

Study of Morphology of Interatrial Septum in 40 Fetuses in Ahmedabad, Gujarat

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Abstract

Introduction: Knowledge of morphological features of the fetal heart is necessary to achieve an accurate diagnosis of possible malformations as well as other conditions that may cause physiological alterations in the fetal heart progressing to cardiac failure and fetal death, if not opportunely corrected. Clinical anatomy of the true interatrial septum is treacherous, difficult and its unfamiliarity can cause many serious complications. **Materials and Methods:** 40 formalin preserved fetal hearts at gestational age from 14 to 40 weeks were dissected through midline thoracotomy and cutting open the pericardial sac. Foramen ovale diameter and septum primum excursion in the left atrium were measured in millimeter. **Result:** In gestational age group of 14-20 weeks (14 fetuses), foramen ovale diameter (FOD) was 2.3 mm in male and 2.2 mm in female while septum primum excursion (SPE) was 2 mm in both. In 21-30 weeks (16 fetuses), FOD was 2.5 mm in both while SPE was 2.2 in male and 2.1 in female. In 31-40 weeks (10 fetuses), FOD was 3.2 mm in male and 3.8 mm in female while SPE was 4 mm in male and 3.6 mm in female. **Conclusion:** A sound knowledge about the normal anatomy and development of the fetal heart has become absolutely necessary to know the fetal echocardiography and new surgical techniques for correction of prenatally diagnosed cardiac malformations.

Keywords: Foramen Ovale; Septum Primum; Interatrial Septum; Fetal Heart.

Introduction

Embryonic development of the human heart depends on cell-cell interaction, particularly myocardial and mesenchymal cells [1-6]. This interaction accounts for the differentiation and morphogenesis of specific areas in the heart [7-10]. The endocardial cushion, a clustering of endocardial and mesenchymal cells, plays a direct role in cardiac septa and atrioventricular valve formation [7, 11]. With the development of fetal echocardiography and new surgical techniques for correction of prenatally diagnosed cardiac malformations, a sound knowledge about the normal anatomy and development of the fetal heart has become absolutely necessary [12]. During intrauterine life, the foramen ovale allows most oxygenated blood entering the right atrium from the inferior vena cava and ductus

venosus to pass into the left atrium. It also prevents blood from flowing in the opposite direction, because the septum primum closes against a relatively rigid septum secundum. After birth, the foramen ovale usually closes, and the interatrial septum completely separates atrial chambers [13].

It is absolutely necessary to know the morphometric features of the fetal heart to achieve an accurate diagnosis of possible malformations as well as other conditions that may cause physiological alterations in the fetal heart progressing to cardiac failure and fetal death, if not opportunely corrected [12]. Clinical anatomy of the true interatrial septum is treacherous, difficult and its unfamiliarity can cause many serious complications. Thus, the aim of our study was to assess the regional morphology of the interatrial septum for a deeper understanding [14].

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Materials and Methods

This study is conducted in the Department of Anatomy, B.J Medical College, Ahmedabad, after obtaining permission from the ethical committee. These fetuses of both the sexes were collected from

the Department of Obstetrics & Gynaecology (Obs & Gyn), B.J Medical College, Ahmedabad with due permission from concerned parties & authorities. 24 female & 16 male fetuses were included in the study. The heart specimens were preserved by injecting 10% formalin into Umbilical vein. Age of the fetuses was determined from last menstrual period (LMP) & Ultrasonography (USG) report of Mother. 40 Fetal Hearts at gestational age from 14 to 40 weeks were dissected. Hearts were removed with a midline thoracotomy and cutting open the pericardial sac.

Inclusion Criteria

Aborted fetuses of gestational age 14 to 40 weeks.

Exclusion Criteria

- Patients refusing to give consent
- Aborted fetuses below the gestational age of 14 weeks & above 40 weeks
- Macerated fetuses

The following parameters were studied:

- a. Foramen ovale (FO)
- b. Septum primum (SP)
- c. Compare septum primum excursion with foramen ovale diameter

Method of Parameter Measurement

The heart was cut transversely to the interventricular septum from the apex to the base, allowing ventricular cavities to be visualized by opening the atrial wall and exposing the septum primum, septum secundum, and foramen ovale. Septum primum maximal excursion and foramen ovale diameter were measured by using an adapted measurement device (a caliper with two sharp metal ends).

Septum primum excursion was measured by fixing one of the ends of the measurement device in the septum secundum and the other in the middle of the free edge of the septum primum, which was pushed toward the left atrium as far as its maximal excursion, without deforming neighbouring structures.

Foramen ovale diameter was measured at a 90° angle in relation to the septum primum excursion measurement, corresponding to a line between septum primum implantation sites.

Results

The anatomical measurements of the formaldehyde preserved fetal hearts are presented in [Table 1].

Study carried out on 3 groups: (1) 14-20 weeks, (2) 21-30 weeks, (3) 31-40 weeks.

We observed that there is no much difference in foramen ovale diameter and septum primum excursion of male and female fetuses. Increasing the size is obvious as age of fetus is increasing [Table 1].

Age groups of fetuses were 14-40 weeks. From them, I am depicting some important figures. Figure 1 showing interatrial septum of heart from left side of 31 weeks. Figure 2 showing heart of 31 weeks measurement of foramen ovale and Figure 3 showing heart of 31 weeks measurement of septum primum.

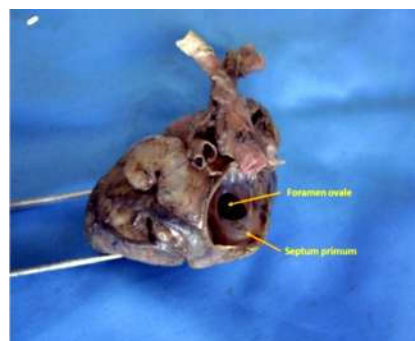


Fig. 1: Showing interatrial septum of heart from left side of 31 weeks

Table 1: Foramen ovale diameter & Septum primum excursion

S. No.	Gestational age (Weeks)	Sex	No. Of Fetus	Foramen Ovale Diameter (mm)	Septum Primum Excursion (mm)
1	14-20	M	6	2.3	2
		F	8	2.2	2
2	21-30	M	6	2.5	2.2
		F	10	2.5	2.1
3	31-40	M	4	3.2	4
		F	6	3.8	3.6



Fig. 2: Showing heart of 31 weeks measurement of foramen ovale



Fig. 3: Showing heart of 31 weeks measurement of septum primum

Discussion

During fetal life, septum primum acts as a valve that closes the foramen ovale when atrial contractions occur. During diastole, septum primum bulges into the left atrium, allowing maximal opening and right-to-left flow [15,16]

With the use of groups of fetuses of diabetic mothers with septal myocardial hypertrophy as a model for decreased left ventricular compliance and relaxation it was noted that, in this situation, septum primum excursion is reduced. Septum primum may also develop hypertrophy [17]. Such type of result was not found in our study as there was no any fetus from diabetic mother.

Conclusion

Septum primum mobility has proved to be an indicator of left diastolic function. Taking into account that septum primum mobility may reflect

changes related to left atrial pressure, alterations in left ventricular relaxation and/or compliance may affect the behavior of the former. It may be suggested that septum primum is active in character, and this behavior may influence the blood flow through the foramen ovale. Moreover, septum primum mobility itself, as well as its excursion into the left atrium, depends not only on left atrial pressure, but also on its muscle fibres [17].

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