

## Research Article

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# Pattern of admission and outcome of neonates admitted to neonatal intensive care unit of alobaid pediatrics teaching hospital-North Kordofan state, Sudan

## Abstract

**Background:** Neonatal morbidity and mortality in our country is high; In order to improve neonatal outcome, it is crucial to identify the areas where health care can be improved. Therefore, studying the pattern of admission and outcome among neonates can be a valuable tool in auditing hospital performance.

**Materials and Methods:** Descriptive cross sectional hospital based study. This study was covered all neonates fulfills case definition; admitted to NICU of Alobaid pediatric teaching hospital during the period from November 2020 to April.

**Results:** the study show the pattern of admission and outcome among neonates with sample size of 750, most of them admitted at the first 24 hours of birth (94%), (70.8%) were term and almost the half of neonates had birth weight less than 2.5 kg (42.1%). The majority of the admitted neonates were delivered via caesarian-section (62.8%). Moreover, the most common cause of admission among them was prematurity and especially RDS (29%), neonatal sepsis (16.5%) and TTN (14%). About tow third of admitted neonates were discharge on good condition (70%) and the overall mortality was 152 neonates (20.4%). Additionally gestational age, maternal complication and antenatal care follow-up were found to be significantly associated with the neonatal outcome.

**Conclusion:** prematurity, RDS and neonatal sepsis were most common cause of admission and death, all these etiologies are preventable up to some extent, and if detected earlier can be effectively treated in order to reduce morbidity and mortality. As (62.8%) of admitted neonates were delivered via caesarian-section, a revisit for the indications of cesarean deliveries may help to improve the neonatal outcome.

**Keywords:** neonatal sepsis, caesarian-section, neonatal outcome, neonatal intensive care unit, Sudan

## Introduction

The neonatal period considered the time from birth up to the first 28 days of life and further classified into very early (birth to < 24 hours), early(24hr to <7 days and late or last neonatal period (7 days to < 28 days).<sup>1</sup> It is characterized by the transition from extra uterine life and rapid growth and development, it is the common vulnerable time or period of human life as it accounts for more high mortalities and morbidities, however, most of them are preventable, so management of the neonate should concentrate on parental anticipatory guidance and early detection or identification of conditions that carry the risk of morbidity or even death.

It is the most hazardous and dangerous period compared to any other period during the child's first year of life.<sup>2</sup> Neonatal morbidity or mortality rate is the number of deaths during the first 28 completed days of life per 1000 live births in a given year.<sup>3</sup> Newborn health is the key to child health and survival. About 2.4 million children died in the first month of life in 2019 globally. There are approximately 7000 newborn deaths every day, amounting to 47% of all child deaths under the age of 5 years, up from 40% in 1990. The vast majority of these neonatal deaths occur in poor countries suffering from diseases and conditions associated with a lack of quality care at birth or skilled care and treatment quickly or immediately after birth and in the first days of life.<sup>4</sup> Since 1990, the globe has made substantial progress in child survival, and in 2019, the number of neonatal deaths declined from

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5.0 million to 2.4 million. In Northern America and Europe, which has one of the lowest under-five mortality rates among SDG regions, during the neonatal period 54 per cent of all under-five deaths occur. An exception is Southern Asia, 62 per cent where the proportion of neonatal deaths is among the highest, although a relatively high under-five mortality rate. In 2019, Sub-Saharan Africa had the highest neonatal mortality rate at 27 deaths per 1,000 live births, followed by Southern and Central Asia with 24 deaths per 1,000 live births. A child born in sub-Saharan Africa or Southern Asia is 10 times more likely to die in the first month compared to a child born in a high-income country.<sup>4</sup> In countries with a high burden of neonatal and child mortality, a variety of interventions could substantially reduce deaths and improve maternal and perinatal outcomes. Care and interventions primarily performed during vast periods from antenatal to the later childhood period can facilitate reductions in neonatal mortality. However, a great obstacle to meeting the proposed reduction is that most neonatal and child health programs do not reach those who need them. Therefore, effective and sufficient interventions and care-based plans need to be more widely deployed to all and be more delivered across the continuum of reproductive, maternal, neonatal and child health care.<sup>5,6</sup> According to WHO the majority or most of all neonatal deaths (75%) occur during the first week of life and within the first 24 hours, about 1 million newborns die. Preterm birth, intrapartum-related complications, infections and birth defects cause most neonatal deaths in 2017.<sup>4</sup> However in Sudan's Demographics Profile,

2019 Birth rate is 34.2 births/1,000 populations (2018 EST).<sup>7-10</sup>  
Neonatal morbidity and mortality in Sudan a developing country is high; To improve neonatal outcome, it is crucial to identify the areas where health care can be improved. Therefore, studying the pattern of admission and outcome among neonates can be a valuable tool in auditing hospital performance.

## Methodology

Descriptive cross-sectional hospital-based study to determine the Pattern of admission and outcome in neonates admitted to NICU of Alobaid pediatric teaching hospital-North Kordofan, from 1st November 2020 to 30 of April 2021. After written consent, 750 neonates were enrolled in this study. Both primary and secondary data were collected. Primary data was collected using interviews. Face-to-face interviews were conducted by interviewers who were research assistants. Data was collected by using a structured questionnaire, developed by the researcher based on the objectives of the study and explained to the participants in simple Arabic. The collected data was checked, verified, coded, then entered into the computer and analyzed using IBM SPSS advanced statistics version 22 (SPSS Inc., Chicago, IL).

## Results

(Table 1-16)

**Table 1** Distribution of neonates according to Sex

Sex	Frequency	Percent
Male	435	58%
Female	315	42%
<b>Total</b>	<b>750</b>	<b>100%</b>

**Table 2** Distribution of neonates according to age at admission

Age	Frequency	Percent
1 <sup>st</sup> 24 hours	702	94%
Day 2	26	3%
Day 3	18	2%
Day 4	4	1%
<b>Total</b>	<b>750</b>	<b>100%</b>

**Table 3** Maternal characteristics parity

Parity	Frequency	Percent
1	290	39%
2	106	14%
3	94	13%
4	71	9%
5 or more	189	25%
<b>Total</b>	<b>750</b>	<b>100%</b>

**Table 4** Maternal complications during pregnancy

Complications	Frequency	Percent
No complication	392	52.30%
Pregnancy induced hypertension	129	17.30%
Gestational diabetes	81	10.80%
Antepartum hemorrhage	70	9.30%
Premature ruptured of membrane	52	7%
Hepatitis b +ve mothers	8	1%
Malaria	10	1.30%
Anemia	4	0.50%
UTI	4	0.50%
<b>Total</b>	<b>750</b>	<b>100</b>

**Table 5** Antenatal Care follow- up

Antenatal Care	Frequency	Percent (%)
YES	615	82%
NO	135	18%
<b>Total</b>	<b>750</b>	<b>100%</b>

**Table 6** Mode of delivery

Mode of delivery	Frequency	Percent (%)
Normal Vaginal delivery	284	37.90%
Emergency c/s	229	30.50%
Elective c/s	230	30.70%
Assisted vaginal delivery	7	0.90%
<b>Total</b>	<b>750</b>	<b>100%</b>

**Table 7** Distribution of neonates according to weight at birth

Weight per Kg	Frequency	Percent
Normal (2.5-3.5)kg	434	57.90%
LBW (1.5-2.49)kg	206	27.50%
VLBW (1-1.49)kg	59	7.90%
ELBW (<1)kg	8	1%
>3.5kg	43	5.70%
<b>Total</b>	<b>750</b>	<b>100%</b>

**Table 8** Distribution of neonates according to cause of admission (Diagnosis)

Cause of admission	Frequency	Percent
Neonatal sepsis	124	16.50%
Prematurity	217	29%
MAS	25	3%
Birth Asphyxia	56	7.50%
Neonatal Jaundice	36	5%
TTN	105	14%
Congenital heart disease	14	2%
Congenital malformation	44	6%
IUGR	31	4%
Neonatal meningitis	4	0.50%
HDN	13	1.70%
IDM	81	10.80%
<b>Total</b>	<b>750</b>	<b>100%</b>

**Table 9** Distribution of neonates according to duration of Admission

Duration of admission	Frequency	Percent
<7days	534	71%
7-14 days	193	26%
>14 days	23	3%
<b>Total</b>	<b>750</b>	<b>100%</b>

**Table 10** Distribution of neonates according to fate of admission (Outcome)

Fate of admission	Frequency	Percent
Discharge in good condition	526	70%
Discharge with complication	2	0.30%
Death	152	20.40%
Referred	56	7.50%
Discharge against medical advice	14	1.80%
<b>Total</b>	<b>750</b>	<b>100%</b>

**Table 11** Death according cause of admission (Diagnosis)

Cause of admission	Frequency	Percent
Prematurity	88	57.89%
Neonatal sepsis	20	13.16%
Birth Asphyxia	15	9.87%
MAS	3	1.97%
Neonatal Jaundice	3	1.97%
TTN	2	1.32%
Congenital heart disease	5	3.29%
Congenital malformation	6	3.95%
IUGR	1	0.66%
HND	6	3.95%
IDM	0	0.00%
Neonatal meningitis	1	0.66%

**Table 12** Correlation between complications of pregnancy and fate of admission (Outcome)

Complications of pregnancy	Outcome						Total
	N	Discharge in good condition	Death	Referred	Discharge against medical advice	Discharge With Complication	
Pregnancy induced hypertension	N	78	43	5	3	0	129
	%	14.83%	28.29%	8.93%	21.43%	0	17.20%
Gestational diabetes	N	76	2	0	2	1	81
	%	14.45%	1.32%	0	14.29%	50%	6.40%
Antepartum haemorrhage	N	32	36	1	1	0	70
	%	6.08%	23.68%	1.79%	7.14%	0	8.27%
Premature ruptured of membrane	N	35	11	5	0	1	52
	%	6.65%	7.245	8.93%	0	50%	6.93%
No complication	N	289	55	44	4	0	392
	%	54.94%	36.18%	78.57%	28.57%	0	52.27%
H.B +ve	N	5	0	0	3	0	8
	%	0.95%	0.00%	0	21.43%	0	1.07%
Malaria	N	4	4	1	1	0	10
	%	0.76%	2.63%	1.79%	7.14%	0	1.33%
Anaemia	N	3	1	0	0	0	4
	%	5.70%	4.93%	0	0	0	4%
UTI	N	4	0	0	0	0	4
	%	0.76%	0.00%	0	0	0	0.53%
<b>Total</b>	<b>N</b>	<b>526</b>	<b>152</b>	<b>56</b>	<b>14</b>	<b>2</b>	<b>750</b>
	<b>%</b>	<b>70.13%</b>	<b>20.20%</b>	<b>7.47%</b>	<b>1.87%</b>	<b>0.27%</b>	<b>100%</b>

**Table 13** Outcome of complicated pregnancy versus uncomplicated pregnancy

Complication of pregnancy	Outcome						Total
	N	Discharge on good condition	death	referred	Discharge against medical advice	Discharge with complication	
Uncomplicated pregnancies	N	298	55	44	4	0	392
	%	73.70%	14%	11.30%	1%	0%	100%
Complicated pregnancies	N	237	97	12	10	2	358
	%	66.20%	27%	3.40%	2.80%	0.60%	100%

**Table 14** Correlation between Antenatal care follow up and Fate of Admission (Outcome)

Antenatal care follow up	Outcome					Total
	Discharge in good condition	Death	Referred	Discharge against medical advice	Discharge With Complication	
YES	N 461	97	44	12	1	615
	% 75%	15.7%	7%	2.10%	0.20%	82
NO	N 65	55	12	2	1	135
	% 48%	40.80%	9%	1.50%	0.70%	18
Total	N 526	152	56	14	2	750
	% 70%	20%	9%	2%	0.27%	100

PValue <0.001

**Table 15** Correlation between Gestational age and Fate of Admission (Outcome)

Gestational age	Outcome					Total
	Discharge in good condition	Death	Referred	Discharge against medical advice	Discharge With Complication	
term ≥37weeks	N 402	64	51	12	2	515
	% 76.43%	42.11%	78.46%	85.71%	100%	68.67
preterm≤37weeks	N 124	88	5	0	0	233
	% 24%	57.89%	7.69%	0.00%	0	31.07
> 42 Post dark	N 0	0	0	2	0	2
	% 0	0	0.00%	14.29%	0	0.27
Total	N 526	152	65	14	2	750
	% 70%	20.27%	8.67%	1.87%	0.03%	100

PValue <0.001

**Table 16** Correlation between Cause of admission (diagnosis) and fate of admission (Outcome)

Cause of admission	Outcome					Total
	Discharge in good condition	Death	Referred	Discharge against medical advice	Discharge With Complication	
Neonatal sepsis	N 88	20	10	6	0	124
	% 16.73%	13.16	17.86	42.86	0	16.53
Prematurity	N 124	88	5	0	0	217
	% 23.57%	57.89	8.93	0	0	28.93
MAS	N 20	3	0	2	0	25
	% 3.80%	1.97	0	14.29	0	3.33
Birth Asphyxia	N 37	15	2	2	0	56
	% 7.03%	9.87	3.57	14.29	0	7.47
Neonatal Jaundice	N 33	3	0	0	0	36
	% 6.27%	1.97	0	0	0	4.8
TTN	N 103	2	0	0	0	105
	% 19.58%	1.32	0	0	0	14
Congenital heart disease	N 0	5	9	0	0	14
	% 0	3.29	16.07	0	0	1.87
Congenital malformation	N 8	6	30	0	0	44
	% 1.52%	3.95	53.57	0	0	5.87
IUGR	N 28	1	0	2	0	31
	% 5.32%	0.66	0	14.29	0	4.13
HND	N 7	6	0	0	0	13
	% 1.33%	3.95	0	0	0	1.73
IDM	N 6	0	1	0	1	8
	% 1.14%	0	1.79	0	50	1.07
Neonatal meningitis	N 2	1	0	0	1	4
	% 0.38%	0.66	0	0	50	0.53
Total	N 526	152	56	14	2	750
	% 70.13%	20.27	7.47	1.87	0.27	100

PValue <0.001

(Figure 1-4)

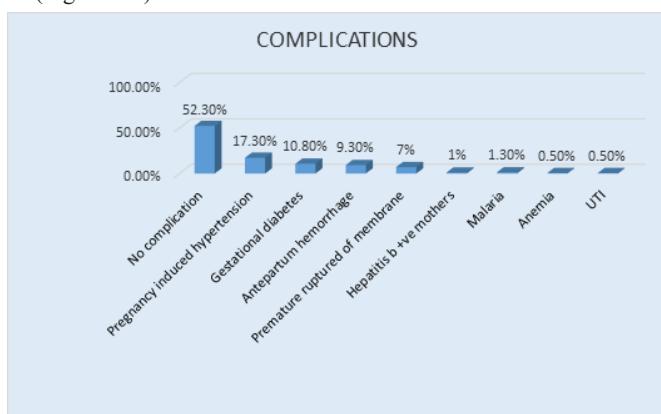


Figure 1 Maternal complications during pregnancy.

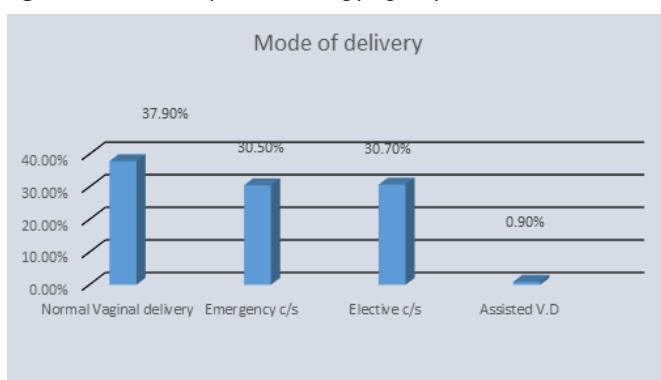


Figure 2 Mode of delivery.

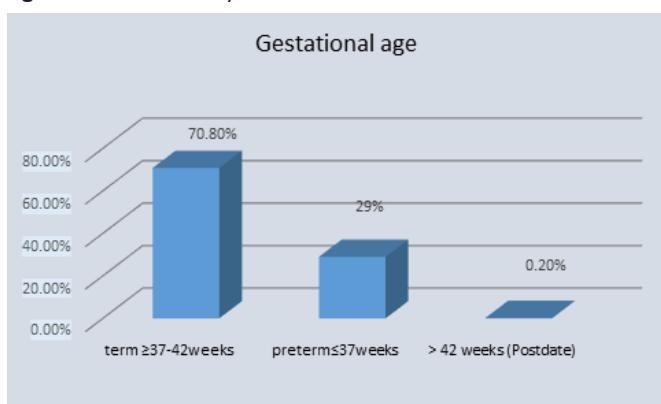


Figure 3 Distribution of neonates according to gestational age.

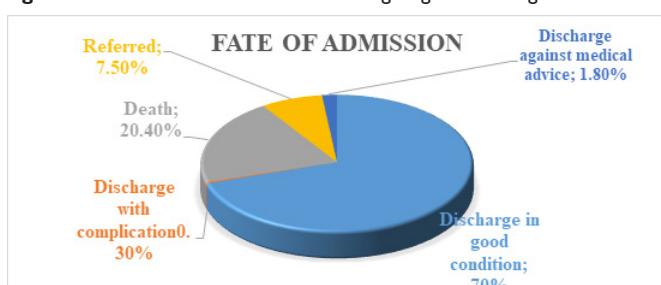


Figure 4 Distribution of neonates according to fate of admission (Outcome).

## Discussion

This is a hospital-based study aimed to demonstrate the pattern of admission and outcomes of neonates admitted to the NICU at

Alobaid pediatric teaching hospital during the period from the first of November 2020 to the thirty of April 2021. Of 750 neonates admitted during the study duration, the male sex was predominant. The majority of admitted neonates were in the first 24 hours of birth. This result consists of the study done in Southwest Ethiopia titled Pattern of disease and associated factors among neonates admitted to neonatal intensive care unit at Jimma university medical centre, (61.9%) were male neonates making the male to female ratio 1.6:1. Vast majority of them (68.3) were admitted in less than 24 hours of their birth.<sup>11</sup> More than one-third of neonate mothers were primigravida (39%), where the grand multipara were (25%), this result is in an agreement with a study done in Northwest Ethiopia in which there were (55.9%) primigravida mothers and (44.1%) multiparous women.<sup>12</sup> About half of the mothers had uncomplicated pregnancy (52.3%), and about tow third (73.7%) of their admitted neonates were discharged in good condition and (14%) of them died. Unfortunately, complicated pregnancies had a higher number of deaths represent (27%), with the most common complication being pregnancy-induced hypertension (17.2%) this result is supported by WHO estimation in 2015 in which 5.6 million women and babies died resulting from complications in pregnancy, childbirth and in the first month of life involving 303 000 maternal deaths, 2.7 million newborn deaths and 2.6 million stillbirths. Most of these deaths occur on the day of birth, the majority are preventable causes.<sup>13</sup> The vast majority of all mothers had antenatal care follow-up (85.4%), with more than two third of their neonates discharged in good condition (75%) and only (15.7%) of them died, in contrast with the neonates whose mothers had no antenatal care follow up, more than third of them died (40.8%). This result is consistent with the result obtained from 193 Demographic and Health Surveys from 69 low-income and middle-income or developing countries titled Antenatal care services and its implications for vital and health outcomes of children, they found that at least one ANC visit was associated with a 1.04% points reduced probability of neonatal mortality and a 1.07% points lower probability of infant mortality.<sup>14</sup>

In this study a total of 750 deliveries, more than half (61.2%) were cesarean section deliveries, this large percentage of cesarean section deliveries need a lot of effort to find out their causes and solutions. About two third of neonates were term (70.8%), and regarding the birth weight, almost half of neonates had a birth weight of less than 2.5 kg (42.1%). Similar findings were reported in a study conducted in Jordan, in which the term neonates represent (62.2%) with a gestational age of ≥37 weeks, the majority of mostly the admitted neonates were delivered via caesarian section (62.8%), and the remaining were delivered normally (37.2%).and (40.9%) of all neonates were weighted less than 2.5kg.<sup>15</sup>

The most common causes of admission to the NICU were prematurity (29%), and about half of them were diagnosed with RDS (49.7%). Followed by neonatal sepsis (16.5%) and TTN (14%). This result is more or less the same as it was observed in the research conducted in the NICU of Saad Abu Elella Teaching Hospital in Khartoum, Sudan 2018 where the major or common diagnosis at admission was neonatal sepsis (28.6%), followed by respiratory distress syndrome (23.3%) and then neonatal jaundice which represents (13.6%).<sup>16</sup> However in a study from a Single Academic Center in Jordan the incidence of neonatal sepsis was 4.4% only.<sup>17</sup> This discrepancy may be due to that about one-third of neonates in this study had a low birth weight (<2.5)kg which is a risk factor for neonatal sepsis, this result was reached in the study done at Gadarif Teaching Hospital, Sudan titled Neonatal sepsis in a General Sudanese Teaching Hospital, Sudan.<sup>18</sup>

In this study, about two third of admitted neonates were discharged in a good condition (70%) and most of them were discharged in less than 7 days (71%).and only (3%) stay more than 14 days. Unfortunately, (20.2%) of the neonates in our study died, Likewise Safaa A, Mohammed A, et al, at Saad Abu Elella hospital and Ehab A, Dina T, et al at NICU of Zagazig University Children's Hospital in Egypt in 2019, all reported a high percentage of death;(at 15%) and (19.2%) respectively.<sup>15,19</sup> Alternatively, a low percentage was documented in a study done in a District hospital in urban India (1.03%).<sup>20</sup> As prematurity was the most common cause of admission in this studied neonates, we were not surprised it was the most common cause of death accounting for more than half of deaths (58.89%), this is maybe due to the lack of facilities available in the neonatal unit followed by neonatal sepsis and birth asphyxia. This result consists of the leading causes of neonatal deaths in Sudan (2017) according to HEALTHY NEWBORN NETWARK: 40% Preterm birth complications, 22% Intra Partum related events, 18% Sepsis | tetanus, 8% Congenital abnormalities,1% Diarrhoea,6% Pneumonia, and 5% Other conditions.<sup>21</sup>

## Conclusion

Prematurity, RDS and neonatal sepsis were the most common cause of admission and death, all these etiologies are preventable up to some extent, and if detected earlier can be effectively treated to reduce morbidity and mortality. As (62.8%) of admitted neonates were delivered via caesarian section, a revisit for the indications of cesarean deliveries may help to improve the neonatal outcome.

## Funding

None

## Conflicts of interest

The authors declare that they have no conflicts of interest.

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