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Clinical Characteristics and Prognostic Factors of Neonatal Intracranial Haemorrhage: A Study of 84 Cases

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Abstract

Introduction: Neonatal intracranial haemorrhage is relatively common. The aim of our study was to describe the clinical characteristics and prognostic factors of neonatal intracranial haemorrhage at the National Children's Hospital Albert Royer (NCHAR) in Dakar.

Materials and methods: This was a descriptive study including all newborns hospitalised in the NCHAR neonatal intensive care unit between 1 January 2017 and 31 December 2021 for intracranial haemorrhage diagnosed on brain imaging.

Results: Eighty four newborns were collected, including 43 boys. The mean age of the newborns was 4.3 days (extremes of 32 minutes and 27 days). Clinical manifestations were dominated by respiratory distress (n=63; 75%) and neurological signs (n=23; 27.4%). Intra ventricular haemorrhage was more common (73 cases or 87%), 45 of which were grade 2, followed by isolated intra parenchymal haemorrhage (7 cases or 8.3%). Etiological factors were dominated by prematurity (n=50; 59.6%) and infections (n=42; 50%). Several aetiological factors (≥ 2) were found in 44 newborns (52.4%). Treatment included oxygen therapy (89.2%), blood transfusion (58.3%), osmotherapy (10.7%), anticonvulsants (22.6%). The evolution in hospital was unfavourable in 39 newborns, including 24 premature. The risk factors for death were the presence of respiratory distress with an odd ratio of 0.27 [CI 0.09-0.83] and a P value of 0.016. Thirty newborns (66.7%) were followed up after hospitalization for a mean of 14 months (extremes of 2 weeks to 53 months). An evolution without sequelae was noted in 27 newborns.

Conclusion: Neonatal intracranial haemorrhages predominate in premature babies and are a major cause of morbidity and mortality in the acute phase.

Keywords: Neonatal; Agriculture; Chemistry; Green chemistry; Renewable energy; Intracranial haemorrhage

Introduction

Intracranial Haemorrhage (ICH) in preterm and term neonates is increasingly recognised, with an estimated incidence of between 0.27 and 0.49 per 1000 live births [1]. The real incidence of ICH is probably higher than reported, due to the presence of asymptomatic forms and some subtle and atypical presentations. Intracranial haemorrhage is an important source of morbidity and mortality, and is more frequent in premature babies, especially intra-ventricular haemorrhage [2-4]. In Africa, few data have been reported and its incidence is not well known [5-7]. The aim of our study was to describe the clinical features and prognostic factors of intracranial haemorrhage in neonates.

Materials and Methods

We conducted a retrospective and prospective mono-centric study with a descriptive aim from 1 January 2017 to 31 December 2021 in the neonatology department of the National Children's Hospital Albert Royer (NCHAR) in Dakar (Senegal).

All newborns (≤ 28 days) hospitalised for intracranial haemorrhage (diagnosis was done by transfontanellar ultrasound or by brain CT scan) were included. Neonates with incomplete or unusable records were excluded.

We collected data about biographical parameters, personal and family history, clinical and para-clinical signs (biology, imaging), etiological factors, treatment and outcome.

The results will be presented as averages for quantitative parameters and as percentages for qualitative parameters. The data from the medical records were entered and analysed using Microsoft office excel. The significance threshold was retained for a p-value <0.05 (*Chi-square* test). To analyse the risk factors, odds ratios were calculated as well as their Confidence Intervals (CI). The confidence interval of the Odds Ratio (OR) was calculated using the Woolf method.

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Results

We collected 84 newborns, representing a hospital frequency of 2.5% of neonatal admissions, 43 (51.2%) male and 41 girls. Thirty-three newborns (39.3%) presented within 3 hours of birth. The average age of the newborns was 4.34 days (extremes of 32 minutes of life and 27 days). Delivery was varied: Caesarean section in 25 babies (29.7%), natural childbirth in 58 (69%) with the use of instrumental manoeuvres (forceps, vacuum) in 2 babies (2.4%). In one baby (1.2%), the type of delivery was not specified. The mean gestational age was 33 Weeks of Amenorrhoea (WA) plus 4 days (extremes 24 and 43 WA plus 2 days) (Table 1). Poor adaptation with an Apgar score below 7 at one minute was noted in 31 patients (37%). The mean birth weight was 1750 g (extremes 620 g and 3900 g) with 51 premature babies.

Table 1: Perinatal data.

Parameters	Number	Percentage (%)
Male gender	43	51,2
Gestational age in WA		
<28	13	15,5
28-32	25	29,8
32-37	13	15,5
≥ 37	33	39,3
Weight (grams)		
<1000	20	23,8
1000-1500	23	27,4
1500-2500	22	26,2
≥ 2500	19	22,6
Consultation period		
≤ 3 h	33	39,3
3 h-24 h	31	37
24 h-48 h	2	2,4
>48 h	16	19
NP	2	2,3

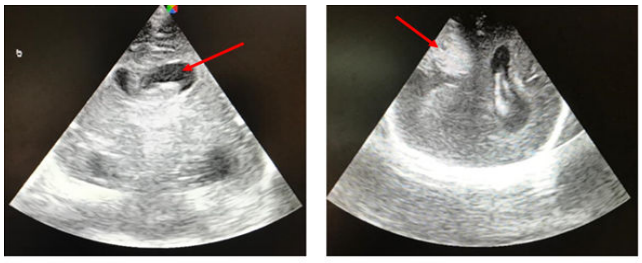
Clinical manifestations were dominated by respiratory distress (75%), neurological signs (27.4%), dehydration (21.4%) and haemorrhagic syndrome (20.2%) (Table 2). Four neonates (4.8%) were asymptomatic.

Table 2: Clinical manifestations.

Clinical manifestations	Number	Percentage (%)
Neurological signs	23	27,4
• Convulsions	15	17,8
• Bulging anterior fontanel	8	9,5
Respiratory distress	63	75
Dehydration	18	21,4
Undernutrition	11	13,1
Cholestatic jaundice	10	12
Fever	12	14,3

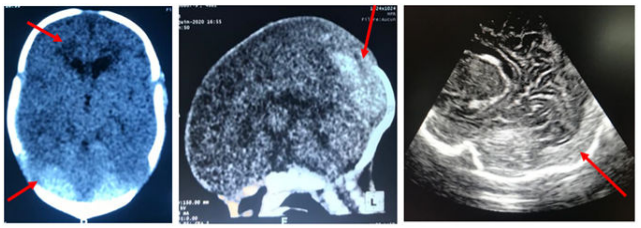
Hypothermia	7	8,3
Haemorrhagic syndrome	17	20,2
• Umbilical	1	1,2
• Digestive	4	4,7
• Sampling site	2	2,4
• Subgaleal hematoma	2	2,4
• Cephalohaematoma	1	1,2
• Pulmonary	1	1,2
• Purpura	3	3,6
• Sero-sanguineous hump	3	3,6

Seventy five neonates (89.3%) had Trans Fontanellar Ultrasound (TFUS), 2 (2.4%) had brain CT and 7 (8.3%) had both combined. The abnormalities were Intra Ventricular Haemorrhage (IVH) (87%), isolated intraparenchymal haemorrhage (8.3%), subarachnoid haemorrhage (2.4%) and subdural haematoma (2.4%). According to the Volpe classification, IVH was grade 1 in 9 cases (10.7%), grade 2 in 45 cases (53.6%), grade 3 in 11 cases (13.1%), grade 4 in 3 cases (3.6%) and unspecified in 5 newborns (5.9%). IVH was present in 49 preterm infants, whereas the lesions were more varied in term infants (Figures 1 and 2).



A B

Figure 1: Ultrasound images of Volpe grade 4 intraventricular haemorrhage.



A B C

Figure 2: Images of a newborn at 23 days of age with a bi-occipital hematoma and active hydrocephalus on the brain scan (A and B) and subdural occipital hematoma on transfontanellar ultrasound.

Table 3: Biological abnormalities.

Biological abnormalities	Number	Percentage (%)
Hematological disorders		
Anemia	44	52,4
Thrombocytopenia	26	31
Hyperleukocytosis	9	10,7
Leukopenia	5	6
Ionic disorders		
Hyponatremia	11	13,1
Hypernatremia	15	17,8
Hyperkalemia	20	23,8

Hypokalemia	5	6
C-reactive protein positive	25	29,7
Hyperbilirubinemia (total, conjugated)	35	41,7
Hepatic cytolysis	5	6
Decreased prothrombin time	9	10,7
Hypoglycemia	3	3,6
Hyperglycemia	14	16,7

Identified aetiological factors were dominated by prematurity (59.6%), infections (50%), dehydration (14.3%) and anoxic ischaemic encephalopathy (14.3%) (Table 4). More than two etiological factors for intracranial hemorrhages were found in 44 newborns (52.4%).

Table 4: Etiological factors.

Etiological factors	Number	Percentage (%)
Prematurity	50	59,5
Infections	42	50
Dehydration	15	17,8
Anoxic-ischemic encephalopathy	12	14,3
Cholestasis	3	3,6
Under nutrition	4	4,8
Hemorrhagic diseases of the newborn	4	4,8
Arteriovenous malformation	1	1,2
Congenital heart disease	1	1,2

Forty nine neonates (58.3%) were transfused: Packed red blood cells in 35 patients (41.7%), platelet concentrate in 4 patients (4.8%) and fresh frozen plasma in 10 patients (12%).

Osmotherapy with hypertonic saline was performed in 9 neonates (10.7%). Nineteen neonates (22.6%) had received anticonvulsant therapy. Oxygen therapy with spectacles was required in 56 neonates (66.6%), 8 with continuous positive airway pressure (9.5%), 11 with optiflow (13.1%) and ventilatory support in 19 neonates (22.6%). Seventy two neonates (85.7%) had received Vitamin K1 supplementation. The short term outcome was unfavorable in 39 newborns, 24 of whom died prematurely, and the lethality rate of 46.4%.

The risk factors for death were the presence of respiratory distress with an odd ratio of 0.27 (0.09-0.83) and a P of 0.016.

Thirty neonates were followed up after hospitalization with a mean follow up of 14 months (extremes of 2 weeks to 53 months). Twenty-six neonates had no sequelae while 4 others had psychomotor delay probably due to the presence of ICH associated with anoxoischemia lesions.

Discussion

Intracranial haemorrhage in newborns has been rarely reported in our country. Since the last publication on the subject, we collected 84 newborns in 4 years in the neonatal intensive care unit of the NCHAR of Fann. The increasing number of ICH cases over the years in our study could be explained by the fact that its search has become systematic as soon as the diagnosis is suspected using the TFUS available at the bedside.

Predominance of ICH in premature infants would be due to neurological and vascular immaturity. Clinical manifestations varied according to the location of the bleed and the grade according to the Volpe classification. Cole, et al., had found that the main clinical manifestations of ICH were convulsions (67%) and respiratory distress (47%). In our study, the proportion of these features was respectively 17.8% and 75% of newborns.

Medical care combined symptomatic (management of of ICH complications) and etiological treatment (fighting against infection, dehydration, coagulopathy and vitamin K deficiency).

Symptomatic ICH in term neonates had a low mortality rate of 11%-24.5% in the acute phase, whereas in premature infants, mortality depended on the occurrence of metabolic, respiratory, haemodynamic, digestive complications [8,9].

In our study the mortality rate was high (46.4%) and prematurity was not a risk factor for death. The high mortality rate could be partly explained by the associated perinatal asphyxia, as most of the deceased neonates had a significantly lower Apgar score at 5 min

(p=0.016). ICH in newborns remained a cause of disability in survivors, with 57% of developmental delays. These neuropsychological impairments would depend on the type of ICH. The most favourable results were observed with subdural haemorrhage, as opposed to Subarachnoid Haemorrhage (SAH) [10]. Mei-Chen Ou-Yang, et al., had found normal psychomotor development in the majority of patients with SAH and/or IPH. Grade III and IV haemorrhages were associated with a high risk of cerebral palsy, blindness and motor and cognitive disorders, whereas for grade I and II haemorrhages, the risk of neurodevelopmental disorders was low at 8% [11].

The neurodevelopmental outcome in survivors in our study after a median follow-up of 14 months was normal in the majority of children (90%) but long term follow up was needed to determine whether neurological complications develop in these subjects with maturity.

Conclusion

Neonatal intracranial haemorrhage is associated with high acute mortality and neurodevelopmental sequelae in survivors. We do not have enough experience to assess the long term prognosis, which implies follow-up during childhood and adolescence.

Conflict of Interest

We declare that we have no conflict of interest.

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