

Survival of preterm babies beyond the neonatal period

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ABSTRACT

Background: Preterm birth is a significant cause of infant deaths particularly during the neonatal period. Study of these births may assist in predicting the survival of those born preterm, and in turn may help in reducing the causes and undesired outcomes.

Objective: This study was designed to explore the chance of survival among babies admitted to intensive care units in Basrah Maternity and Children Hospital.

Method: The study was a follow up study carried out on 440 babies who were born preterm and were admitted for reasons related to their prematurity to neonatal intensive care units in Basrah maternity and children hospital in 2012, of whom 408 were successfully followed up until the end of the neonatal period (birth to 28 days).

Results: Most of the babies were males (58.8%), singleton (93.1%), delivered by normal vaginal delivery (74.01%), moderately preterm (53.4%) and of birth weight range 1500- < 2500 grams(62.5%). Logistic regression analysis to identify independent predictors of survival showed that neonatal outcome (the probability of surviving the neonatal period) was significantly and independently related to birth weight and gestational age. Other variables [sex, type of delivery and type of birth(single, twin and multiple)] could not significantly predict survival in the present study.

Conclusions: It is concluded that the problem of neonatal mortality in Basrah is similar to that reported for other developing and neighboring countries. In our study the neonatal mortality rate was 27.94%, mostly in the first 24 hours of life. Two significant predictors could be identified as undesired predictors of survival; namely; low birth weight and shorter gestational age. We highly recommend a larger scale study on issue of neonatal survival. Perhaps improved care of mothers and neonates reduce the risk of both preterm birth and neonatal death.

Key words: Preterm, Infants, Death, Survival, Basrah

فرصة الحياة للأطفال الخدج بعد فترة الولادة الحديثة

الخلفية: الولادة قبل الأوان سبب هام من أسباب وفيات الرضع وخاصة خلال الفترة الأولى ما بعد الولادة. دراسة هذه الولادات قد تساعد في توقع البقاء على قيد الحياة من أولئك الذين ولدوا قبل الأوان، وبالتالي قد تساعد في الحد من أسباب ونتائج غير مرغوب فيها. **الأهداف:** قد تم تصميم هذه الدراسة لاستكشاف احتمالات الوفاة والبقاء على قيد الحياة بين الأطفال المحالين الى وحدات العناية المركزة في البصرة في مستشفى الولادة والطفل.

الطريقة: الدراسة تمت عن طريق تتبع ٤٠٨ طفلاً بنجاح حتى نهاية فترة ٢٨ يوماً بعد الولادة.

النتائج: معظم الأطفال الرضع من الذكور (٥٨.٨٪) و ٩٣.١٪ منهم مواليد نتجوا عن حمل بطفل منفردة وحوالي ٧٤٪ منهم كانت ولادتهم طبيعية، نسبة معتدلي الخدج بينهم كانت (٥٣.٤٪) ومدى نطاق الوزن ل(٦٢.٥٪) كان > ٢٥٠٠ - ١٥٠٠. أظهر تحليل الانحدار اللوجستي لتحديد المنبئات المستقلة لاحتمال البقاء على قيد الحياة لفترة ما بعد الولادة ان مدة الحمل الأقصر والوزن الوليد الأقل تحدد احتمال الموت للطفل الوليد. ولم تظهر العوامل الأخرى كالجنس وطبيعة الولادة و نوع الحمل اي تنبؤ معتد به.

الاستنتاجات: نستخلص من هذه الدراسة أن مشكلة وفيات حديثي الولادة في البصرة هي مماثلة لتلك التي ذكرت للبلدان النامية والبلدان المجاورة الأخرى. في دراستنا كان معدل وفيات الأطفال حديثي الولادة ٢٧.٩٤٪، معظمها في الـ ٢٤ ساعة الأولى من الحياة.

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يمكن التعرف على عاملين اثنين للتوقع بقلة احتمالية بقاء المواليد الخدج على قيد الحياة لأكثر من ٢٨ يوماً بعد الولادة وهي: انخفاض الوزن عند الولادة وقصر عمر الحمل. ونحن نوصي بشدة على إجراء دراسة على نطاق أوسع حول مسألة بقاء الأطفال الخدج حديثي الولادة على قيد الحياة، وضرورة التركيز على أهمية الرعاية المحسنة للأمهات وحديثي الولادة من أجل تقليل خطر الوفاة على الرضع حديثي الولادة المولودين ولادة مبكرة.

الكلمات المفتاحية: الخدج والرضع، الموت، البقاء على قيد الحياة، البصرة

INTRODUCTION

Preterm birth (PTB) refers to the birth of a baby of less than 37 weeks gestational age.^[1] It is further classified into three main sub- categories: extremely preterm (< 28 weeks), very preterm (28 to < 32 weeks), and moderate to late preterm (32 to < 37 weeks) with average frequencies of 85%, 10% and 5%, respectively.^[1-3] With corresponding birth weight of < 2500 g, <1500g and < 1000 gm in that order.^[4] The cause for preterm birth in many situations is unknown; many factors appear to be associated with the development of preterm birth, making the reduction of preterm birth a challenging proposition. Premature birth, commonly used as a synonym for preterm birth, refers to the birth of a baby before the developing organs are mature enough to allow normal postnatal survival. These infants are at greater risk for short and long term complications, including disabilities and impediments in growth and mental development.^[5] Despite major preventive efforts, the incidence of PTB has remained constant at about 5–10% of live births in most countries over the past two decades.^[5,6] Significant progress has been made in the care of preterm infants, but not in reducing the prevalence of preterm birth,^[7] which remained a major cause of neonatal mortality in developed countries.^[1] High survival among preterm infants may be achieved through reduction of the risk of preterm birth and high quality care immediately after birth. One measure to help reduce the risk of preterm birth is the use of drugs to accelerate maturation of the fetus.^[8] Pre-term birth (PTB) is a major determinant of neonatal mortality, morbidity and childhood

disability. More than a third of infant deaths are related to preterm births.^[9,10] They have an increased risk of death in the first year of life (infant mortality), with most of that occurring in the first month of life (neonatal mortality).^[4] Worldwide, prematurity accounts for 10% of neonatal mortality, or around 500,000 deaths per year.^[8] In the U.S. where many infections and other causes of neonatal death have been markedly reduced, prematurity is the leading cause of neonatal mortality at 25%.^[11] Prematurely born infants are also at greater risk for having subsequent serious chronic health problems like mental retardation, learning and behavioral problems, cerebral palsy, lung problems, vision and hearing loss, diabetes, high blood pressure, and heart disease.^[4] The earliest gestational age at which the infant has at least a 50% chance of survival is referred to as the limit of viability. As care in the neonatal intensive care units has improved over the last 40 years, viability limit has been reduced to approximately 24 weeks.^[12,13] Rare survivors have been documented as early as 21 weeks.^[7] Evidence from local studies in Basrah suggest a high risk of infant deaths during neonatal care.^[14,15] This study attempts to explore the chance of survival among preterm births.

PATIENTS AND METHODS

This is a prospective follow up study involving 440 preterm neonates who were admitted to the neonatal intensive care units in Basrah Maternity and Children Hospital in 2012. Parents were informed about the study objectives and their neonates were included after giving a verbal consent to take part. None

refused to participate, giving an overall response rate of 100%. A special questionnaire form was prepared for the purpose of data collection for this study. The data were collected by direct interview of the mothers, in addition some of the data were derived from the case sheet of each neonate included in the study. After discharge and in order to determine the state of these babies (alive or dead), the neonates were followed up to the end of the neonatal period. For follow up of the neonates, telephone number for one of the parents was taken and the answers about the state of these babies were obtained through telephone calls. Overall 32 neonates were lost to follow up leaving 408 neonates to be included in the study. For this report, preterm birth was defined as a live birth occurring at 17-36 completed weeks of gestation and the studied babies were sub-grouped:

1. According to weeks of gestation as moderately preterm (32- < 37 weeks), very preterm (28- < 32 weeks), extremely preterm (< 28 weeks).
2. According to their birth weight as low birth weight weighing less than 2,500 g, very low birth weight (< 1,500 g), extremely low birth weight < 1,000 g) and babies weighing 2,500 g or more. Statistical

package for social science (SPSS) version 20 was used for the analysis of data. Chi-square test, Fischer's exact test, and logistic regression analysis were used for statistical analysis. P value of less than 0.05 was considered to be significant.

RESULTS

A total of 408 preterm babies were included in the study. Out of them 240 (58.8%) were males and 168 (41.2%) were females. About 93.1% were singleton births, and 6.9% were multiple births. The delivery was normal vaginal delivery in 74%, caesarean section in (25%), assisted vaginal delivery in (1%). The gestational age for the studied group ranged between 17-36 weeks of gestation with a mean of **35.3 ± 3.05** weeks. More than half (53.4%) were in the gestational age group of 32- < 37 weeks, 32.4 % were in the gestational age group 28 - < 32, 14.2% were extremely preterm. (Table-1.d) The birth weight ranged between 280-3600 grams, more than a half (65.0%) of the studied babies had low birth weight (< 2500 grams). More than one fifth (22.3%) had birth weight (<1500 grams), and only (5.6%) were weighing < 1000 grams at birth. Of the studied babies 7.1% had optimal birth weight (2500-3600 grams). (Table-1)

Table 1. Characteristic of the studied births

VARIABLE	NO.	%
Sex		
Male	240	58.8
Female	168	41.2
Type of birth		
Single	380	93.1
Multiple	28	6.9
Type of Delivery		
Normal Vaginal Delivery	302	74.0
Caesarean	102	25.0
Assisted vaginal delivery	4	1.0
Gestational age(weeks)		
32- <37	218	53.4
28- <32	132	32.4
<28	58	14.2
Birth Weight(gms)		
< 1000	22	5.4
1000 to < 1500	92	22.5
1500 to < 2500	255	62.5
≥2500	39	9.6
Total	408	100.0

At the end of the follow up period (Table-2), 294(72.1%) of the studied births were alive, and the remaining 114 died during the neonatal period giving a neonatal mortality rate of 27.9%.

Table 2. The distribution of study population by outcome after 28 days

Outcome after 28 days	Frequency	Percent
Alive	294	72.1
Died	114	27.9
Total	408	100.0

Deaths within the first 24 hours contributed to 66.7% of all preterm deaths, 28.8% of these deaths were from 2nd -7th day; that is early neonatal mortality contribute to 95% of the overall mortality and the late neonatal mortality (death occurred at the age of 8-28 days contribute to only 5.3%. (Table-3).

Table 3. The distribution of neonatal deaths according to the time of death

Time of death	No.	%
Within the first day	76	66.7
2 nd -7 th day	32	28.0
8 th -28 th day	6	5.3
Total	114	100%

In order to determine the independent effect of variables on the outcome of admitted preterm neonates, a logistic regression analysis was carried out. The results indicate that neonatal outcome (the probability of surviving the neonatal period) was significantly and independently related to birth weight and gestational age Other variables (sex, Type of delivery and type of birth) could not significantly predict survival in the present study. (Table-4)

Table 4. The main predictors of neonatal outcome.

Independent variables	B	P. Value
A. Significant predictors		
1. Birth weight	0.000	0.001
2. Gestational age at delivery	-0.027	0.010
B. Non significant predictors		
1. Sex	0.008	0.854
2. Type of delivery	-0.064	0.142
3. Type of birth	0.062	0.335

DISCUSSION

Pre-term birth (PTB) is a major determinant of neonatal mortality, morbidity and childhood disability and it remains one of the most serious neonatal problems with further long term squeals.^[16] In Iraq the under-5 mortality (per 1000 live births) in 2004 was 38 for males 31 for females and 34 for both sexes, 54% were attributed to neonatal causes of which the main resulted from preterm births.^[17,18] The shorter the term of pregnancy, the greater the risks of mortality and morbidity for the baby primarily due to the related conditions.^[1] An estimated 15 million babies are born too early every year. That is more than 1 in 10 babies. Almost 1 million children die each year due to complications of preterm birth.^[1] Shorter gestational age and low birth weight were the two significant predictors of neonatal death and lower chance of survival. This result agrees with the results reported in the United States where 25% of neonatal deaths were related to preterm births^[18,19]. Preterm birth affected about 1 of every 10 infants born in the United States in 2014.^[20] In Europe and many developed countries the preterm birth rate is generally 5–9%, by gestational age, 5% of preterm births occur at less than 28 weeks (extreme prematurity), 15% at 28–31 weeks (severe prematurity), 20% at 32–33 weeks (moderate prematurity), and 60–70% at 34-36 weeks (late preterm).^[5] For babies born extremely early, new research shows that other factors aside from the baby's gestational age may affect their odds of survival if given

intensive care. The researchers tracked the babies from birth up to 22 months. Among babies who got intensive care, survival rates were better for girls, and for babies born in singleton as compared to multiple pregnancies, and for longer gestational age.^[21,22] In the present study apart from shorter gestational age and lower birth weight, other factors (type of birth, type of delivery and sex of the baby were not determinants of death or survival). A study in the UK about the survival of very premature babies, survival rates increased from 53% in 2006 to 80% in 2011. Survival increases by 9.5% for each week the baby stays in the womb if the baby is born at around 23 weeks, and 16% per week if the baby is born at around 25 weeks. Improving survival at lower gestations and weight makes it challenging for health professionals.^[23,24] The National Institutes of Health's study identified three additional factors contributing to survival: being female, being a single birth and being born to a mother dosed with corticosteroids to encourage fetal lung development.^[25] The results of this study are similar to the first predictors "gestational age at birth and birth weight", but not to the other three. Methodological issues and sample size could account for the difference in these results. As weight is easier to determine than gestational age, the World Health Organization tracks rates of low birth weight (< 2,500 grams), which occurred in 16.5 percent of births in less developed regions in 2000. It is estimated that one-third of these low birth weight deliveries are due to preterm delivery. Weight generally correlates to gestational age, and both correlates to survival.^[26] Globally, more than one in 10 infants are born preterm and 70% of them are born with a LBW; both of these rates are increasing.^[27] According to the report of a joint study from UNICEF and the WHO, which investigated global, regional and country-specific LBW rates in 2000, more than 20 million infants around the world (16% of total births) were born with LBW and approximately 95% of these infants were born in developing

countries.^[28] However, these numbers are mainly based on births that occurred in healthcare facilities and have been recorded officially. As more than half the number of babies born in the developing world are not weighed, since they are born outside health facilities, the actual number could be double this official statistic.^[28]

It is concluded that the problem of neonatal mortality in Basrah is similar to that reported for other developing and neighboring countries. In this study the neonatal mortality rate was 27.9%, mostly in the first 24 hours of life. Two significant predictors could be identified as undesired predictors of survival; namely; low birth weight and shorter gestational age. We highly recommend a larger scale study on the issue of neonatal survival. Perhaps improved care of mothers and neonates reduce the risk of both preterm birth and neonatal death.

REFERENCES

1. World Health Organization. "Preterm birth Fact sheet N°363" 2014. Available from *who.int*. Retrieved 6 Mar2015. Available from <http://www.who.int/mediacentre/factsheets/fs363/en>. Accessed on 6/11/2016
2. Lawn JE, Gravett MG, Nunes TM, Rubens CE, Stanton C. Global report on preterm birth and stillbirth (1 of 7): definitions, description of the burden and opportunities to improve data. *BMC pregnancy and childbirth* 2010; 10 (Suppl 1), S1.
3. Preterm birth: a global health priority. *The Lancet* 2012;379(9832), 9-15.
4. March of Dimes. 2010 Premature Births Report Card. Available from: www.marchofdimes.com/padmap.html. Marchofdimes.com. 2016 (accessed on 5 October 2016).
5. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. *The Lancet* 2008;371 (9606): 75-78.
6. Centers for Disease Control and Prevention; CDC 24/7. Preterm Birth. Available from <http://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm>.
7. Accessed on 2 December 2015 Howson PC, Kinney MV, McDougall L, Kawn JE. Preterm

- birth matters. *Reprod Health* 2013; 10 (Suppl 1) Available from: <https://www.ncbi.nlm.nih.gov/pmc/issues/229769/> Accessed on September 5, 2016.
8. Norwitz ER, Phaneuf LE, Caughey AB. Progesterone Supplementation and the Prevention of Preterm Birth. *Obstetrics & Gynecology*. 2011; 4(2): 60-72.
 9. Martin J A, Hamilton BE, Sutton PD, Ventura SJ. Births: Final data for 2006. *National Vital Statistics Reports*. National Center for Health Statistics. 2009; 57 (no 7).
 10. Williamson DM, Abe K, Bean C, Ferré C. Current research in preterm birth. *Journal of Women's Health* 2008; 17 (10): 1545-1549.
 11. Mathew TJ, MacDorman MF. Infant Mortality Statistics from the 2006 Period Linked Birth/Infant Death Data Set. *Division of Vital Statistics, National Vital Statistics Reports* 2010; 58 (17). Available from: http://www.cdc.gov/nchs/data/nvsr/nvsr58/nvsr58_17.pdf Accessed on October 16, 2016.
 12. Kaempf JW, Tomlinson M, Arduza C. Medical staff guidelines for periviability pregnancy counseling and medical treatment of extremely premature infants. *Pediatrics* 2006;117 (1): 22-29.
 13. Morgan MA, Goldenberg RL, Schulkin J. Obstetrician-gynecologists' practices regarding preterm birth at the limit of viability". *Journal of Maternal-Fetal and Neonatal Medicine* 2008; 21 (2): 115-121.
 14. Warid SA, Habib OS. Mortality among children in Basrah The *Medical Journal of Basrah University* 2015; 33(1): 93-99.
 15. Alwan ZA, Hameed LA. A study on mortality in children aged less than 5 years in Basrah in 2014. A diploma Dissertation, College of Medicine, University of Basrah 2016.
 16. Cunningham FG, Kenneth JL, Steven L, Bloom CY, Spong JS, Barbara L, Brian M, Jeanne S. The preterm labor. *Williams Obstetrics*. 24th ed. New York, The McGraw-Hill Companies 2013.
 17. UNICEF. Iraq-Statistics. 2013. Available from http://www.unicef.org/infobycountry/iraq_statistics.html. Accessed on 24 Oct 2016
 18. The UN Inter-agency Group for Child Mortality Estimation. UNICEF, WHO, World Bank, UN DESA Population Division Estimates. 2015. Available from www.childmortality.org. Accessed on 5 October 2016.
 19. March of dimes. Neonatal death. 2015. Available from <http://www.marchofdimes.org/complications/neonatal-death.aspx>. Accessed on 7 September 2017.
 20. Centers for Disease Control and Prevention. Preterm birth 2015. Available from <http://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm>. Accessed on 6 Jul 2016.
 21. Hitti M. Weight, Sex Affect Early Preterm Survival. *Web MD Magazine* 2008. Available from <http://www.webmd.com/baby/news/20080416/weight-sex-affect-early-preterm-survival#1m>. Accessed on 8 Mar 2016.
 22. Jon E, Tyson MD, Nehal A, Parikh DO, Langer J, Green C, Higgins RD. Intensive Care for Extreme Prematurity-Moving beyond Gestational Age. *N Engl J Med* 2008; 358: 1672.
 23. Neonatal care in the UK-facts and statistics. *Statistics*. Available at: <https://www.bliss.org.uk/pages/category/statistics> (accessed 2 June 2016).
 24. Costeloe KL, Hennessy EM, Haider S, et al; Short term outcomes after extreme preterm birth in England: comparison of two birth cohorts in 1995 and 2006 (the EPICure studies). *BMJ* 2012; 345:e7976.
 25. NIH. Study Reveals Factors That Influence Premature Infant Survival, Disability 2008. Available from <https://www.nih.gov/news-events/news-releases/nih-study-reveals-factors-influence-premature-infant-survival-disability>. Accessed on 7 Aug 2014.
 26. Subramanian KN. Extremely Low Birth Weight Infant. *eMedicine* 2009. Available from <http://www.emedicine.com/ped/topic2784.htm>. Accessed on 9 Apr 2016.
 27. March of Dimes, Partnership for Maternal, Newborn & Child Health, Save the Children, World Health Organization. *Born Too Soon: The Global Action Report on Preterm Birth*. Available from: www.who.int/maternal_child_adolescent/documents/born_too_soon/en/ Accessed on Oct 2015.
 28. United Nations Children's Fund and World Health Organization. *Low Birth weight: Country, regional and global estimates 2004*. From: www.unicef.org/publications/index_24840.html. Accessed: Oct 2014.