

The Principle Causes Of Newborn Structural Abnormalities (Malformations) A Brief Review

ALAA ADREES A. AL-DANNOON

Abstract: Structural abnormalities, often referred to as birth defects, has a set of causes ranging from pregnancy or birth complications to genetic malformations to viral infection in utero. Different causes of malformations have been established. The surveillance of a consecutive population of births, including stillbirths and selective terminations of pregnancy because of fetal anomalies can identify each infant with malformations and determine the frequency of the apparent etiologies. The abnormalities were identified from the review of the examination findings of the pediatricians and consultants and diagnostic testing for the liveborn infants and the autopsies of the fetuses in elective terminations and stillbirths. Mendelian disorders, including infants with postaxial polydactyly, chromosome abnormalities, vascular disruption and complications of monozygous twinning, However, environmental factors were also determined. The while several causes of malformations have been identified, many remain unexplained. Combining the ascertainment in a future surveillance programs with genome sequencing and chromosome microarray analysis will increase significantly the number of malformations attributed to genetic mechanisms. In this descriptive article, review, all newborns, whether alive or stillborn, were screened for congenital anomalies, soon after birth. Detailed history was taken. Investigations were done when required to confirm certain defects.

Keywords: Newborn, Structural abnormalities.

Date of Submission: 07-05-2019

Date of acceptance: 23-05-2019

I. Introduction

Abnormalities of the structures or birth defects were resulted in physical, mental disability or even mortality, which mostly occurring due to multiple etiological factors (Brent, 2001). Indeed, with the control of infectious diseases and malnutrition, The congenital anomalies are now making a relatively greater contribution to ill health and are currently a leading cause of infant mortality in developed countries (Correa *et al*, 2007). The incidence and prevalence of Congenital anomalies might differ among countries over the world, Different anomalies can be recorded such as tube defects, congenital heart diseases, musculoskeletal defects, gastrointestinal defects, genitourinary defects, face defects and ear anomalies (Alaani *et al*, 2011).

It had been shown that, The frequency of structure abnormalities increase in the first year of life as what calls, silen abnormalities which might not detected at birth, such as heart defects, anomalies of the urinary tract, and bowel malrotation, which were identified from diagnostic studies encouraged by signs and symptoms in the affected infant, However, It were documentaed that, The role of environmental pollutants, drugs and infectious agents in causing congenital anomalies are a major global concern. Furthermore, the underlying causes for the most congenital malformations remain obscure and multifactorial inheritance is believed to be the underlying etiology of most common abnormality (Al-Hadithi *et al*, 2012). (Khan *et al*, 2012) was mentioned that, The frequency of malformations is much higher in the fetuses in spontaneous abortions or stillbirths than that of the live born infants. On the other hand, Stillerman, *et al*, 2008 were also mentioned that, The root causes of many adverse pregnancy outcomes are not well understood, but there is growing evidence that the environment can play an important role. The environment, is a broad term that includes familiar contributors such as nutrition, adequacy of prenatal care, smoking and alcohol use, maternal age, and socioeconomic disparities, as well as less familiar contributors including pollution and chemical agents encountered both indoors and outdoors. In many cases, two or more environmental factors may be interrelated or synergistic.

Most studies were stabilized the many different causes of a specific malformation highlight the heterogeneity in the etiological factors, Represent the fact, that some have a genetic component and others reflect environmental factors (Syamasundar Rao, 2009). This report is a follow up to the common causes of congenital malformations identified and diagnosed at pediatrics hospitals.

II. The Review

Common Anomalies of Central nervous system

Hydrocephalus:-

Hydrocephalus is one of the most common congenital abnormalities affecting the nervous system, It results from obstruction of cerebrospinal fluid (CSF) pathways by a diverse range of developmental, both, genetic, and acquired abnormalities can have negative consequences on the neurodevelopmental outcome of affected neonates. Hydrocephalus was diagnosed after birth and managed with a shunt procedure. However, with the advanced antenatal imaging techniques, it may now be detected and treated before delivery in some individuals. Moreover, surgical options for the treatment of hydrocephalus have increased over the past few decades, and temporary CSF diversion may prevent the need for permanent shunt placement (McAllister, 2012).

Meningomyelocele:-

It's the Failure of closure of the neural tube mostly, during the third week of gestation, which leads to the constellation of defects observed in patients with meningomyelocele (MMC). The open neural tube is continuous with the surface of the skin. Therefore, infants with MMC are at risk for bacterial meningitis due to the spinal defect. However, Leak of cerebrospinal fluid is commonly observed. The major indication for early operative repair (mostly within 48h of delivery) is the prevention of infection. Although protection of the exposed neural tissue from trauma and drying is essential, the neurological deficit caused by MMC is fixed and rarely improves following repair. Health deterioration, however, can occur (Bulbul *et al* ,2010).

Congenital microcephaly:-

Congenital microcephaly, it is a descriptive term for a structural defect in which a fetus or infant's head (cranium) circumference is smaller than expected when compared to other fetuses or infants of the same gestational age, sex and ethnic background. Congenital microcephaly can be diagnosed either postnatally or prenatally and is usually defined by the measurement of occipital-frontal circumference (head circumference) (DeSilva *et al* , 2017).

Anencephaly:-

Anencephaly is a life-limiting condition as the newborn baby brain and spinal cord do not develop properly. This is a very serious condition where large parts of the baby's skull and brain are missing. The baby's face and neck may also be affected. In the early stages of pregnancy, the nervous system of the developing baby starts as a single structure called the neural plate. By day 28-30 of pregnancy, the neural plate should fold over and close to form the neural tube. If the neural tube does not close completely it results in a neural tube defect such as anencephaly (Moore , 2010).

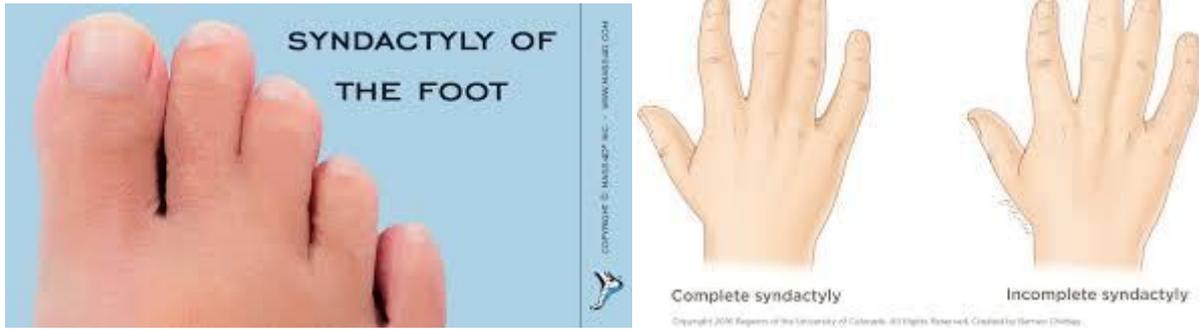
Encephalocele:-

An encephalocele result from failure of the surface ectoderm of two separate from the neuroectoderm. This leads to a bony defect in the skull table, which allows herniation Of the meninges or of brain tissue. The occiput is the most common site of this type of neural tube defect (Ugras *et al* ,2016).

Common defects of Musculoskeletal system

Syndactyly:-

Syndactyly is one of the most common hereditary limb malformations depicting the fusion of certain fingers and/or toes. It may occur as an isolated entity or a component of more than 300 syndromic anomalies. Syndactylies exhibit great inter- and intra-familial clinical variability. Even within a subject, phenotype can be unilateral or bilateral and symmetrical or asymmetrical. At least nine non-syndromic syndactylies with additional sub-types have been characterized. Most of the syndactyly types are inherited as autosomal dominant, but two autosomal recessive and an X-linked recessive entity has also been described (Malik, 2012).



Polydactyly:-

Polydactyly is one of the most common congenital anomalies of the hands and feet consisting of supernumerary fingers or toes. The extra digit is usually a small piece of soft tissue. Occasionally, it may contain bone without joints. It may be a complete functioning digit. This condition can occur in one limb or can be exceptionally present in all four limbs a condition called tetrapolydactyly(Ahmed *et al* , 2017)



Talipes equino varus (Clubfoot):-

Clubfoot describes a range of congenital foot abnormalities usually present at birth in which the baby's foot is twisted out of shape or position. In clubfoot, the tissues connecting the muscles to the bone (tendons) are shorter than usual. Clubfoot is a fairly common birth defect and is usually an isolated problem for an otherwise healthy newborn. Clubfoot can be mild or severe. About half of children with clubfoot have it in both feet. If the child has clubfoot, it will make it harder to walk normally, so doctors generally recommend treating it soon after birth. Doctors are usually able to treat clubfoot successfully without surgery, though sometimes children need follow-up surgery later on(Gibbons and Gray, 2013).



Developmental dysplasia of hip:-

Developmental Dysplasia of the Hips (DDH) is a condition with a range of anatomical abnormalities of the hip joint in which the femoral head has an abnormal relationship with the acetabulum. This includes, Dysplasia in which, there is an inadequate acetabulum formation (may not be clinically noted). Subluxation which, occurs if the femoral head can be partially displaced out of the acetabulum. Dislocatable, when the femoral head may be displaced from the acetabulum with manoeuvres. Dislocated, the femoral head is completely outside the acetabulum. Clinically detected neonatal hip instability ranges from 1.6-28.5 neonates per 1000. Long term consequences of undiagnosed or untreated DDH leads to pain in the hip, knee and lower back, gait abnormalities, and degenerative changes of the hip joint. During the immediate neonatal period (Cady, 2006)



Arthrogryposis multiplex congenita (AMC):-

Arthrogryposis multiplex congenita or simply arthrogryposis, describes congenital joint contracture in two or more areas of the body. Children born with one or more joint contractures have abnormal fibrosis of the muscle tissue, causing muscle shortening, and therefore are unable to perform active extension and flexion in the affected joint or joints. Arthrogryposis multiplex congenita has been divided into three groups: amyoplasia, distal arthrogryposis, and syndromic. Amyoplasia is characterized by severe joint contractures and muscle weakness. Distal arthrogryposis mainly involves the hands and feet. Types of arthrogryposis with a primary neurological or muscular disease belong to the syndromic group (Michael *et al*, 2009).



Genitourinary Common defects

When the external genitalia do not have the typical anatomic appearance of normal male or female genitalia, the condition is known as ambiguous genitalia. Most of the cases present in the newborn period. It is a social as well as a medical emergency, Ambiguous genitalia in a neonate may be suspected with: 1. Penis with bilateral cryptorchidism. 2. Unilateral cryptorchidism with hypospadias. 3. Bilateral testes with perineoscrotal or penoscrotal hypospadias. 4. Apparently female with clitoromegaly (>1 cm) or inguinal hernia. 5. Overtly

abnormal genitals like cloacal exostrophy. 6. Asymmetry of labioscrotal folds. 7. Micropenis: <2.5cm in term male neonate. (Ahmed and Rodie, 2010).



Undescended testes:-

The undescended testis, retentio testis, cryptorchidism, and maldescended testis describe a testis that is not normally located at the bottom of the scrotum .The UDT may be situated along its normal route of descent or in an ectopic position.Cryptorchid/undescended: testis neither resides nor can be manipulated into the scrotum.Ectopic: aberrant course of descent, usually after leaving inguinal canal: femoral, pubopenile, perineal or crossed scrotal .Retractile: testis can be manipulated into scrotum where it remains without tension.Gliding: testis can be manipulated into upper scrotum but retracts when released.Acquired: testis previously descended or after orchiopexy or other inguinal surgery (hernia), then ascend spontaneously (Radmayr *et al* , 2016).

CRYPTORCHIDISM



Hypospadias:-

Hypospadias, a condition where the urethra opens on the underside of the penis with associated ventral penile curvature, is the second most common genital birth defect in boys, following cryptorchidism. With an incidence of one in 200 live male births. The initial diagnosis of hypospadias is typically made after birth during a physical exam, where boys with hypospadias are found to have a ventral skin deficiency with a dorsal hood of fore skin and an abnormally located meatus with varying degrees of ventral penile curvature. (Schnack *et al*, 2010).



Common Facial defects

Cleft lip/palate:-

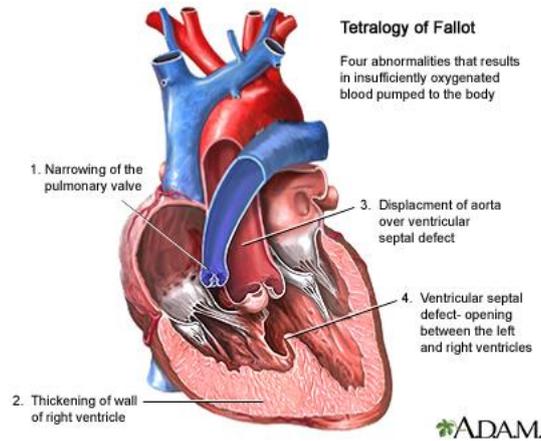
A cleft lip is an opening or split in the upper lip that occurs when developing facial structures in an unborn baby don't close completely. Cleft lip may be unilateral or bilateral. A baby with a cleft lip may also experience a cleft in the roof of the mouth (cleft palate). Cleft lip and cleft palate are among the most common birth defects. They most commonly occur as isolated birth defects, but are also associated with many inherited genetic conditions or syndromes. Having a baby born with a cleft can be upsetting, but cleft lip and cleft palate can be corrected. In most babies, a series of surgeries can restore normal function and achieve a more normal appearance with minimal scarring (Watkins *et al* ,2014).



Common defects of Cardiovascular

Cyanotic heart disease :-

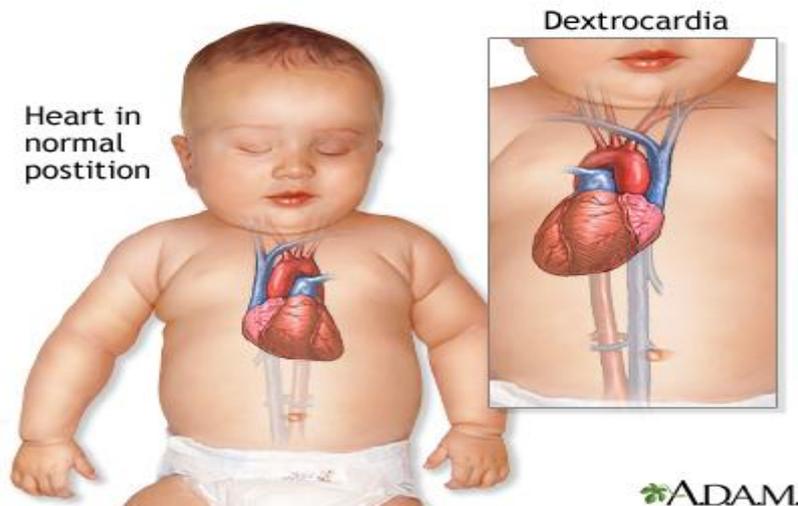
Cyanotic heart disease refers to a group of many different congenital heart defects that are present at birth . They result in a low blood oxygen level. Cyanosis refers to a bluish color of the skin and mucous membranes. Normally, blood returns from the body and flows through the heart and lungs. Blood that is low in oxygen (blue blood) returns from the body to the right side of the heart. The right side of the heart, then pumps the blood to the lungs, where it picks up more oxygen and becomes red. The oxygen-rich blood returns from the lungs to the left side of the heart. From there, it is pumped to the rest of the body. Heart defects that children are born with can change the way blood flows through the heart and lungs. These defects can cause less blood to flow to the lungs. They can also result in blue and red blood mixing together. This causes poorly oxygenated blood to be pumped out to the body. As a result, the blood that is pumped out to the body is lower in oxygen. Moreover, Less oxygen delivered to the body can make the skin look blue (cyanosis). Some of these heart defects involve the heart valves. These defects force blue blood to mix with red blood through abnormal heart channels. Heart valves are found between the heart and the large blood vessels that bring blood to and from the heart. These valves open up enough for blood to flow through. Then they close, keeping blood from flowing backwards (Syamasundar Rao, 2009).



Dextrocardia:-

Dextrocardia is a rare congenital condition where the heart points toward the right side of the chest instead of the left. The condition is usually not life-threatening, although it often occurs alongside more serious complications, such as heart defects and organ disorders in the abdomen. Dextrocardia in isolation, without any other heart defects, is unusual. There are two major types of dextrocardia.

Dextrocardia situs inversus. In this type of dextrocardia, the tip of the heart and its four chambers are pointing towards the right side of the body. Dextrocardia with situs inversus totalis. With this type of dextrocardia, abdominal and chest organs and other vessels, such as the liver, stomach, and spleen are also out of position. In fact, the other organs are in the opposite position, or in mirror-image reversal, to where they should be (Bernasconi *et al*, 2005).



III. Discussion

In few past years there have been several anecdotal reports of geographical regions with an unusually high prevalence of congenital birth defects in different countries. Most of the reports did not meet the norms for an objective study of birth defects, and a review of the published literature could find no clear evidence to support their findings. Because of continuing uncertainty in the Ministry of Health of specially developing countries, undertook a systematic collection of information on the prevalence of congenital birth defects (Bachman *et al*, 2015).

Major congenital anomalies occur in approximately 2-3% of births with a variable frequency in different populations (Khan *et al*, 2012).

It was shown that, most children, whom born with congenital anomalies and survive their childhood are affected mentally, physically, or socially and can be at increased risk of morbidity due to various health disorders (Brent, 2001).

It has been documented that, Nervous system defects, especially neural tube defects were the commonest anomaly found, which is comparable to international studies (McAllister, 2012). Musculoskeletal anomalies were encountered, some cases becoming the second most common anomalies which is comparable to other studies (Michael *et al*, 2009). Rate of cardiac malformation in most studies might be lower compared to

other anomalies, This may be due to under diagnosis because of lack of availability of sophisticated diagnostic technique, lack of routine autopsies and neonatal follow-up loss (Syamasundar Rao, 2009).

It was proposed that, maternal age is an important parameter in the Birth of a congenitally malformed fetus. For this reason, females who are older than 35-37 years of age need to be examined more carefully since the risk of birth of a congenitally malformed fetus might increase (Alaani *et al*, 2011., Ahmed *et al* ,2017).

The evaluations of the different infants with common malformations made it possible to establish the etiologic heterogeneity for several, including myelomeningocele, cleft lip and palate, hypospadias, cleft palate alone, esophageal atresia, and congenital diaphragmatic hernia (McAllister, 2012). This experience established the fact that clinicians should expect to identify several different etiologies for common malformations. These diverse causes have practical value. For example, the analysis of limb reduction defects identified a subset which attributed to the process of vascular disruption. This established the baseline prevalence rate, which was used to assess whether or not the fetus exposed to the prenatal diagnosis procedure chorionic villus sampling had a significant increase in the frequency of a vascular disruption type of limb defects (Bulbul *et al*, 2010).

Prevention of congenital anomalies can be primary and secondary. Primary prevention includes folic acid and multivitamin supplement, maternal disease prevention and /or treatment and preconception vaccination, especially against chicken pox and rubella. Secondary prevention aims at early detection of congenital anomalies and advising early termination of affected pregnancies with lethal anomalies. These measures are especially useful in neural tube defects whose incidence significantly decrease in developing countries as a result of preventive measures, but are still very high in our study as well as most studies in our region. In our region, the magnitude of this problem can be attributed to several factors including the higher rate of traditional consanguineous marriages, advanced maternal age, lack of educated mothers with poor knowledge regarding antenatal checkups, difficult access to health care centers and larger family size.

IV. Conclusions

Congenital anomalies are one of the most important causes of fetal deaths, Therefore, It becomes inevitable to keep an account of the incidence and prevalence of congenital abnormalities in the society. The present review article showed a high incidence of congenital malformations in the young age group especial among woman of different countries globally. However, The commonest associated risk factor might be the consanguineous marriage. Early prenatal diagnosis is helpful in decreasing perinatal mortality by early termination of pregnancy.

References

- [1]. Ahmed, H , B.A., Akbari, H , Emami, A ., Akbari, M. R. (2017). Genetic Overview of Syndactyly and Polydactyly. *Plast Reconstr Surg Glob Open*. Nov: 5 (11): e1549.
- [2]. Ahmed, S.F., Rodie, M. (2010). Investigation and initial management of ambiguous genitalia. *Best Pract Res Clin Endocrinol Metab*. 24 (2):197–218
- [3]. Alaani, S., Savabieasfahani, M., Tafash, M., Manduca, P. (2011). Four polygamous families with congenital birth defects from Fallujah, Iraq. *Int. J. Environ Res. Public Heal*. 8: 89-96.
- [4]. Al-Hadithi, T.S., Al-Diwan, J.K, Saleh, A.M., Shabila, N.P. (2012). Birth defects in Iraq and the plausibility of environmental exposure: a review. *Confl. Heal*. 6: 3-10.
- [5]. Bachman, K.K., DeWard, S.J., Chrysostomou, C, et al. (2015). Array CGH as a first-tier test for neonates with congenital heart disease. *Cardiol Young*. 25:115–122.
- [6]. Bernasconi, A ., Azancot, A ., Simpson, J M , Jones, A , Sharland, G_K (2005). Fetal dextrocardia: diagnosis and outcome in two tertiary centres. *Heart*. 91(12): 1590–1594.
- [7]. Brent, R.L. (2001). The cause and prevention of human birth defects: what have we learned in the past 50 years? *Congenit Anom*. 41:3–21.
- [8]. Bulbul, A., Can, E., Bulbul, L.G., Cömert, S., Nuhoglu, A.(2010). Clinical characteristics of neonatal meningomyelocele cases and effect of operation time on mortality and morbidity. *Pediatr. Neurosurg*. 46(3):199-204.
- [9]. Cady, R. B. (2006). Developmental dysplasia of the hip: Definition, recognition, and prevention of late sequelae. *Ped. Ann*. 35, 92-101.
- [10]. Correa, A., Cragan, J.D., Kucik, J.E, et al. (2007). Metropolitan Atlanta Congenital Defects Program (MACDP). 40th Anniversary Edition Surveillance Report. Reporting birth defects surveillance data 1968-2003. *Birth Defects Res A. Clin. Mol Teratol*. 79:65–93
- [11]. DeSilva, M., Flor, M. M., Erick, S., Helen, M. et al (2017). ongenital microcephaly: Case definition & guidelines for data collection, analysis, and presentation of safety data after maternal immunization. *Vaccine*. 4: 35(48Part A): 6472–6482.
- [12]. Gibbons, P.J., Gray, K. (2013). "Update on clubfoot". *Paed. Child Heal*. 49 (9): E434–7.
- [13]. Khan Amir, A., Tariq, A. K., Syed, H. A. S., Emran, R. , Anwar, U.I H. (2012). Pattern of Congenital Anomalies in the Newborn. *JRMC*. 16(2):171-173.
- [14]. Malik, S.(2012). Syndactyly: Phenotypes, genetics and current classification. *European J. Hum. Gen*. 20(8):817-824.
- [15]. McAllister, J.P (2012). Pathophysiology of congenital and neonatal hydrocephalus. *Semin Fet. Neonat. Med*. 17(5):285–294.
- [16]. Michael, B., Van Heest, A.E., Pleasure, D (2009). "Arthrogyposis: A Review and Update". *Bon. Join. Surg. Amer*. Vol. 91 (Suppl 4): 40–6.
- [17]. Moore, L.(2010). Anencephaly. *Diagnos. Med.l Sonograph*. 26(6) 286–289.
- [18]. Radmayr, C., Hasan, S. D., Piet, H. et al (2016). Management of undescended testes. *Ped. Uro*. 12: 335-343.

- [19]. Schnack, T.H., Poulsen, G., Myrup, C. et al.(2010). Familial coaggregation of cryptorchidism and hypospadias. *Epidemiol.* 21:109–13.
- [20]. Stillerman, K.P., Mattison, D.R., Giudice, L.C., Woodruff, T.J.(2008). Environmental exposures and adverse pregnancy outcomes: a review of the science. *Reprod Sci.* 15(7):631–635.
- [21]. Syamasundar Rao, P. (2009). Diagnosis and Management of Cyanotic Congenital Heart Disease: Part I. *Indian J. Ped.* 76:57-70.
- [22]. Ugras, M., Ozgur, K., Faruk, A., Selim K. H., Suat, B.(2016). New born children with Encephalocele. *Neurol. Neurosci.* 7 :1:73.
- [23]. Watkins, S.E., Meyer, R.E., Strauss, R.P., Aylsworth, A.S (2014). "Classification, epidemiology, and genetics of orofacial clefts". *Clin Plast Surg.*

ALAA ADREES A." The Principle Causes Of Newborn Structural Abnormalities (Malformations) A Brief Review." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, vol. 18, no. 5, 2019, pp 55-63.