Role of 3D / 4D Ultrasound in Assessment of Fetal CNS Congenital Anomalies

Thesis

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List of Contents

List of Tables

Table No.	Title	Page No.

List of Figures

List of Figures cont...

List of Figures cont...

List of Figures cont...

List of Abbreviations

Abb.	Full term
3D US	*Three-dimensional ultrasound*
3D	*Three dimension*
4D	*Four dimension*
3HV	*Three-horn view*
3V	*Third ventricle*
4V	*Fourth ventricle*
AH	*Anterior horn*
BPD	*Biparietal diameter*
BS	*Brain stem*
CC	*Corpus callosum*
CM	*Cisterna magna*
CNS	*Central nervous system*
CRL	*Crown-rump length*
CSP	*Cavum septi pellucidi*
CT	*Computed tomography*
CV	*Cavum vergae*
HC	*Head circumference*
HTN	*Hypertension*
IH	*Inferior horn*
ISUOG	*The International Society of Ultrasound in Obstetrics and Gynecology*
MRI	*Magnetic resonance imaging*
NTDs	*Neural tube defects*
OFD	*Occipitofrontal diameter*

List of Abbreviations cont...

Abb.	Full term
PH	*Posterior horn*
PNS	*Peripheral nervous system*
QC	*Quadrigeminal cistern*
QP	*Quadrigeminal plate*
ROI	*Region of interest*
STIC	*Spatiotemporal image correlation*
TC	*Tela choroidea*
US	*Ultrasound*
V	*Cerebellar vermis*

INTRODUCTION

Congenital abnormalities account for 20-25% of perinatal deaths.

Central nervous system anomalies are often severe and are the most common indications for therapeutic abortions ***(Bornstein et al., 2014).***

Central nervous system (CNS) malformations are the second most frequent category of congenital anomaly, after congenital heart disease ***(Monteagudo et al., 2017).*** Approximately 21% of congenital malformations involve the CNS, constituting one of the most common congenital defects and may occur either isolated or in association with other malformations of the CNS itself or other systems ***(Alvarengfernandes et al., 2012).***

The CNS develops from 3 to 20 weeks of intrauterine life. Almost all CNS anomalies are a result of the insult in embryogenesis at some point of development. Ultrasound can diagnose many CNS anomalies in first and early second trimester. Some develop or become apparent in late pregnancy. The earlier the detection, the more time available for the clinician and parents to plan the outcome of pregnancy. Lethal and severely life limiting disorders warrant early termination of pregnancy, whereas detection of minor anomalies helps

everybody to be prepared for postnatal management ***(Bornstein et al., 2014).***

Prenatal diagnosis uses various noninvasive and invasive techniques to determine the health condition of the fetus or any abnormality in an unborn fetus. Techniques of fetal visualization are:

a) Non invasive techniques; Ultrasound (US), fetal echocardiography, Magnetic resonance imaging (MRI).

b) Invasive techniques; Embryoscopy, Fetoscopy.

US examination is an effective modality for prenatal diagnosis of these anomalies. It is a non-invasive technique which is more acceptable by patients. Several studies have shown an accuracy of 92% to 99.7% for US detection of CNS anatomic anomalies ***(Monteagudo et al., 2017).***

The current study advocates performing a CNS targeted 3D / 4D ultrasonography after an initial diagnostic 2D ultrasonography.

AIM OF THE WORK

The aim of this study is to verify the role of 3D, 4D ultrasonography in prenatal assessment of anatomical structure of central nervous system and early diagnosis of the CNS congenital anomalies.

EMBRYOLOGICAL DEVELOPMENT OF THE CENTRAL NERVOUS SYSTEM

Neural development is one of the earliest systems to begin and the last to be completed after birth. This development generates the most complex structure within the embryo and the long time period of development means in utero insult during pregnancy may have consequences to development of the nervous system ***(Wang et al., 2014).***

The early central nervous system begins as a simple neural plate that folds to form a groove then tube, open initially at each end. Failure of these opening to close contributes in a major class of neural abnormalities (neural tube defects).

Within the neural tube stem cells generate the 2 major classes of cells that make the majority of the nervous system: neurons and glia ***(McShane et al., 2015).***