Call to establish a national lower limit of viability

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The birth of premature infant of extremely low birthweight (ELBW), around the margins of viability, poses difficult management decisions for health professionals and parents because mortality, morbidity, and human and economic costs are high, and the likelihood of long-term survival without disabilities is low.^{1,2} Admittedly, the development of neonatal intensive care is effective in the survival of preterm infants, and thus some physicians may feel an obligation to proceed with maximal resuscitation and initiation of neonatal intensive care because such infants occasionally survive, even though they are below what is considered the stage of viability, which has been defined as either the point of ability to survive or the point of ability to grow and develop normally.³ The World Health Organization places 22 weeks of gestational age or 500 gram birthweight as the lower limit, at least for the purpose of perinatal statistics. The International Classification of Diseases describes the perinatal period as starting at 22 completed weeks. The European Association of Perinatal Medicine (EAPM) defines the perinatal period "from 22 completed weeks (154 days) gestation and ending 7 complete days after birth."⁴ The Eugenic Protection Act in Japan was amended in 1991, shortening the viability limit from 24 to 22 completed weeks of gestation.⁵ The American Academy of Pediatrics suggests that noninitiation of resuscitation for newborns of less than 23 weeks gestational age and/or 400 grams in birthweight is appropriate.⁶ These amendments directly encourage physicians to fully resuscitate these infants at the delivery room without considering the high mortality and morbidity. In addition, much has changed in neonatal intensive care in the past decade. Exogenous surfactants are administered uniformly for respiratory distress. High-frequency oscillation and inhaled nitric oxide are widely available. Antenatal corticosteroids have become standard therapy for women in whom preterm delivery is threatened. All these changes have contributed posi-

tively to the survival of extremely premature infants.

In Saudi Arabia and at the national level, we do not have written guidelines on the definition of the lower limit of viability, and thus the question, with all its medical, religious, legal, social and financial implications, is: can we establish a national lower limit of viability? To achieve that goal, we should understand the outcome of extremely low birth infants. The outcome of these infants varies from one hospital to another and is determined by the availability of facilities and the attitude of the neonatal intensive care unit staff, whether they are proactive or selective in their management.

Studies usually base the survival outcome on either the gestational age and or the birthweight. If accurate, the gestational age reflects the degree of immaturity, and thus physicians need to be extremely careful in discussing outcomes for a specific gestational age unless it has been carefully defined (e.g. early ultrasonography, in vitro fertilization). Once the infant is born, physicians will have the gestational age more confirmed by using the Ballard Scoring System. Survival outcome based on birthweight at least begins with a more accurate measurement. The data demonstrate the same dramatic increases in survival for each 100-gram increase in weight as seen for each additional gestational week. However, there are additional problems with estimates of survival based on weight. For each gestational week, there is a several hundred-gram range in normal fetal growth. Therefore, a 600-gram infant may behave physiologically as infants with a gestational age of 23 to 26 weeks. Infants with intrauterine growth restriction have better survival than appropriate-for-gestational age (AGA) newborn preterm infants with similar birthweight. Physiology would be expected to correlate better with gestational maturity than with size.

We as physicians understand that biological survival depends not just on the presence of a given organ but on its functional maturation. For example, alveolarization,

essential for survival, is a process that includes anatomical, physiological and biochemical differentiation starting from about 24 weeks gestation, progressing until term and continuing throughout the postnatal period and childhood. This means that infants born before 24 weeks gestation are considered preivable.

In the modern era, we should analyze perinatal data so as to better define our limits and to individualize resources for allocation of neonatal critical care. This is possible only with a large data collection from many centers in order to have a large enough cohort of babies with different characteristics and to avoid inter-centre variability. Unfortunately, in Saudi Arabia survival and outcome data on infants less than 25 weeks gestation are insufficient. Almost all the published studies from Saudi Arabia were single center-based studies of small sample size and were inadequate to outline the problem nationwide.⁷⁻¹¹ Most of the data I describe here were obtained from other countries. A national population-based study in the UK and Ireland in the mid-1990s, of all infants born between 22 and 25 weeks gestation, revealed 2 survivors at discharge at 22 weeks, with increasing survival rates from 11% at 23 weeks to 44% at 25 weeks.¹² At our hospital, we reviewed the outcome of 50 infants, and found that 9 were born at 22 weeks gestation, 17 at 23 weeks and 24 at 24 weeks.¹³ Twenty-two (44%) infants survived to discharge and 28 (56%) died during hospitalization. The survival rate varied according to the gestational age; it was 58% for 24 weeks, 29% for 23 weeks and 33% for 22 weeks. The majority of infants (89%) died in the first week of life. One infant at 22 weeks, 4 at 23 weeks and 9 at 24 weeks were found to be free of neurological abnormalities. We found that survival rate increased by 4% for each day the fetus stayed in utero. All infants were further stratified to two groups according to the birthweight, less than 600 grams ($n=33$, group 1) and 601 grams or more ($n=17$, group 2). The survival rate was found to be 45.5% ($n=10$) and 54.5% ($n=12$) among group 1 and group 2, respectively. In a survey of 21 European countries, the mortality rate for infants weighing between 500 and 749 grams at birth was 44% but with some wide variation within countries, approaching a 90% mortality rate in the less affluent countries versus 26% in the more developed European regions.¹⁴ Therefore, it is not surprising that 10 of 21 European countries have changed their lower limit of viability from 22 weeks gestation to 24 to 25 weeks gestation. Nevertheless, several reports show an increasing survival rate in extremely preterm infants, especially after the introduction of steroids and surfactant.¹⁵⁻¹⁷ Survival, however, should not be the only measurement in perinatal medicine when attempting

to establish a lower limit of viability; the quality of life should be a major preference. Although several studies on the follow-up of these very immature babies have shown that increasing survival has not been mirrored by an increase in disability, the fact is that a proportionally higher number of infants are now the survivors of very low gestational age and birthweights. Furthermore, major neuromotor, psychomotor development, neurosensory and cognitive dysfunctions are found, especially in the most immature infants below 25 gestational weeks.^{1,5,16-18} In addition, the interpretation of these studies is difficult because they use different assessment tools and different assessment ages, and the follow-up of the population is incomplete. Additionally, different definitions of the severity of developmental morbidity have been used. Furthermore, developmental assessments at an early age may be less accurate, since learning difficulties, behavioral and educational problems become apparent at the school age.

Other important aspects of this issue are regionalization and neonatal transport. In Saudi Arabia, regionalization does not exist because each health sector has regulations stating that eligibility for treatment is mainly for employees and dependants. As a result of these regulations, sick neonates cannot be transferred easily to these hospitals. In terms of neonatal transport only one-way neonatal transport (i.e., that performed by the referring hospital) is available. Outcome during transport has been shown to improve when accomplished by trained teams based at the accepting hospital (two-way transports), as opposed to one-way transports performed by local personnel. The improvement in outcome with the two-way transport is directly related to training of specialized teams and a rapid response time, from mobilization to arrival at the accepting hospital.¹⁹ In Saudi Arabia, there were efforts to establish a two-way neonatal transport program and regionalization but they were unsuccessful. One of these efforts, the formation of a task force committee in 1998 from all large hospitals of Riyadh by the Ministry of Health, studied the feasibility of regionalization in the Riyadh region. The survey (unpublished) included the following: number of level 3 NICU beds with their occupancy rate, number of deliveries per year, number of qualified neonatologists, number and type of neonatal equipment, the design of the NICU, and conformance with international standards. One of the most important items of information obtained from this survey was the number of beds needed to cope with the number of deliveries. This was calculated from the internationally agreed formula of 1.5 beds per 1000 annual deliveries. In the Riyadh region, the number of deliveries during

that period exceeded 100 000 births per year. After subtracting the available beds from what was required at that time, it was found that the Riyadh region was almost 40% short in level 3 NICU beds. Since that time there has been an increase in NICU beds, but the growth of NICU beds did not increase linearly with the growth of the population of Saudi Arabia, which was estimated to be 29.1 births/1000 population.²⁰

In our society, religion has a strong impact in helping families and professionals make decisions on such ethical issues. For direction in solving this dilemma I would like to review some verses from the Holy Quran that give guidance toward the definition of the lower limit of viability. In the Quran, the duration of breastfeeding of infants by their mothers is specified to be a maximum of 2 years: "The mothers shall give suck to their children for two whole years, (that is) for those (parents) who desire to complete the term of suckling" (*Al-Baqara*, Chapter 2, Verse 233) and in another verse it states that the duration of pregnancy and weaning infants is 30 months: "His mother bears him with hardship and she brings him forth with hardship, and the bearing of him, and the weaning of him is thirty (30) months, till

when he attains full strength" (*Al-Ahqaf*, Chapter 46, Verse 15). If we subtract 24 months from 30 months the result will be 6 lunar months, i.e. 177 days, which are equal to 25 weeks and 2 days. This gestational age as indicated by the Quran can be studied by physicians and Islamic scholars as a lower limit of viability.

Conclusion

Advances in perinatal and neonatal care have significantly reduced neonatal mortality, but this was associated with a significant increase in morbidity among the ELBW survivors. In the presence of a limited number of NICU beds, lack of regionalization and proper transport as well as the lack of large data collection from many centers in Saudi Arabia, I strongly believe that judgments have to be made about whether an infant is "viable" and whether resuscitation should be started. Parents and professionals need clear guidelines to support shared decision making. Physicians alone cannot derive these guidelines. They need the support of Islamic scholars and all health sectors to avoid inconsistency in managing ELBW infants at all hospitals in Saudi Arabia.

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