REVIEW ARTICLE

Atrioventricular block during fetal life

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Congenital complete atrioventricular (AV) block occurs in approximately 1 in 20,000 live births and is known to result in significant mortality and morbidity both during fetal life and postnatally. Complete AV block can occur as a result of an immune or a non-immune mediated process. Immune mediated AV block is a multifactorial disease, but is associated with the trans-placental passage of maternal autoantibodies (anti-Ro/SSA and/or anti-La/SSB). These autoantibodies attach to and subsequently damage the cardiomyocytes and conduction tissue in susceptible fetuses. In this report, we examine the evidence in reference to means of assessment, pathophysiology, and potential prenatal therapy of atrioventricular block.

Keywords: Congenital heart disease, Fetal arrhythmia, Fetal echocardiography, Complete atrioventricular block, Prenatal therapy

Contents

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Abbreviations

A	atrial
AA	ascending aorta
AV	atrioventricular
AVCTI	atrioventricular contraction time interval
CTD	connective tissue disease
ECG	electrocardiogram
EFE	endocardial fibroelastosis
IVC	inferior vena cava
IV	intravenous
LA	left atrium
LAI	left atrial isomerism
LV	left ventricle
LVOT	left ventricular outflow tract
MCG	magnetocardiography
MV	mitral valve
RA	right atrium
RPA	right pulmonary artery
SLE	systemic lupus erythematosis
SP	spine
SVC	superior vena cava
TV	tricuspid valve
V	ventricular
VSD	ventricular septal defect

Introduction

Congenital complete atrioventricular (AV) block is defined as the dissociation of atrial and ventricular contractions which occurs in approximately 1 in 20,000 live births [1–3]. This causes a significant drop in the ventricular rate which may cause fetal cardiac failure, including fetal hydrops. Complete AV block is associated with a risk of intrauterine or postnatal demise and the optimal prenatal therapy for affected fetuses has proven controversial. Congenital complete AV block may result from either an immune or non-immune mediated process. It can be associated with underlying structural heart disease or can develop in association with a multifactorial, autoimmune process, associated with the trans-placental transfer of maternal autoantibodies. These autoantibodies are directed against Ro/SSA and La/SSB antibodies expressed on the fetal cardiomyocytes of susceptible fetuses. Congenital complete AV block of either is associated with significant prenatal mortality and postnatal morbidity and thus remains an area of major clinical interest [1,4–8]. The aims of this report are to review atrioventricular block occurring during fetal life, with particular reference to means of assessment, causation and prenatal therapy.

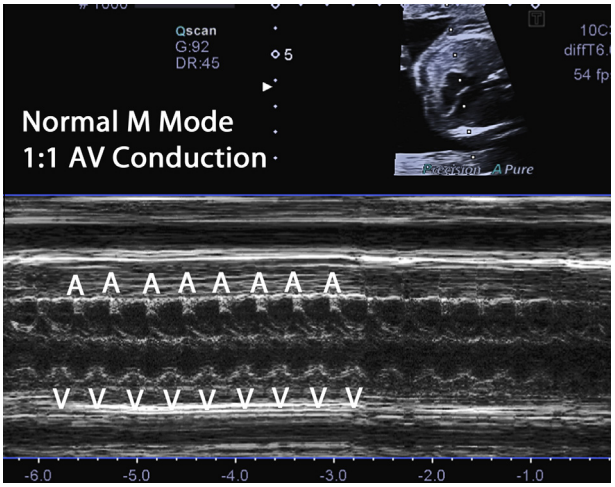

Figure 1. Normal M mode. The cursor is aligned through the atrial and ventricular myocardium. This is a normal M mode recording demonstrating 1:1 AV conduction. AV, atrioventricular; A, atrial; V, ventricular.

Assessment of fetal atrioventricular block

Postnatally, the 12 lead electrocardiogram (ECG) recording is the gold standard for assessment and diagnosis of rhythm disturbance. During fetal life it is difficult to extract the fetal ECG because of the distance of the fetus to the maternal skin, possible insulating properties of vernix, and the small size of the fetus, all of which contribute to low voltages. Fetal movement, interference from the maternal heart rate and maternal muscular contraction further contribute to the difficulties in extracting a fetal ECG [9]. Despite these limitations, this method has been used to accurately record the fetal ECG. An alternative technique, fetal magnetocardiography (MCG) has been used to detect the magnetic fields caused by electrical signals in the fetal heart. This technique is used in a research setting and typically depends on a magnetically-shielded room to be feasible [10–12].

Thus, echocardiography remains the principal technique for assessing AV synchrony or arrhythmias in the fetus. Mechanical assessment by M mode infers electrical activity by demonstrating sequential contraction of the atrial and ventricular myocardium by aligning the cursor simultaneously through both myocardial walls [13] (Fig. 1). The M mode technique can be used to confirm normal sinus rhythm, tachycardia and fetal bradycardia, including complete AV block [14] (Fig. 2). Tissue Doppler and pulsed Doppler techniques are also widely employed [15–17].