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Original Research Article

Neonatal readmissions at Saint-Pierre hospital, epidemiology and risk factors

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ABSTRACT

Background: Newborn attendance at pediatric emergency departments has sharply increased in France since the early 2000s. Early discharge from maternity is the main risk factor. The purpose of this study was to describe the demographic and perinatal factors involved in the readmission to hospital of newborn babies in Southern reunion Island.
Methods: This was a 13-month, single-center, case-control retrospective study (December 2015 to December 2016) carried out in the neonatal and pediatric intensive care units of the Saint-Pierre university hospital. Cases were represented by any newborn released from the maternity hospital and having been re-hospitalized. Controls were represented by newborns born during the same study period and not readmitted during their first month of life. One case was matched with a control.
Results: We included 109 newborns. The re-hospitalization rate was 2.08%. The most common presentation were: fever (35.7%), and neurological symptoms (34.8%). The main etiologies were infections (33.9%), respiratory pathologies (24.7%), and breastfeeding difficulties (11.9%). Breastfeeding OR=0.53; 95% CI [0.30-0.92] (p=0.03) and neonatal pathologies during the stay in the maternity hospital OR=0.49; 95% CI [0.28-0.45] (p=0.016) were protective factors.
Conclusions: The lack of identification of a risk factor encourages us to expand our study population and to look for other factors such as the medical and paramedical supervision of the mother-child couple during the postpartum period and the follow-up of the new born after leaving the maternity ward.

Keywords: Risk factor, Re-hospitalization, Newborn

INTRODUCTION

According to the national institute of statistics and economic studies, there were 785,000 births in France in 2016. This figure has tended to decrease since 2010 with in particular 809,556 births in 2014.[1] At the same time as the decrease in the number of births, we are seeing an increase in the number of consultations of newborns in pediatric emergencies as well as their readmission. Thus in 2002, infants under one year of age had the highest rate of emergency room visits (48% of pediatric emergency room consultations).[2-4] Within a period of ten years, visits to pediatric emergencies have practically doubled at the national level, going from 7 million in 2000 to 14 million in 2010, including 4% of newborns aged less than 28 days.[5-6] Similarly, each year in France, 2 to 3% of newborns discharged from the maternity ward are rehospitalized before their 28th day of life during the neonatal period.[7] While early discharge from the maternity ward is frequently reported in the literature as

being a risk factor for readmission during the neonatal period, other factors such as maternal sociodemographic characteristics or factors specific to the newborn are little studied.[8-12] The main objective of this work is therefore to determine the risk factors that promote hospital readmission of newborns and secondarily to describe the epidemiological, clinical and etiological profile of readmissions in the reunionese context.

METHODS

This was a retrospective analytical study of the case-control type over a period of 13 months from December 1, 2015 to December 31, 2016 and carried out at the Saint-Pierre university hospital center in reunion and particularly in the two units of the "pediatric resuscitation and neonatology" service.

Were defined as cases: any newborn aged less than 28 days discharged from the maternity ward of the Saint Pierre university hospital or other surrounding hospitals and having been re-hospitalized within one of the two aforementioned care units, whatever the reason for hospitalization.

Were excluded from the study: hospitalized newborns coming from the delivery room, newborns hospitalized in the neonatal intensive care units or neonatal resuscitation unit; direct transfers from other maternity wards for any pathology at birth; incomplete files.

Were defined as controls: newborns born at Saint-Pierre university hospital during the same study period and not hospitalized during their first month of life.

The matching was done on the gestational age at birth, according to a ratio of 1 control for 1 case.

The sample size was calculated by the following formula: $N=z^2\times p(1-p)/m^2$ (z=1,96, p=standard deviation and m=marging of error).

Neonatal variables

Age at re-hospitalization, gestational age at birth, gender, birth weight, the mode of delivery, the pathology diagnosed at birth, the duration of the maternity stay, the reasons for consultation.

Maternal variables

Age, work status, marital status, parity, pathology identified during pregnancy.

Risk factors

Early discharge from the maternity ward (duration between the date of birth and the discharge, which is lower discharge than 72 hours for vaginal deliveries and less than 96 hours for caesarean deliveries), the male gender, smal for gestational age,primiparity, young maternal age (<18 years) at childbirth, difficult socio-economic conditions (unemployed, family isolation, single, divorced/separated or widowed), the low level of studies defined by a level lower than high school, exclusive breastfeeding when leaving the maternity ward, maternal pathologies during pregnancy, neonatal pathologies during the stay in the maternity ward.

Data were entered anonymously into a database designed using Microsoft excel software. Statistical analysis was performed using MedCalc 12.3.0 software. The comparison between the cases and the controls was made according to the McNemar test. A value of $p<0.05$ was considered significant. The odds ratio was calculated with a 95% confidence interval.

Ethical approval was approved by the institutional ethics committee

RESULTS

During our study period, we counted 5222 births in the south of reunion. One hundred and seventeen newborns were re-hospitalized. Eight files were rejected due to their incompleteness. A total of 109 cases were retained. The re-hospitalization rate was calculated in relation to the number of live births in the south of reunion. This rate was therefore 2.08%.

The average of the terms of birth was 38.5 weeks and the median of 39 weeks. Birth weight averaged 3150±527.8 grams. The other characteristics summarized in Table 1.

Table 1: Characteristics of newborns.

Variables	N	Percentage (%)
Gender		
Female	50	45.8
Male	59	54.1
Sex ratio : 1.1		
Age new-born at admission (Days)		
0-7	9	8.26
7-13	40	36.7
14-20	36	33.03
21-28	34	31.19
<37 weeks	11	10.09
>37 weeks	98	89.91
Low birth weight<2500 g	11	10.09
Small for gestational age	5	4.59
Vaginal delivery	70	64.22
Cesarean	19	17.43

We counted 14 cases (12.8%) of early discharge (all modes of delivery combined).

The most frequent reasons for hospitalization were: fever (39 cases or 35.7%), neurological reasons (38 cases or

34.8%), respiratory reasons (36 cases or 33%), consultations for disorders weight gain (loss of weight or stagnation of the weight curve; 28 cases or 25.6%), and digestive reasons (21 cases or 19.2%).

The most frequent hospitalization diagnoses were: infections (37 cases or 33.9%); respiratory pathologies (27 cases or 24.7%), breastfeeding problems (insufficient weight gain due to lack of intake and difficulty in setting up breastfeeding; 13 cases or 11.9%), and digestive pathologies (11 cases or 10%). Concerning the distribution of re-hospitalization diagnoses according to age at admission: newborns aged less than 8 days were mainly admitted for breastfeeding difficulty (37.5%) and for jaundice (18 .7%), newborns aged between 8 and 14 days were mainly admitted for infectious (30.9%) and respiratory (21.4%) etiologies and newborns older than 15 days were mainly admitted for infectious (37.7%) and respiratory (32%) etiologies (Figure 1).

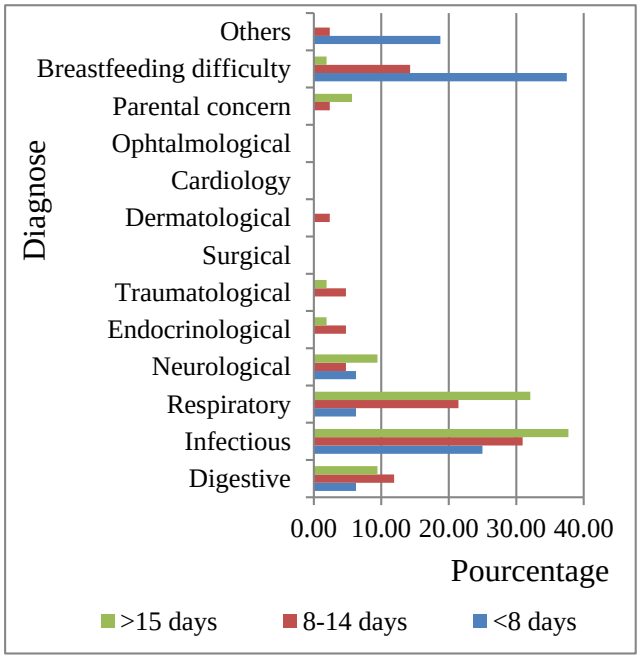

Figure 1: Rehospitalisation diagnoses according to days of life on admission.

The mean length of hospital stay was 3.6±2.7 days.

The average age of the mothers was 27.8±6.2 years. The minimum maternal age was 16 years and the maximum maternal age was 46 years. Thirty-nine mothers or 35.7% presented a pathology during their pregnancy. These pathologies were represented by: gestational diabetes (14 cases or 35.8%), medical history (18 cases or 46.1%), hospitalizations in a high-risk pregnancy unit (4 cases or 10.2%).

The presence of neonatal pathology during the stay in the maternity ward was a protective factor, while the other factors were not significant (Table 2). Breastfeeding was a protective factor while the other factors were not significant (Table 3).

Table 2: Neonatal risk factor.

Variables	P value	OR	IC 95%
Male gender	0.68	-	-
Neonatal pathologies during the stay in the maternity hospital	0.016	0.49	0.28-0.45
Small for gestational age	0.41	-	-
Early discharge*	0.69	-	-

*The 11 children born prematurely were excluded from the analysis for the "early discharge" risk factor because this variable was defined according to the 2014 HAS criteria and therefore only concerns children born at term (n=98 cases and 98 witnesses) but also because of their small number.[26]

Table 3: Maternal risk factors.

Variables	P value	OR	IC 95%
Age< 18 years	1	-	-
Exclusive breast feeding	0.03	0.53	0.30-0.92
Low level of education	0.58	-	-
Family isolation	0.88	-	-
Disease during pregnancy	0.4	-	-
Unemployed	0.24	-	-
Primiparity	0.26	-	-
Origin			
Réunion	NS		
Métropolis	NS		
Mayotte	0.09		
Smoking during pregnancy	0.17	-	-

DISCUSSION

The re-hospitalization rate found in our study is included in the values reported by other authors. Eleven recent studies (including 7 retrospective and 4 prospective) have in fact evaluated this rate between 1 and 10%.[11,13-19] Our results are in particular similar to those of Oddie, who found a rate of 2.8%.[11]

Although the average age of re-hospitalization varies greatly according to the literature, the studies of Chen and that of Farhat found a similar average age of 14 days.[14,17] The male predominance found in our results is in agreement with most of the published studies.[12,21] The reason for this finding remains unknown.

The reasons for hospitalization of newborns in pediatric emergency departments are variable but mainly dominated by medical reasons. By reporting a predominance of fever and neurological reasons, our data differ from those of the French literature which rather

targets the predominance of digestive and respiratory reasons. Thus, Claudet reported that digestive reasons were the majority (25%) followed by respiratory reasons (21%) while fever and jaundice represented only 11% and 1.7%.[21] The trend is different for Canada and the United States, where jaundice and feeding difficulties are the first reasons for consultation.[23,24] Our results agree with those of Mabiala-Babela, who found fever (40%) to be the main reason for consultation in the emergency room.[25]

Concerning the etiologies of re-hospitalizations, the literature underlines two facts: the first is that the most frequent etiology of re-hospitalizations remains jaundice.[26] The second concerns the distribution of etiologies according to the age of newborns. Pathologies related to neonatal adaptation such as jaundice and problems related to breastfeeding are found in newborns aged less than 14 days and more precisely less than 7 days. Conversely, infections and digestive pathologies mainly concern new-born children older than 14 days.[26] Thus, Chen studied the readmission rate by including newborns aged less than 14 days. The main reason for readmission was jaundice at 74%.[14] Vanpée, in a prospective study carried out in Sweden in 2009, included newborns aged less than 7 days and found a similar result: 78% of readmissions were attributed to jaundice.[20] Young's retrospective study carried out in the United States in 2006 found the same observation: the most common etiologies in newborns aged less than 14 days concerned feeding difficulties and jaundice, while respiratory etiologies concerned those aged more than 14 days.[27] In our study infections and respiratory etiologies predominated. In accordance with the literature, they concerned newborns aged over 7 days.

The literature is not consensual concerning early maternity leave. Some studies claim that early discharge (within 48 hours of birth) from maternity increases the risk of readmission of newborns. Liu and Lee, in a retrospective cohort study carried out between 1990 and 1997, objectified an increase in neonatal readmissions, which was inversely proportional to the reduction in the length of stay in maternity (4.2 days in 1990 against 2.7 days in 1997).[28,29] Furthermore, Paul found that an early discharge of less than 72 hours for newborns born by caesarean section was a risk factor for rehospitalization (OR=1.44, [1.07-1.96], p<0.02).[15] Other studies (the majority of which were conducted in the United States) found the opposite finding: Kotagal did not find a significant association between early discharge (defined as less than 48 hours after birth) and readmission in the first 14 days of life in term neonates delivered vaginally or by caesarean section.[30] Edmonson have objective that early discharge (less than or equal to 48 hours from birth in newborns born vaginally) did not increase the risk of readmission (adjusted OR=1.05 [0.71-1.53]).[31] The discrepancy between the literature data and the results of our study can be explained by two facts. First, our definition of early discharge was different from those in the literature (which is defined by any discharge during the first 48 hours of life after birth). Our definition was based on the recommendations issued by the high authority of health in 2014 (during the first 72 hours of life after vaginal delivery or during the first 96 hours of life after cesarean delivery).[26] Secondly, the medical supervision of the mother-child couple in intra-hospital and during home follow-up was not taken into account in our analysis. Indeed, Vanpée report the experience of the Karolinska university center, where they emphasize that between 2003-2004 and 2007-2008, discharges before 72 hours increased (66% vs 77%), but readmissions before the 7th day of life decreased (3.2 per month against 3.3 per month). Contributed to these results: improved home monitoring, better identification of risk factors for jaundice, maternal anxiety and food problems, the institution of a newborn examination at 72 hours.[20]

Several authors define male gender as a specific risk factor for readmission in newborns.[10,15,32-35] Thus Escobar in a 2-year retrospective study carried out from 1998 to 2000 in the United States objectified an adjusted OR of 1.28 [1.11-1.50].[12] The reason for this finding remains unknown.

The small for gestational age (SGA) was not defined as a risk factor given to the low number of cases found in our study population: 5 out of 109 or 4.6%. The literature is unequivocal concerning SGA, defining it as a risk factor for readmission.[16,18,35] Thus, Kattie defined an OR=1.01 [1.00-1.03] while Oddie found an adjusted OR=1.95 [1.16-3.28].[10,11]

Our study objectified the presence of neonatal pathologies during the stay in the maternity ward as a protective factor. Some authors have found an opposite result, but only concerning jaundice. Thus, Errol found a higher frequency of jaundice in readmitted children.[24] Maisels defined jaundice as a risk factor, OR=1.73 [1.14-2.63].[34] The contrast could be explained by the benign nature of the pathologies presented by the newborns in our study.

As with early discharge, data from the literature on breastfeeding methods are contradictory. Oddie found a significant association between breastfeeding and a reduced risk of readmission (OR=0.69 [0.53-0.90]).[11] However, other authors have defined breastfeeding as a risk factor.[15,25,34,35] According to the scientific argument of the high Autority of Health published in 2014, a longer length of stay, a socio-cultural context favorable to breastfeeding and optimized home monitoring are favorable to good quality breastfeeding, which indirectly reduces the risk of readmission.[26]

Concerning primiparity, the data from the French literature are in contradiction with those from the Anglo-Saxon literature. Claudet found that newborns of multiparous mothers were more often hospitalized (RR=1.70 [1.27-2.21] p<0.001). According to the author,

siblings play a vector role in the transmission of infectious agents and a direct role in the occurrence of trauma or an indirect role through the phenomenon of maternal overflow and less surveillance.[21] On the other hand, the authors Danielsen and Kotagal have defined primiparity as a risk factor for readmission (respectively OR=1.21, OR=1.52 [1.26-1.83].[10,32] This observation could be explained by the inexperience of primiparous mothers and/or the inadequacy of supervision by the medical team in the hospital or at home. Nevertheless, these two hypotheses have not been evaluated by these authors.

The lack of involvement of young maternal age as a risk factor could be explained by the low proportion of cases noted (4 cases out of 109, i.e., 3.7%) but also by a tendency for parturient to age in Southern reunion. The influence of young maternal age on the risk of readmission is still debated. Thus, Martens et al found a higher risk of readmission in newborns born to mothers aged 17 or less (adjusted OR=1.30 [1.10-1.55]).[36] On the other hand, Paul have objectified that newborns born to mothers aged 30 or over were more at risk of being readmitted.[15]

Some authors define maternal pathology during pregnancy as a risk factor. Maisels found that maternal diabetes increased the risk of readmission (OR=3.45 [1.39-8.60]).[34] Finally, Paul found the involvement of maternal hypertension and pre-eclampsia.[15] Pre-eclampsia increases the risk of chronic fetal distress, perinatal asphyxia and premature birth.[37] Gestational diabetes increases the risk of neonatal respiratory distress, macrosomia, cardiac malformation and metabolic disorders (hypoglycaemia and hypocalcaemia).[37]

The non-significance of the unemployed factor could be explained by the high rate of unemployed mothers in the southern réunion (60% from 2001 to 2016 according to the report of the perinatal epidemiological survey in southern réunion).[38]

Our study did not show a significant association either for family isolation (p=0.88) or for low level of education (p=0.58). Kotagal also found no association while Edmonson defined them as a risk factor.[31,39]

Limitations

The retrospective nature of the study, the small sample size, the geographical location of the files (2 hospitals only), the method matching (1 case for 1 control, no matching according to gender) represent the main limitation of this study.

CONCLUSION

Hospital readmission during the first month of life of the newborn remains an infrequent incident both in the literature and in southern reunion. “Non-avoidable” causes represented by infections and respiratory pathologies predominated over “avoidable” causes (problems breastfeeding and jaundice). Given the lack of significant data, it is difficult for us to rule on the question, particularly concerning early discharge, which remains the most discussed risk factor in the literature. Two factors proved to be protective factors, namely the existence of neonatal pathology and exclusive breastfeeding. However, the interpretation of our results must be carried out with a critical mind due to the retrospective nature of our study and its many limitations, methodological differences compared to those of the literature (in particular concerning the definition of early discharge), the socio-demographic context of mothers in southern Reunion and the different methods of care for the mother-child couple during their stay in the maternity ward and during home care. In order to establish a certain causal link, it will be necessary in the future to enlarge the study population and to insist on the prospective nature. This perspective should also include the evaluation of supervision in the maternity ward and follow-up at home because the literature is unanimous on their strongly preventive role.

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