–2006 and found a 10% improvement in the survival of the 23 and 24 WG age groups [21]. Thomas et al. in a small sample size cohort reported a survival rate of 33% for 23 WG [22]. On the other hand, some investigators have found a considerably higher survival on discharge from the NICU for both 23 WG (65%) and 24 WG (78%). Nozomi et al. demonstrated different survival rates among other large cohort studies, fluctuating between 36% and 65% at 23 WG and up to 98% at 24 WG [23]. Publications from Arab Gulf countries who share a similar health care structure, almost all, were single center-based studies of small sample size with larger gestational age. Recently Abulfotouh et al. from Saudi Arabia reviewed the survival rate of 117 ELBW infants below 1000 grams which showed 22%, 31%, 52%, and 72% survival rates among those 4 gestation ages. [24]. In 2012, S Al-Alaiyan et al demonstrated survival rate varied according to the gestational age; it was, 29% for 23 weeks, 58% for 24 weeks, 63% for 25 weeks, and 83% for 26 weeks [25].

Limitation of the study and Conclusion

In this study, we focused on the short-term survival until discharge recorded over 3 years in our institute which was 35%, 66%, 73%, and 81.4% for 23, 24, 25, and 26 WG, respectively. Within this study, we can use such outcome figures during counseling parents at risk of premature delivery. As well, although such figures are more consistent with reports from several developed countries, however there is rooms to improve especially 2 years long-term outcome is more important than short outcome inside the NICU. The sample size in this study is comparatively adequate for single institute while the duration covered in the study is short and need to be longer to reflect an established survival rate.

Competing Interests

All authors have read and approved the final version of the manuscript. The authors have no conflicts of interest to declare.

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