NEONATAL READMISSION FOLLOWING EARLY DISCHARGE FROM NEONATAL INTENSIVE CARE UNIT IN AL GALAA TEACHING HOSPITAL

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ABSTRACT

Objectives : The purpose of our study was to characterize early rehospitalization (within 2 weeks) among infants early discharged (within 4 days) from the NICU.

Subjects & Methods: This is a retrospective case study where we recruited all newborns admitted to our regional neonatal care unit at AL Galaa Teaching Hospital over a 6 months period from 1st January 2012 to 30th June 2012. Neonates discharged from the NICU within 4ds age were assigned into two groups according to whether readmitted (within 14 ds) after discharge have occurred (group I), or no readmission took place (group II). Group II cases were considered as control group when studying factors underlying and prognosis of newborn readmission.

Results: A total of 350 newborns were recruited in this study, Group I were 40 neonates and group II were 310 neonates .The incidence of readmission among our study population was 11.4 % over the study period. Mean timing of readmission was 2.32 days following discharge, and mean duration of hospital stay after readmission was 6.5 days. There is statistically significant difference between two groups as regards the mode of delivery, apgar score, need for resuscitation ,gestational age and birth weight. But not maternal disease. The major cause of readmission was jaundice (40%) followed by sepsis (27.5%), feeding problems (12.5%) then respiratory problems (10%) and lastly convulsions and congenital heart diseases (5% each). The mean serum bilirubin was statistically significant higher in group I cases than group II. There was an inverse relationship between neonatal readmission rate and average length of hospital stay at birth.

Conclusion: Decreases in newborn length of stay may result in substantial increases in morbidity however timing of newborn discharge should be determined on individual basis

Key words : Readmission – Discharge – Neonates – NICU – Jaundice.

INTRODUCTION

Neonatologists may have limited control over events that occur long after discharge from the NICU. For those individuals who are actually involved in the discharge

planning of high-risk newborns, information on rehospitalization in the immediate postdischarge period would be highly desirable. Few studies have reported on such events **(Gray et al 1996)**. This differs from the literature on healthy term newborns in which a number of studies have reported on rehospitalization rates shortly after discharge from the birth hospitalization for different follow-up periods, eg, 2 weeks **(Liu et al 1997)**. Given the volume of neonatal hospitaliza-tions and their contribution to pediatric health care spending, this represents an important area for potential improvements in hospital care quality. **(Carns et al 2010)**. Early discharge carry the risk of increased rate of readmission to hospital in the first few weeks of life **(Wen et al 1998)**. The American Academy of Pediatrics has expressed concern about early discharge and has developed guidelines emphasiz-ing that early discharge be individualized and that stringent discharge criteria be used **(Fetus and Newborn Committee 1996)**. Such criteria aim to avoid the most common complications, namely, neonatal hyperbilirubi-nemia, sepsis and dehydration. Other concerns include loss of follow-up of newborns with abnormal results-of screening tests.

Proponents of early discharge claim that it is safe, decreases the risk of iatrogenic infection, promotes family bonding and attachment, and reduces the hospitalization care and patients costs. However, concerns have also been expressed about potential disadvantages of early discharge: breastfeeding is not established until the third or later postpartum day, a number of conditions do not manifest themselves early after delivery, time is reduced for in-hospital teaching on breastfeeding, infant care and women's health **(Farhat, Rajab 2011)**. Many neonatal readmissions occur due to non-preventable condition as com-munity-acquired infections while some readmissions occur for potentially preventable conditions such as extreme hyperbilirubi-nemia and feeding related read-missions which can be accom-panied by serious neonatal morbidity **(Liu et al 1997).**

SUBJECTS AND METHODS

All newborns admitted to our regional neonatal care unit at Al Galaa Teaching Hospital over a 6 months period from 1st January 2012 to 30th June 2012 and discharged from the NICU within 4ds age were assigned into two groups according to whether readmission after discharge have

occurred (group I), or no readmission took place (group II). Group II cases were considered as control group when studying factors underlying and prognosis of newborn readmission. Subjects fulfilled the following inclusion criteria:

● Discharge at Age < 96 hours.

● Readmission should be in the first 14 days following discharge.

● Readmission of newborn who were only delivered in our hospital and no referral cases from other centers were considered as readmission in the study.

● Criteria for discharge: Normal cardiorespiratory adaptation to extra-uterine life, stable Temperature in cot, no apparent feeding problems (at least two successful feedings documented), physical examination of the baby by physician or other qualified health professional within 12 hours prior to discharge indicates no need for additional observation and/or therapy in hospital, arrangements are made for the mother and baby to be evaluated within I week of discharge.

Then all our studied cases were subjected to the following:

1. Complete neonatal history including:
   a) Maternal diseases
   b) Mode of delivery
   c) Apgar scoring
   d) Need for resuscitation.

2. Clinical assessment for weight, gestational age, presence or absence of congenital malformations.

3. Clinical examination and some laboratory investigations according to the case as: complete blood picture, C-reactive protein, serum bilirubin, serum electrolytes, culture for blood and cerebrospinal fluid when indicated, and chest x ray.

4. Outcome of the cases was recorded, and included final discharge, morbidity or mortality of study neonates.

Our results were processed and statistical analysis was done using SPSS Computer Program for Windows.

RESULTS

A total of 350 subjects were recruited in this study, of whom group I cases were considered when neonates were readmitted to the same Unit, and the remaining neonates served as control group (group II). Group I were 40 subjects and group II were 310 subjects.

Incidence of readmission among our study population was 11.4 % over the study period (6 months). Mean timing of readmission in group I subjects was 2.32 days following discharge, and mean duration of hospital stay was 6.5 days.

Table (1): Maternal and neonatal demographic characteristics of studied neonatal groups.

	Group I (n=40)		Group II (n=310)		Chi-square	
					X^2	P-value
1-Maternal diseases None	30	75.0	248	80.0		
Transient disease (eg Pregnancy induced hypertension)	3	7.5	31	10.0	4.481	0.106
Chronic disease (eg Hypothyroidism)	5	12.5	14	4.5		
Missing data	2	5.0	17	5.5		
2-Delivery Vaginal delivery	26	65.0	171	55.2	1.394	0.238
CS	14	35.0	139	44.8		
3-Apgar score at 5 min <4	3	7.5	0	0.0		
from 4-7	21	52.5	67	21.6	43.306	<0.001 *
>7	14	35.0	223	71.9		
Missing data	2	5.0	20	6.5		
4-Need for resuscitation Negative	15	37.5	240	77.4		
Positive	23	57.5	50	16.1	36.380	<0.001 *
Missing data	2	5.0	20	6.5		
5- Body weight (kg) >2.5	17	42.5	216	69.7		
2-2.5	15	37.5	59	19.0	15.549	<0.001 *
<2	6	15.0	15	4.8		
Missing data	2	5.0	20	6.5		
6- GA (w) Full term ≥37	21	52.5	230	74.2		
Pre term <37	17	42.5	60	19.4	10.815	0.002*
Missing data	2	5.0	20	6.5		

There is statistically significant difference between the two groups as regards apgar score, need for resuscitation, gestational age and birth weight. But not maternal disease nor the mode of delivery.

Table (2): Comparison between group I and group II as regard diseases when initially admitted.

	Group I		Group II		Chi-square	
	N	%	N	%	X^2	P-value
Sepsis						
Ruled out	16	40.0	240	77.4	25.253	<0.001*
Suspected	24	60.0	70	22.6		
Fits						
Absent	32	80.0	291	93.9	9.575	0.002*
Present	8	20.0	19	6.1		
Feeding problems						
None	9	22.5	155	50.0	11.787	0.003*
Mild	16	40.0	93	30.0		
Poor Feeding	15	37.5	62	20.0		
Dehydration						
None	28	70.0	263	84.8	55.357	<0.001*
Moderate	5	12.5	47	15.2		
Severe	7	17.5	0	0.0		
Respiratory distress						
Absent	28	70.0	248	80.0	2.125	0.145
Present	12	30.0	62	20.0		
Congenital heart disease						
Absent	32	80.0	290	93.5	8.836	0.003*
Present	8	20.0	20	6.5		

There is a statistically significant difference between the two groups as regard all diseases except respiratory problems.

Table (3): Comparison between level of serum bilirubin in both study groups when re-examined after discharge.

Groups	Serum bilirubin		T-test	
	Range	Mean ± SD	t	P-value
Group I	6 - 22	13.73 ± 4.96	7.112	<0.001*
Group II	2.8 - 17	9.27 ± 3.51		

The mean serum bilirubin was statistically significant higher in group I cases than group II .

Table (4): The incidence of readmission according to the cause and age of readmission.

Disease	N	%	Mean Age Of Readmission (days)
Jaundice	16	40.0	2
Sepsis	11	27.5	2.7
Feeding problems	5	12.5	2.3
Respairatory problems	4	10.0	2.6
Convulsions	2	5.0	1.2
CHD	2	5.0	3.1
Total	40	100.0	2.32

Incidence of readmission among our study population was 11.4 % over the study period (6 months). Mean timing of readmission in group I subjects was 2.32 days following discharge.
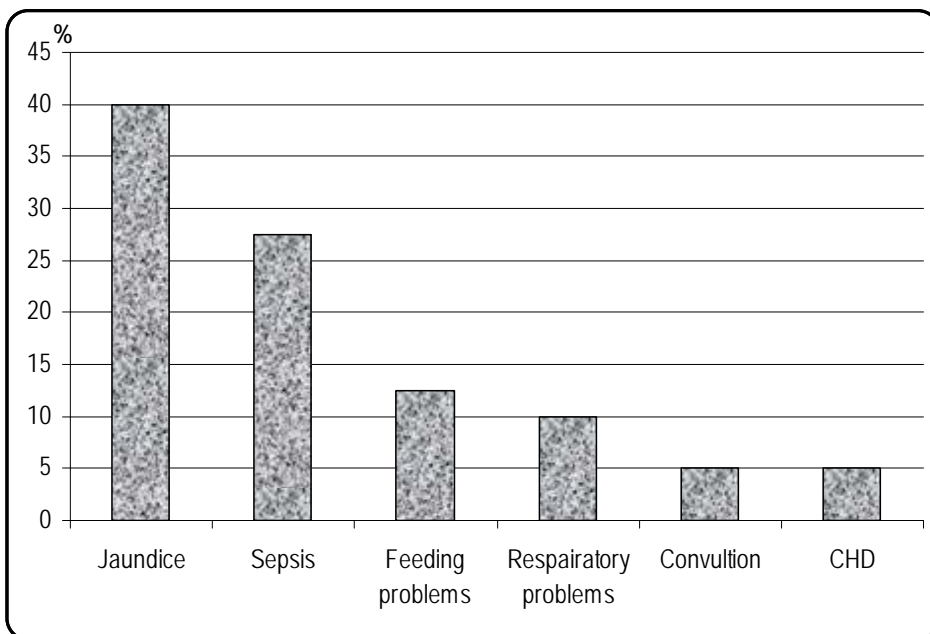
Figure (1): Incidence Of Causes Of Readmission

Table (5): Length of hospital stay after readmission

Disease	Number	Mean (days)	Range (days)
Jaundice	16	3	2 – 8
Sepsis	11	10	7 – 15
Feeding Problems	5	6	2 – 10
Respiratory Problems	4	8	4 – 10
Convulsions	2	8	4 – 12
CHD	2	12	10 – 14
Total	40	6.5	2 - 15

Mean duration of hospital stay in group I after readmission was 6.5 days while the range was 2 – 15 days.
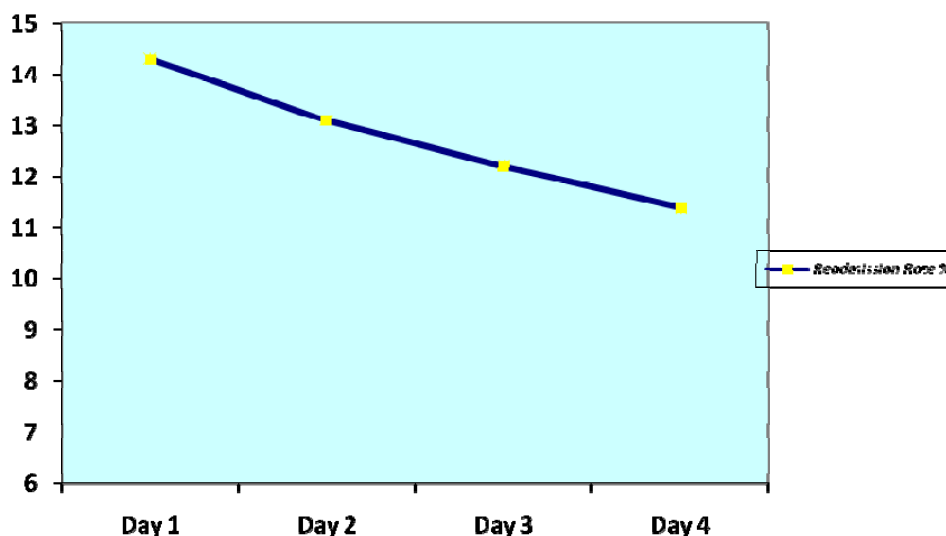
Figure (2): **Relation between mean length of hospital stay at birth and neonatal readmission rate**

This figure demonstrates an inverse relationship between neonatal readmission rate and average length of hospital stay at birth

DISCUSSION

Our results showed that incidence of readmission were 11.4 % of study subjects within study period. This is relatively high and different from other reported rates. For example neonatal readmission in a survey study was 6.5 % (**Rieger et al 1995**) and the author considered it among the highest rates in the United States as Canada rates may be as low, as 2.7 % (**Lee et al 1995**). In Lebanon, rate of readmission was 7.9% , out of which about 89% were early discharged ≤ 48 hours (**Farhat, Rajab 2011**).

In another study Rehospitalisation rates within two weeks after nursery discharge ranged from 1.0% to 3.7%. (**Escobar et al., 2005**). Of 1861 late-preterm infants delivered during the study period, 67 (3.6%) were readmitted within 28 days of birth (**Laurel et al., 2014**). This could be explained in part due to restriction of our cases to the neonatal unit, and not the nursery room, so neonates recruited in our study were suffering from some illnesses or complications of birth however in a similar study to ours done by **Escobar et al. in 1999** the overall

rehospitalization rate was 2.72% (among infants from 33 to 36 weeks' GA and <4 days' legnth of stay), which is 20% higher than the rate among healthy term newborns in the Kaiser Permanente Medical Care Program (2.26%). On the other hand, readmission rates might reflect lack of compliance of mothers to the follow up schedules, and to some environmental factors such as exposure to adult persons with infections.

Mean timing before readmission in our work was 2.3 days after discharge and the mean timing of discharge was 2.4 days, and mean duration of hospital stay was 6.5 days with range varying between 2-15 days. In a study done by **Laurel et al. in 2014** , the average age at readmission was 7.3 days; however, age varied according to infant's readmission diagnosis. The mean age at readmission was the youngest (4.5 days) for those infants with hyperbilirubinemia, whereas the mean age at readmission for feeding problems, hypothermia, and suspected infection was 10.4, 9.3, and 13.0 days, respectively . Our study showed less mean age of readmission 4.7ds vs 7.3ds , this may be because different age group studied and different diseases causing readmission as

the mentioned study examined readmission within 28ds period

Our results showed that some intrapartum events are significantly different between both study groups. Low 5 minutes apgar score, need for resuscitation, gestational age and weight are variables significantly different between both groups, which is expected in view of the ill consequences of these factors upon infant's health. This is supported by many studies as shown below:

-It was found that newborns undergoing a normal 6 hours postnatal transition are far less likely to have problems requiring hospitalization in the first 3 days of life than those who have an abnormal transition period **(Kong et al., 1997).**

-Low 5 minute apgar score was associated with higher post-discharge medical resource use and higher rate of rehospitalization **(Rich et al., 1995).**

-The work of **Lee et al. in 1995** showed that preterm neonates 33 to 36 weeks gestational age are more prone to be re-hospitalized than all other infants (adjusted odd ratio 1.88) . Another work showed that preterm infants are significantly more likely to be readmitted **(Worrall et al., 1997).** Previous

studies demonstrated that late-preterm infants may be up to 3 times more likely to be readmitted than term infants **(Mally et al., 2010)**. One of the factors associated with an increased risk of readmission to the hospital was gestation ≤ 36 weeks (OR, 4.56; CL, 1.45 to 14.33), and 37 1/7 to 38 weeks (OR, 2.95; CL, 1.63 to 5.35) versus ≥ 40 weeks **(Maisels, Kring 1998)** .

-**Farhat and Rajab in 2011** found a significantly increased risk of readmission for low birth weight newborns (weight < 2500 gram OR: 3.25 CL 1.23 to 8.52) of 2.8 times greater than that of normal birth weight.

-No statistically significant difference between both study groups as regards occurrence of maternal disease

When analyzing comparison between both groups concerning disease states, it was found that group I neonates had statistically significant higher rates of neonatal jaundice, sepsis, feeding problems, dehydration, abnormal movements and congenital heart disease. These results may be explained by the nature of these illnesses, which could present lately after the newborn have been discharged, and thus were missed or under-estimated.

Our study shows that the major cause of readmission was jaundice (40%) followed by sepsis (27.5%), feeding problems (12.5%) then respiratory problems (10 %) and lastly convulsions and congenital heart diseases (5% each) .These results are in accordance with the work results of others which revealed that 17 % of newborns under the age of 15 days readmitted to a tertiary centre suffer from cardiac defects, gastrointestinal obstruction, major infections, seizures, hyperbilirubi-nemia, and dehydration (**Britton et al., 1994). Lee et al. in 1995** showed that increased rates of readmission were most marked for jaundice and dehydration. While **Farhat and Rajab in 2011** showed that (84.2%) were readmitted due to hyperbilirubi-nemia, (10.5%) with a diagnosis of "rule out sepsis" and (5.3%) for respiratory distress. A similar causes of readmission was reported in the literature, in which jaundice accounted for 50% of the subjects (**Luca et al., 2009)**. Of 29,934 infants discharged, 247 (0.8%) were readmitted by the age of 14 days. 51% were admitted because of hyperbilirubinemia and 30% with the diagnosis of "rule out sepsis." **(Maisels, Kring 1998).** The majority of readmissions occurred due to hyperbilirubi-nemia, followed by feeding

problems, then hypothermia, and lastly suspected infection **(Laurel et al., 2014)**

We found that jaundice accounted for most readmissions. Other investigators have suggested that complications of early discharge would manifest principally as feeding-related problems that may be prevented with a longer stay. However, our findings confirm the population-based data (**Edmonsonm et al., 1997**) that the rate of feeding-related problems is not increased. One explanation for this disparity may be the degree of inpatient and outpatient support and training that was offered by our hospital. A more worrisome explanation is that there were unmeasured complications that a longer stay prevented. The identification of these variables should be a primary area of research. Establishing neonatal feeding was found to decrease the need for readmission of the neonates since inadequate breast milk intake is associated with increased neonatal jaundice (**Maisels and Meyer 1995).** To decrease the risks associated with neonatal jaundice, discharge and follow-up guidelines should be individualized for each infant and not mandated by gestational age at birth. Length of birth stay should be decided by considering the

impact of gestational age until 38 weeks. Practitioners must identify readiness for discharge by ensuring that infants have demonstrated appropriate feeding skills, do not experience excessive weight loss and have good supports in the community with appropriate follow-up. **(Ruth et al., 2014)**

Our study demonstrates an inverse relationship between neonatal readmission rate and average length of hospital stay at birth. The main reason for early readmission was neonatal jaundice, with a higher rate among infants in the early-discharge cohort than among those in the pre guideline (late discharge) cohort (8.6% v. 3.1%; odds ratio 2.96, 95% CI 2.29-3.84). **(Lock , Gray 1999).** Neonatal readmission rates increased from 27.3 per 1,000 in 1989/90 to 38.0 per 1,000 in 1996/97, while mean length of hospital stay at birth decreased from 4.2 days to 2.7 days during the same period. The provinces and territories with decreased length of hospital stay at birth usually had increased neonatal readmission rate and earlier age at readmission (**Liu et al., 2000)**. In Ontario the mean length of stay decreased from 4.5 days to 2.7 days and the readmission rate during the first 2 weeks of life

increased from 12.9 to 20.7 per 1000 **(Lee et al., 1995).** In multivariable regression, each additional day in length of stay was associated with a significantly reduced odds ratio (OR) for readmission (0.57, $P =$ .004) **(Laurel et al 2014) .** However a study done by **Goyal et al. in 2013** demonstrated no reduction in 7-day readmissions associated with longer legnth of stay for late preterm infants.

The outcome of studied neonates of both groups did not differ in statistically significant manner, which may reflect similar standards of care in the neonatal unit for both groups and influence of other factors upon morbidity and mortality notably the original diagnosis.

There are several limitations to our study. Readmissions to other hospitals after initial discharge were not included in our data set. However, we see no reason why there would be a sizeable difference between the early- and late-discharge groups. Furthermore, we had few data on individual maternal or neonatal risk factors that might otherwise explain why some newborns required readmission. Similarly, we were not equipped to demonstrate equivalence of the two groups according to other factors, such as maternal education, income and parity. Finally, our study was large enough to detect differences in rates of neonatal illness but not rare events like neonatal death.

CONCLUSIONS

We conclude from our results that multiple causes for readmission of newborns to neonatal unit are present particularly some illnesses like jaundice, sepsis, and dehydration, We recommend that timing of newborn discharge should be determined on individual basis, with consideration of perinatal history. We stress upon the importance of neonatal follow up in the first two weeks of life after being discharged from a hospital. The results of this study need to be supported by similar national multicenter studies involving University Hospitals and Ministry of Health Hospitals in future works.

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إعادة إدخال الأطفال حديثى الولادة إلى المستشفى بعد خروجهم المبكر من الحضانة

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د. ريهام شاكر عبد الحميد

مستشفى الجلاء التعليمى

أجريت هذه الدراسة على 350 طفل فى مستشفى الجلاء التعليمى فى الفترة من يناير 2012 إلى يونيو 2012 و قد تم خروجهم فى خلال 4 أيام من ولادتهم و تم تقسيم الأطفال إلى مجموعتين:

الأولى: عددهم 40 طفل تم إدخالهم مرة أخرى بعد خروجهم فى خلال 14 يوم من الخروج.

الثانية: عددهم 310 طفل لم يتم إدخالهم مرة أخرى إلى الحضانة.

وكل الأطفال قد تم اخذ الآتى من الملفات :

● تاريخ مرضى كامل للطفل و لأم .

● الفحص للأم و الطفل .

● التحاليل التى تم عملها للطفل .

النتائج:

● معدل أعادة إدخال الأطفال إلى الحضانة 11.4%.

● متوسط العمر عند أعادة الدخول إلى الحضانة 2.32 يوم بعد الخروج.

● عدد الأيام فى الحضانة بعد إعادة الدخول 6.5 يوم.

وقد تبين من النتائج :

1– أن أسباب دخول الحضانة عديدة أولها الصفراء ثم ميكروب بالدم – عدم أعطاء تغذية صحية – أمراض تنفسيه

2– كلما نقص عدد أيام وجود الطفل فى الحضانة بعد الولادة كلما زاد معدل إدخاله إلى الحضانة.

استخلصت الدراسة إلى أهمية و جود الطفل فترة كافية بالمستشفى بعد الولادة والفحص جيدا لتجنب إعادة إدخاله ببعض الأمراض مره أخرى ولابد من فحص الطفل بعد أسبوع من تاريخ الولادة .