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Full Length Research Paper

Prevalence of congenital anomalies in Sudanese fetuses: a prospective study

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ABSTRACT

Congenital anomalies (CAs) are important causes of infant and childhood deaths, chronic illness and disability. The objective of this study was to provide a new detail regarding the prevalence of CAs in Sudanese fetuses and to investigate the association between these anomalies with fetal weight and/ or maternal disorders. During the period February 2018 to November 2019, a descriptive prospective study was conducted at the ultrasound unit (U/S), Omdurman Maternity Teaching Hospital, Sudan. Inclusion criteria include any fetus with features of intrauterine fetal anomaly. Mindery D-C6 U/S system with a 3.5 MHz convex transducer was used. Five thousand two hundred and eighty pregnant women underwent routine U/S scanning through a standard protocol. CAs were noted in 39 fetuses (0.738%) among the studied population. 28.2% of the detected CAs were noted in diabetic and hypertensive women. The major CAs were the central nervous system (CNS) followed by the renal system, skeletal, and gastrointestinal tract (GIT). A significant statistical association between the types of CAs and fetal weight was observed (p= 0.03). In conclusion, the prevalence of CAs in Sudanese fetuses is < 1.0%. The CAs were more prevalent in diabetic than hypertensive women. CAs and fetal weight were significantly associated. The CNS anomalies were common CAs. Further studies regarding the CAs in Sudanese fetuses were recommended.

Keywords: Congenital anomaly, fetus, Sudanese, ultrasound.

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INTRODUCTION

Congenital anomalies (CAs) can be defined as structural or functional anomalies that occur during intrauterine life and can be identified prenatally, at birth or later in life. CAs may occur due to genetic defects, chromosomal disorders, multifactorial inheritance or environmental teratogens (World Health Organization, 2017). CAs have a high mortality rate and they are important causes of infant and childhood deaths, chronic illness and disability. WHO fact-sheet showed that globally around 303 000 newborns die within 4 weeks of birth every year, due to congenital anomalies (World Health Organization, 2016). Early diagnosis of CAs is useful for providing suitable clinical care and management.

From the clinical perspective ultrasound (U/S) is an accepted technique used worldwide and seen as a useful tool to identify some structural abnormalities and provide confidence to support clinical management of pregnancy (Ward and Soothill, 2011). There are few published data regarding fetal anomaly in Sudan through literature review three studies were found; one conducted by Kheir and Yassin (2016) showed that the incidence of major congenital anomalies in Sudan is 2.4%. Mahmoud et al. (2014) studied the association between the incidence of congenital anomalies and hydrocephalus in Sudanese fetuses; they showed that there is considerable variation among different regions of Sudan, but without providing a certain figure about this incidence. The third study was about congenital brain malformations in children and stated that the common anomalies include corpus callosum hypoplasia (23.3 %) and hydrocephalus (13.4%) (Salih, 2018).

The current study aimed to provide additional details

regarding the prevalence of CAs in Sudanese fetuses and to answer the following question; Do CAs have a statistical association with fetal weight and/ or maternal disorders such as; diabetes and hypertension?

PATIENTS AND METHODS

The study was conducted at U/S unit in Omdurman Maternity Teaching Hospital, Sudan during the period Febraury 2018 to November 2019. Mindery D-C6 U/S system with a 3.5 MHz convex transducer was used in the study. The study design was a prospective cross-sectional descriptive study, and the inclusion criteria included any fetus with features of intrauterine fetal anomaly. The participants were selected through a convenient simple selection. All cases were selected during maternal standard obstetric U/S scanning by expert sonologist. The American Institute Ultrasound in Medicine (AIUM) guidelines (doi:10.1002/jum.14831) were considered in conducting the U/S scanning.

Data collection

Data collection sheet was used to organize the study data variables, which include; participant demographic data, gestaional age (GA) estimation, fetal weight, type of fetal anomaly and maternal status (diabetic/ or hypertensive). The GA was estimated through measuring the crown rum length in the first trimester, and the average of two of the following parameters (biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femoral diaphysis length (FL)) during the second and third trimesters. The parameters; BPD, HC, and AC were used to estimate the fetal weight. The data regarding fetal CAs were documented according to certain U/S features for any anomaly. The maternal clinical data regarding diabetes and hypertension were obtained from the clinical data on U/S examination's requests' forms which were sent by the obstetrician or physician. Ethical considerations were applied in the data collection to ensure anonymity all participants were given a number instead of writing his/her name on the data collection sheet. The images presented in the study do not carry any identifying information about the participants. An ethical approval letter (MO/50) was obtained from the research committee of Omdurman Maternity Teaching Hospital. Verbal consents were obtained from the authorized co-patients.

Data analysis

A computing software, Statistical Package for Social Sciences (SPSS- Version 25) (IBM, Armonk, NY, USA), was used in analyzing the processes of the findings. Statistical correlations' tests were applied to achieve the statistical values for associations between the study variables. The association was considered statistically significant when the P-value < 0.05.

RESULTS

5280 singleton pregnant women underwent U/S scanning in the current study. The fetal mean age for the selected participants was 29 ± 6.6 weeks and the mean weight was 1.99 ± 1.2 kg. Figure 1 summarizes the maternal status for the selected participants around 70% were asymptomatic, 17.9% were diabetic, and 10.3% were hypertensive. Table 1 and Figure 2 presents the U/S findings of the study, the prevalence of fetal CAs was noted in 39 fetuses out of 5280 (0.738%). The central nervous system (CNS) anomalies were noted in 0.41%. The renal system CAs is in 0.17%. The skeletal CAs observed in 0.072%. Gastrointestinal tract (GIT) and hydrops fetalis were seen in similar prevalence (0.036%). Pearson's correlations showed a statistical association between the types of CAs and fetal weight (P= 0.03).

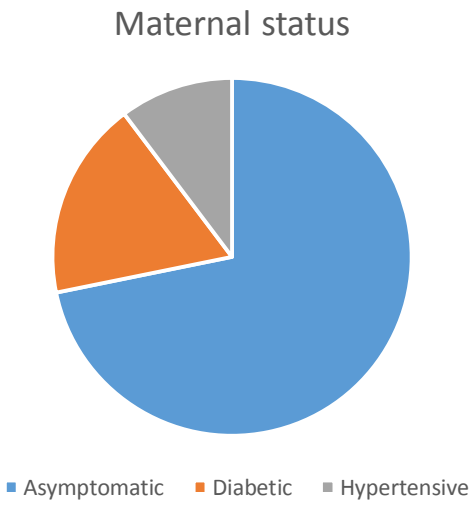

Figure 1. Maternal status for the participants.

Table 2 showed a cross-tabulation between the types of anomalies and maternal disorders. 28.2% of the CAs were noted in diabetic and hypertensive pregnant women, although the statistical analysis revealed no statistical association between the types of CAs and maternal disorders (P= 0.124).

Figures 3 to 8 present sample images for CAs findings; cystic hygroma in 24 weeks (Figure 3). Hydrops fetalis in 30 weeks (Figure 4). Severe ventricular dilatation due to hydrocephalus in 34 weeks (Figure 5). Posterior urethral valve syndrome in 27 weeks (Figure 6). Polycystic kidney disease in 29 weeks fetus (Figure 7). Duplex pelvic kidneys in 26 weeks fetus (Figure 8).

DISCUSSION

CAs are important causes of infant and childhood deaths, chronic illness and disability. The current study suggested that the prevalence of fetal CAs in Sudanese fetuses is <1.0%. The CNS anomalies were the most common among the detected CAs; they were noted in 56.4%, followed by the renal system anomalies (23%) then the skeletal anomalies (10.3%), the GIT anomalies (5.12%) (Table 1 and Figure 1). A statistical association between the types of CAs and the fetal weight was noticed (P = 0.03).

Regarding the prevalence of fetal CAs in Sudan, the researchers did not find enough published data to

Table 1. Congenital anomalies' frequencies in relation to the total study population.

Congenital anomalies	Frequency (n)	Percentage (out of 39) (%)	Percentage (out of 5280) (%)
Hydrocephalus	10	25.6	0.189
Anencephaly	9	23.1	0.17
Spina bifida	1	2.6	0.018
Cystic hygroma	2	5.1	0.036
Polycystic kidney disease	4	10.3	0.072
Duplex pelvic kidney	1	2.6	0.018
Posterior urethral valve	4	10.3	0.072
Achondropasia	4	10.3	0.072
Duodenal atresia	1	2.6	0.018
Megacolon	1	2.6	0.018
Hydrops fetalis	2	5.1	0.036
Total	39	100.0	0.738

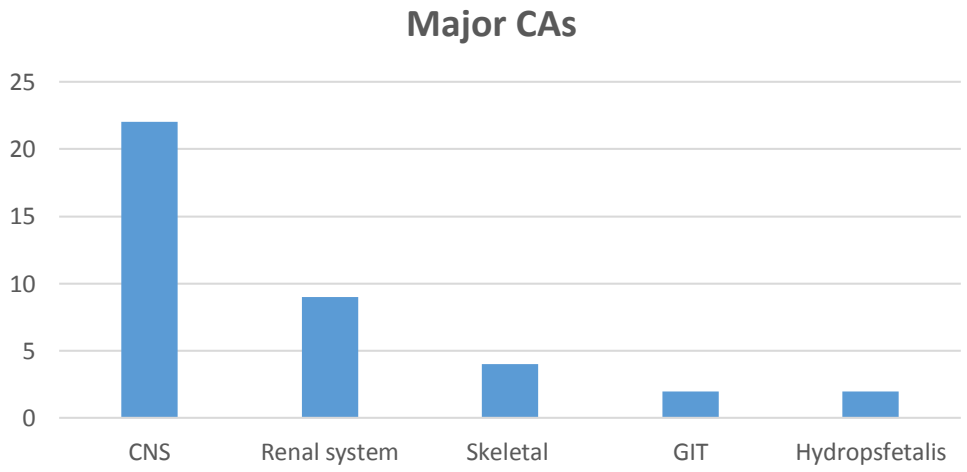

Figure 2. Major fetal congenital anomalies.

Table 2. Types of anomalies * maternal disorders cross-tabulation.

Congenital anomalies	Asymptomatic	Diabetic	Hypertensive	Total
Hydrocephalus	6	3	1	10
Anencephaly	6	2	1	9
Posterior urethral valve	2	1	1	4
Duodenal atresia	1	0	0	1
Megacolon	1	0	0	1
Achondropasia	3	0	1	4
Hydrops fetalis	1	1	0	2
Polycystic kidney disease	4	0	0	4
Spina bifida	1	0	0	1
Cystic hygroma	2	0	0	2
Pelvic kidney	1	0	0	1
Total	28	7	4	39

compare with other than the results of Kheir and Yassin (2016) who proposed that the incidence of major congenital anomalies in Sudan was 2.4%. This finding is not in agreement with what the current study concluded,

Figure 3. Cystic hygroma in 24 weeks fetus.

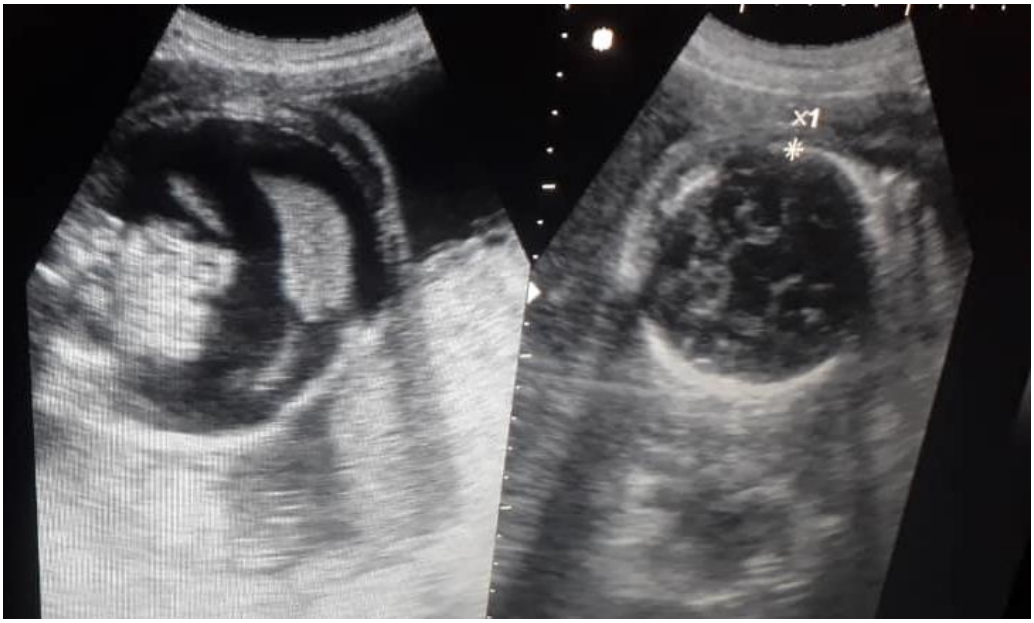

Figure 4. Hydrops fetalis in 30 weeks fetus.

but it could be acceptable after reviewing the study result of Mahmoud et al. (2014) who showed that there is considerable variation among different regions of Sudan, although they did not provide any comparable figures regarding these variations. The prevalence of CAs seems to be varied; Sunitha et al. (2017) suggested that eleven percent were pregnant women carrying fetuses with CAs. Onyambu and Tharamba (2018) showed that the prevalence of CAs through routine U/S was 3%. Ukweh et al. (2019) concluded that anomaly prevalence is 1.67%. Neto et al. (2009) indicated a very high prevalence of CAs; they stated that the prenatal ultrasonography diagnosed congenital anomalies presented in 63.2%, among this 56.2% were confirmed after birth. Abouel-Ella et al. (2018) showed that out of 100 cases, 51% had isolated anomalies and 49% had multiple anomalies.

Regarding the classification of common CAs, the current study results are in agreement with several results. Kheir and Yassin (2016) indicated that the anomalies of the nervous system were the commonest detected among newborns. Sunitha et al. (2017) showed that the major CAs observed were CNS followed by renal anomalies. These results fall in line with Anderson et al.

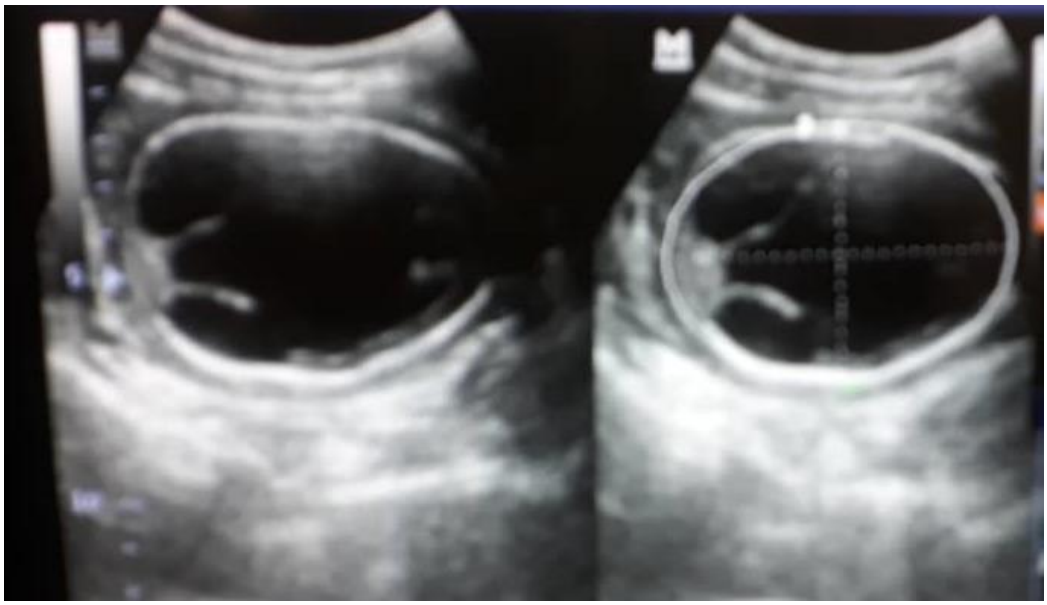

Figure 5. Severe dilatation of the ventricles due to hydrocephalus in 34 weeks fetus.

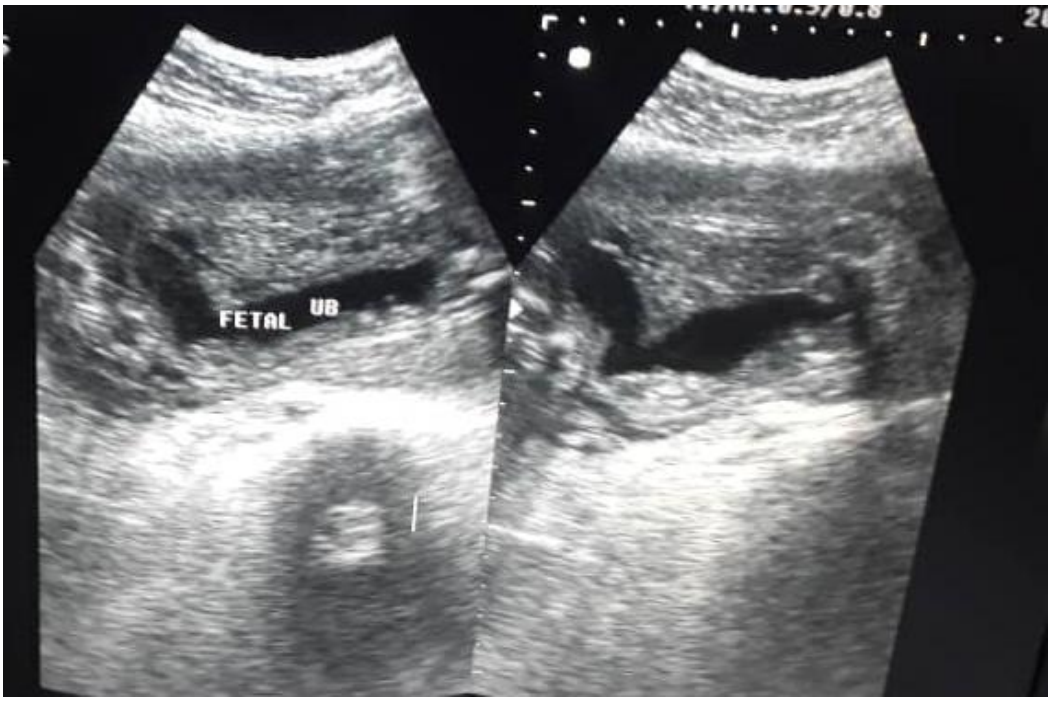

Figure 6. Posterior urethral valve syndrome in 27 weeks fetus.

(1995) who proposed that the CNS was reported in 92% of the CAs and Singh et al. (2006) who concluded that the common anomaly was ventriculomegaly 27.33% followed by anencephaly 26.00%. Although other authors (Ukweh et al., 2019) stated that a majority (35%) of the detected CAs were related to the central nervous system followed by digestive (12.8%) and genitourinary (11.9%) systems.

The current study results revealed a statistical association between the types of CAs and the fetal weight these findings agree with Pandala et al. (2018) who showed that birth weight is significantly associated with increased risk of CAs.

Regarding maternal disorders' association with CAs;

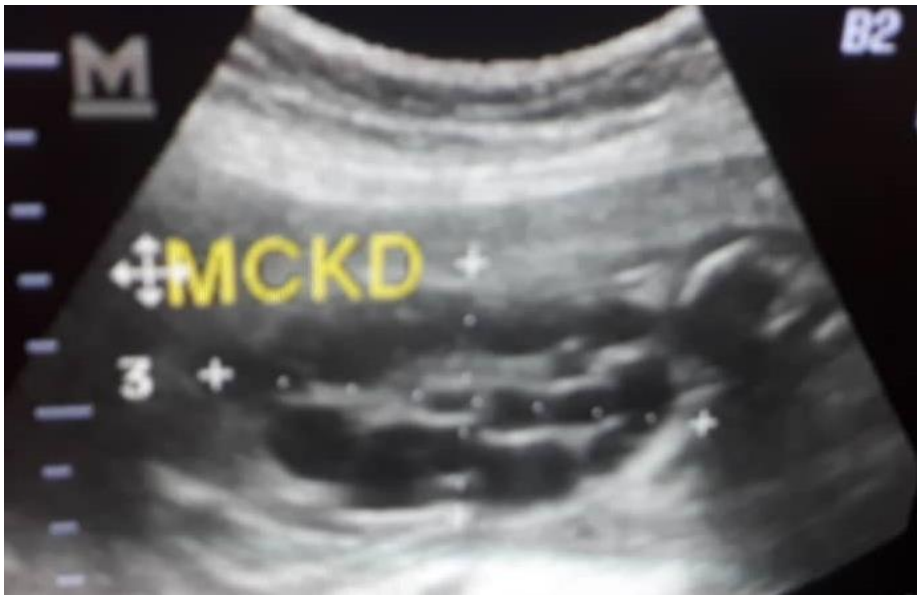

Figure 7. Polycystic kidney disease in 29 weeks fetus.

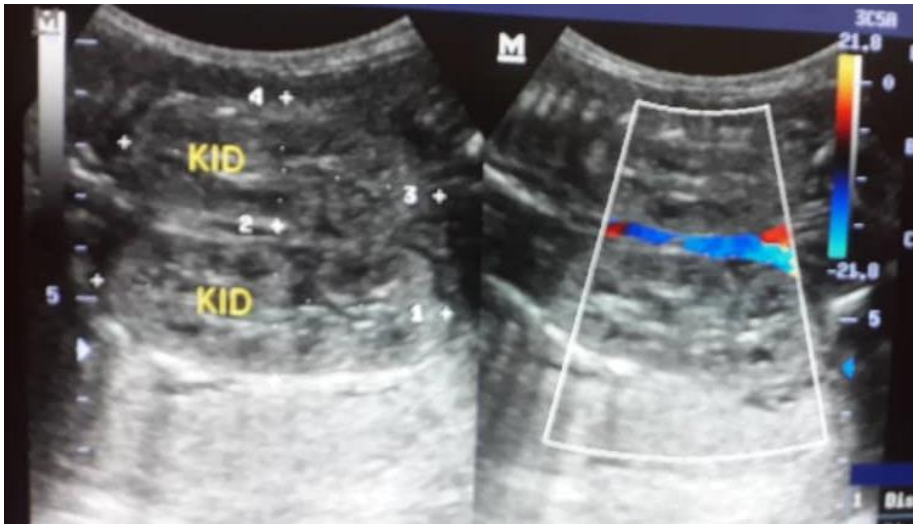

Figure 8. Duplex pelvic kidneys in 26 weeks fetus.

the current study showed that there was no statistical association between the types of CAs and maternal disorders. Conversely, these results are not in agreement with Sunitha et al. (2017) who indicated that the high prevalence of CAs was found in high risk pregnant (HRP) women compared to the general population. Alaarji (2017) showed that 7.79% (out of 100) CAs were noted in mothers with a history of diabetes mellitus. The current study suggested that the prevalence of CAs was 28.2 (out of 39) in diabetic pregnant women this represents 0.2% of the whole study population (Table 2).

Despite the additional data provided by the current study regarding CAs in Sudanese fetuses, the researchers suspect that the small sample size and specific study area remain a limitation. Therefore further studies in several areas with a big enough sample size are recommended.

CONCLUSION

In conclusion, this study showed that the prevalence of fetal CAs in Sudanese fetuses is < 1.0%. The CAs prevalence was higher in the diabetics than the hypertensive pregnant women. However, there is no statistical association between the types of CAs and

maternal disorders. The CNS anomalies were common, followed by the renal system then the skeletal and GIT anomalies. A significant statistical association between the types of CAs and the fetal weight was noted. Further studies regarding the CAs in Sudanese fetuses were suggestive.

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