

Prevalence, Associated Factors, and Outcome of Neural Tube Defects: A Retrospective Study

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The aim was to assess the prevalence, associated factors, and outcome of neural tube defects (NTDs). A retrospective study design was applied at neonatal intensive care unit. Study subjects: A convenience sample of all (90) neonates who were admitted to the study setting during 12 months period and diagnosed as having NTDs were chosen retrospectively. Tool: One structured interview questionnaire was implemented. It included three sections: Personal and clinical data of neonates, characteristics and clinical data of neonates' mother, and associated factors of NTDs. Study results: It was indicated that 62.2% of neonates were males, 56.7% of NTDs were preterm neonates, 58.9% of neonates were delivered emergency cesarean section (CS). Concerning the discharge outcome from NICU; 46.7% of NTDs' neonates have died. The present study revealed that 55.6% of neonates having NTDs their mothers aged from 20-29 years and 44.4% had parents' consanguinity. Moreover, it was found that NTDs were more prevalent (40% and 37.8%) with mothers who were multigravida <4 and >4 and 76.7% were multipara <4. 28% of congenital anomalies (CAs) neonates were having NTDs; 53.3% of NTDs were spina bifida followed by 40% were hydrocephalus and 4.4% were encephalocele. The study results found that recurrent abortions 30% and diabetes mellitus (DM) 4.4% among mothers of the studied neonates before current pregnancy. In addition; 15.6% were taking drugs, 7.8% had an infection, only 6.7% were taking folic acid, and 4.4% had gestational diabetes during current pregnancy.

Keywords: Associated factors, neural tube defects, outcome, prevalence, retrospective study.

Neural tube defects (NTDs) still a main problem in developing countries (1). Worldwide, the congenital anomalies' (CAs) are affecting about 3-7% of all neonates. The incidence has been proved to differ from one geographical area to another. Many studies stated, NTDs seem to be the most widespread systemic CAs (2, 3, 4). "NTDs are CAs emerging from developmental deformity of the central nervous system (CNS) during the embryonic period" (5). NTDs consist

of disorders termed spina bifida, anencephaly, and encephalocele which are all present at birth (1).

NTDs are linked with many factors that could be either genetic or environmental (6). However folic acid deficiency exists as a contributing factor of NTDs (7). So, folic acid supplementation is predictable to decrease the occurrence of NTDs (8). Also, certain associated factors as diabetes mellitus (DM), preconception period fever (indicating infection), and therapeutic

drugs have increased the occurrence of NTDs (9, 10, 11). Other associated factors such as parental consanguinity, maternal age, male sex, and prematurity (12).

Prenatal diagnosis of NTDs, its types, and detection of cases have increased its prognosis (13). Survived infants who were born with CAs; have affected their health physically, mentally, or socially. Also, they are more susceptible to morbidity (14).

Study significance

CAs are one of primary causes of mortality and morbidity in developed and developing countries (15, 16). NTDs encompass a major public health problem. It is estimated that about 300,000 neonates are born each year with NTDs worldwide (17). The WHO in 2010, reported that 270,000 neonates died worldwide because of CAs, with NTDs being one of the most serious and most common of these anomalies (18). Treatment and prognosis of infants and/or children with CAs are so difficult (19). So, early detection, diagnosis, and determine causes of CAs consider the base of prevention programs (20).

Study aim

The aim was to assess the prevalence, associated factors, and outcome of neural tube defects.

Research question

What is the prevalence, associated factors, and outcome of NTDs among neonates?

MATERIALS AND METHOD

Study design

A retrospective study design was applied in this study.

Study setting

The study conducted at the Neonatal Intensive Care Unit (NICU) in Assiut University Children Hospital.

Study subjects

A convenience sample of all (90) newborn infants (from a total of 1400 neonates). They were admitted to the NICU during 12 months period from January to December 2016 and diagnosed as having NTDs were chosen retrospectively based on medical records of the hospital. NTDs were diagnosed by neonatologists based on the clinical evaluation of neonates.

Data collection tool

One structured interview questionnaire was implemented through three sections as follow:

Section I: Personal and clinical data of neonates as; gestational age, sex, method of delivery, type of gestation, and discharge outcome from NICU.

Section II: Characteristics and clinical data of neonates' mothers as; age, job, residence, parents' consanguinity. Also, number of mothers' gravidities, parities, abortions, stillbirths, and neonatal deaths.

Section III: Associated factors of neural tube defects containing:

Related to neonates as; male gender, multiple gestations, and preterm neonates.

Related to neonates' mothers as; age and parents' consanguinity. And obstetrical history (i.e. multigravida, multipara, and recurrent abortions). History of diseases, complications before current pregnancy (i.e. medical illness as DM and hypertension, and previous congenital anomalies). Complications during current pregnancy (i.e. anemia, gestational diabetes or pregnancy induced hypertension, infection, deficiency of folic acid intake, and taking drugs during pregnancy).

METHOD

- Official permission for conducting the study was obtained from the head of NICU. The aim of the study was clarifying.
- The tool's content validity index (CVI) was done by five experts in the field of pediatric nursing and pediatrics (CVI = 0.9). While Cronbach's alpha coefficient was used to test the tool's internal consistency $r=0.81$.
- Nine newborn infants (10%) of the study sample were included in the pilot study. It was applied to test the applicability of the study tool. No changes were performed. It was included in the study sample.
- The study data was collected by the researcher. It was performed during four months. From April to August 2017, in the morning and afternoon shift, two days/week.
- A written approval was taken from the head of NICU. The researchers confirmed that the collected data used only to fulfill the study aim.

Statistical analysis

The statistical package for social science software (SPSS) version 16.0 was used to enter and analyze the study data. Frequencies and percentages (i.e. qualitative variables) and Means and standard deviations (i.e. quantitative variables) were used to describe the statistics.

RESULTS AND DISCUSSION

The study found that 62.2% of neonates were males. It was in the same with (21, 13)

who found that anomalies of the CNS were more prevalent (61.1%) among males to females with a ratio of 1.6:1. Disagree with (22) who indicated that sex was not associated with CAs. This result attributed that male gender had lethal, sex, and genetic predisposing factors which affect their health. Regarding gestational age; a higher incidence (56.7%) of NTDs was found among preterm neonates. The result is in accordance with (15) who indicated that a significantly higher incidence of CAs was in preterm neonates when compared with the full term neonates. This could

Total numbers of admission and NTDs

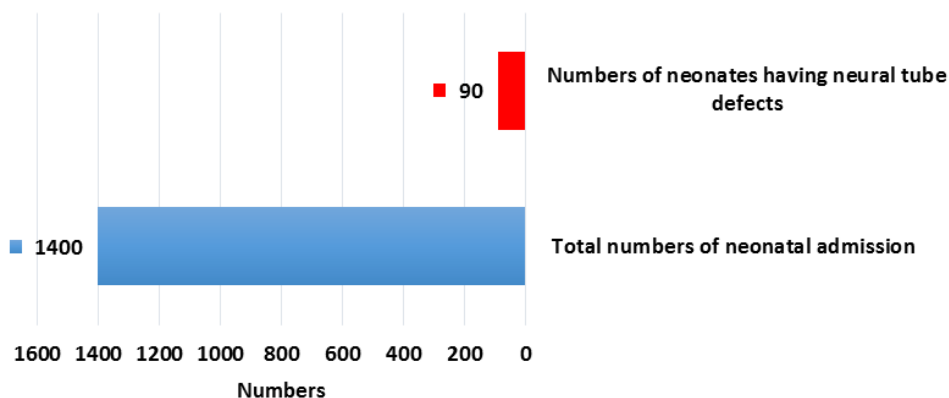


Fig. 1. Distribution of total numbers of neonatal admission and neural tube defects

Table 1. Personal and clinical data of the studied neonates (N=90)

Data of neonates	No	%
Sex:		
• Male	56	62.2
• Female	34	37.8
Type of neonates' gestation:		
• Single	81	90.0
• One of twins	9	10.0
Gestational age:		
• Preterm	51	56.7
• Full term	39	43.3
Mean ± SD (Min-max)	36.9 ± 2.2 (28-40)	
Method of delivery:		
• Normal vaginal delivery	16	17.8
• Elective CS	21	23.3
• Emergency CS	53	58.9
Discharge outcome from NICU:		
• Improvement	48	53.3
• Death	42	46.7

Table 2. Characteristics of the studied neonates' mothers (N=90)

Characteristics of mothers	No	%
Age/years:		
• <20	10	11.1
• 20-29	50	55.6
• 30-39	26	28.9
• 40 and more	4	4.4
Mean ± SD (Min-max)	26.8 ± 6.5 (16-43)	
Occupation:		
• Housewife	78	80
• Working	18	20
Residence:		
• Rural	64	71.1
• Urban	26	28.9
Parents' consanguinity:		
• Present	40	44.4
• Not present	50	55.6

be explained that the presence of CAs made the neonates more complicated and high risk to be delivered before the normal birth time.

Furthermore, 58.9% of neonates were delivered emergency CS this could be due to that most of the NTDs in the studied sample were hydrocephalus and needed urgent CS. Concerning the discharge outcome from NICU; 46.7% of

NTDs' neonates have died. This was in agreement with (22) who reported that the relation between CA and neonatal deaths less frequent than other acute conditions, with no statistically significant difference.

The present study revealed that 55.6% of neonates having NTDs their mothers aged from 20-29 years. The result was concurrent with (13) who revealed that 73.6% of mothers aged less than 35 years, their delivered infants had CNS anomaly. (23, 24) indicated that the median mother's age at CAs' diagnosis was between 20 -< 30 years old. Furthermore, 44.4% had parents' consanguinity. The finding was strengthened by (25, 26). This could be attributed that consanguinity is considered one of the most common contributing factors in transferring CAs' genetic traits.

Moreover, it was found that NTDs were more prevalent among multigravida mothers <4 and more than 4 (40% and 37.8% respectively) and multipara <4 were 76.7%. These were in the same line with (27, 25) who highlighted that multiparity was one of the obstetrical risk factors for congenital malformation in Egypt.

The total number of neonatal admission was 1400 neonates; 90 (6.4%) of them have NTDs. 28% were having NTDs, while 72% were having other congenital anomalies. These results were consistent with (13, 28) who found that NTDs were the most frequent types of CAs (32.5%). Also, (1) indicated that 63.3/10 000 children in

Table 3. Obstetric history of mothers of the studied neonates (N=90)

Obstetric history	No	%
Number of gravidities:		
• Primigravida	20	22.2
• <4	36	40.0
• 4 and more	34	37.8
Mean \pm SD (Min-max)	3.2 \pm 2.0 (1-9)	
Number of parities:		
• <4	69	76.7
• 4 and more	21	23.3
Mean \pm SD (Min-max)	2.9 \pm 1.6 (1-7)	
Number of abortions:		
• No	63	70.0
• <3	22	24.4
• 3 and more	5	5.6
Number of still births:		
• No	89	98.9
• 1-2	1	1.1
Number of neonatal deaths:		
• No	82	91.1
• Yes	8	8.9

Prevalence of NTDs

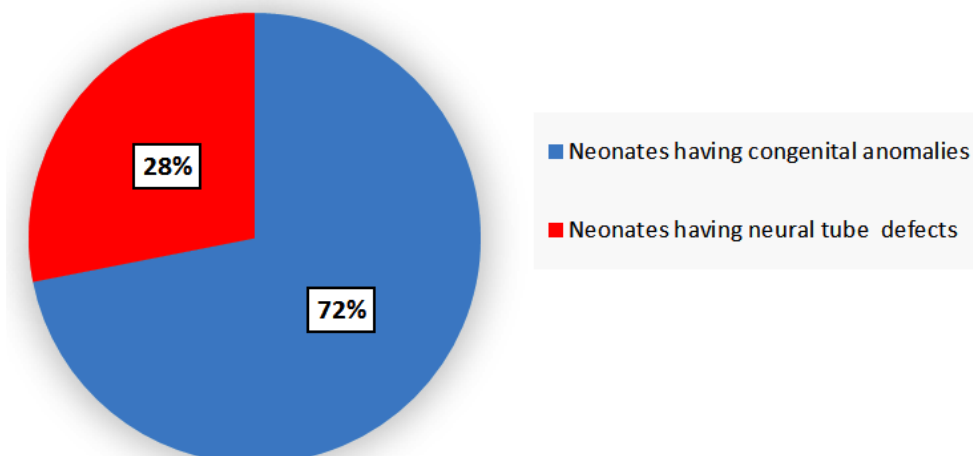


Fig. 2. Prevalence of neural tube defects among congenital anomalies neonates

Ethiopia have NTDs. As well, the study findings revealed that 53.3% of NTDs were spina bifida followed by 40% were hydrocephalus and 4.4% were encephalocele. It came in agreement with (29, 13) who reported that spina bifida was the most prevalent NTDs (68.1%). Also, (1, 21) declared that spina bifida, anencephaly, and encephalocele were the most prevalent. This could be explained

by the prevalence and type of NTDs may differ with time and/or geographical setting.

The study results found that recurrent abortions 30% and diabetes mellitus 4.4% were the most associated factors as regards NSTDs before current pregnancy among mothers of the studied neonates. (30, 27, 31) support this study result. As they declared that occurrence of illness during

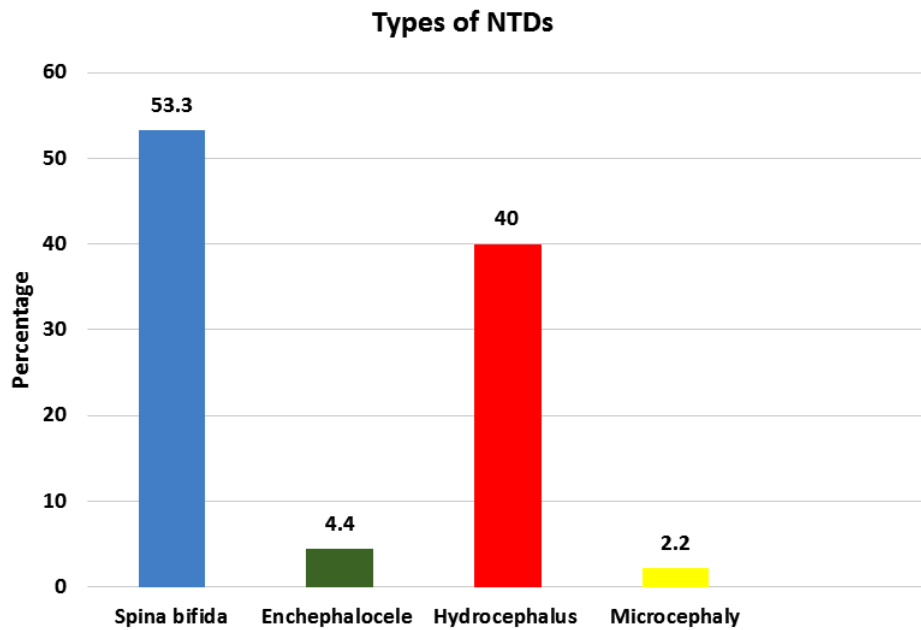


Fig. 3. Prevalence of neural tube defects' types among neonates

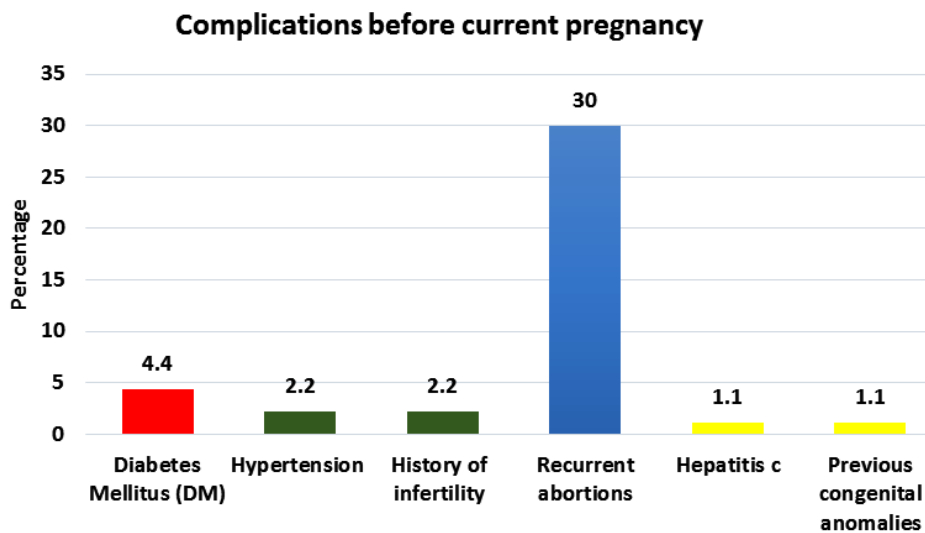


Fig. 4. Complications before current pregnancy among mothers of the studied neonates

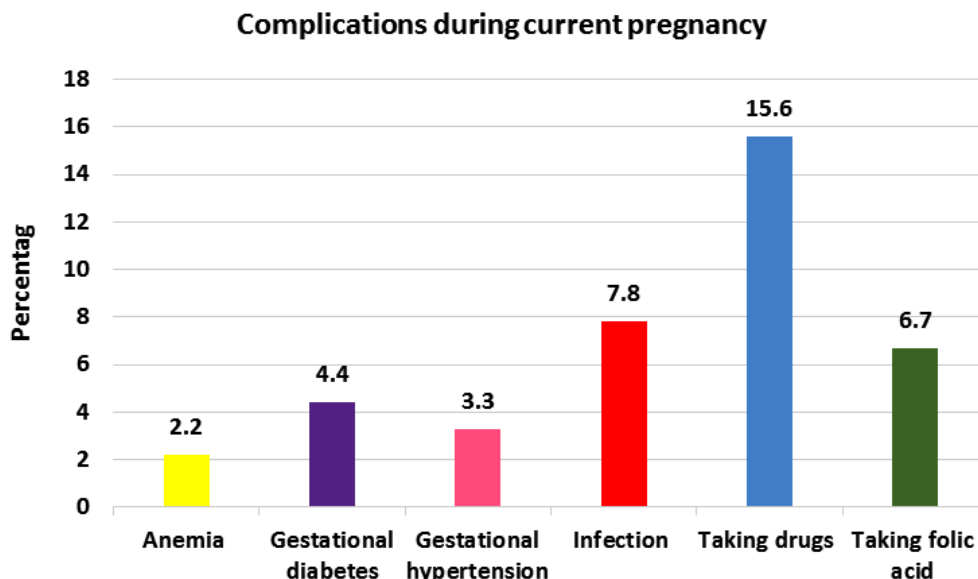


Fig. 5. Complications during current pregnancy among mothers of the studied neonates

pregnancy especially in the first trimester, recurrent abortions, and DM were risk factors that increase prevalence of CAs in neonates.

In addition; the most associated factors as regards NSTDs during current pregnancy among mothers of the studied neonates were 15.6% taking drugs, 7.8% had infection, only 6.7% taking folic acid, and 4.4% had gestational diabetes. These results were supported by (21, 28, 13) demonstrated that lack of folic acid supplementation, and history of febrile illness in the first trimester, and DM in pregnancy were associated factors for NTDs. Moreover, (24) emphasized that maternal infection with toxoplasmosis represented an important role in having neonate with CAs as pregnancy outcome.

Likewise, Egyptian studies done by (32, 33) revealed that taking drugs during pregnancy, and having infections considered risk factors that increase the incidence of CAs. Similarly, other studies implemented in Egypt by (25, 34) demonstrated that maternal disease as DM, the presence of fever due to infections, and medications misuse during pregnancy were maternal risk factors for CAs in Egypt.

CONCLUSION

NTDs were more prevalent among the studied neonates; 28% of CAs neonates were

having NTDs, spina bifida and hydrocephalus were the most frequent types. 46.7% of NTDs' neonates have died on discharge from NICU. Male sex, preterm birth, mothers' age, parents' consanguinity, multigravida, and multipara were associated factors for NTDs. Likewise, complications before current pregnancy as; recurrent abortions and presence of medical illness e.g. DM, and complications during current pregnancy as; taking drugs, catching an infection, folic acid deficiency, and gestational diabetes were associated factors for NTDs. So, the study recommended that early detection and diagnosis of NTDs are important for planning care and knowing the etiology and are the base of prevention programs

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Conflict of Interest

No conflict of interest.

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