

Ectopic Beats

Insights from Timing and Morphology



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KEYWORDS

- Ectopic beats • Premature atrial beats • Premature junctional beats • Premature ventricular beats
- Atrial fibrillation • Electrocardiography • Arrhythmias

KEY POINTS

- Premature complexes are electrical impulses arising from sites other than the sinus node, which can cause contractions of the heart.
- Premature electrical impulses can arise from atrial, junctional, or ventricular tissue.
- Premature atrial beats are much more frequent than those arising in the atrioventricular junction, but less frequent than premature beats from the ventricles.
- Surface electrocardiogram (ECG) analysis of premature beats is of pivotal importance to predict the site of origin of the ectopic focus.

INTRODUCTION

Premature complexes are electrical impulses arising from sites other than the sinus node, which can cause contractions of the heart. The sinus node normally initiates cardiac activation, as a result of a faster intrinsic rate of automaticity; however, premature electrical impulses can arise from atrial, junctional, or ventricular tissue, leading to premature heart beats. The most common mechanism promoting the development of a premature beat is increased automaticity. Premature atrial beats (PABs) are much more frequent than those arising in the

Premature junctional beats (PJBs) but less frequent than Premature ventricular beats (PVBs). The aim of this article was to review the main electrocardiogram (ECG) features of premature complexes and discuss their implications in clinical practice.

PREVIOUS CONSIDERATIONS AND DEFINITIONS

Significant insights for diagnosis and localization of ectopic beats can be obtained via the analysis of the coupling interval and the post-extrasystolic pause (**Fig. 1**); they both result from the

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Abbreviations	
AD	Afterdepolarization
AV	Atrioventricular
LBBB	Left bundle branch block
LV	Left ventricle
PAB	Premature atrial beat
PJB	Premature junctional beat
PSVB	Premature supraventricular beat
PVB	Premature ventricular beat
RBBB	Right bundle branch block
RV	Right ventricle
SA	Sinoatrial
SHD	Structural heart disease
SoO	Site of origin
VT	Ventricular tachycardia

interactions between the ectopic focus and the conduction system of the heart.

Coupling Interval

The coupling interval is the interval between the dominant heart beat and a following ectopic beat. In an ECG recording several premature beats, the coupling interval may be fixed or variable. Coupling intervals are classified as fixed (Fig. 2) if their difference is <120 ms in the same patient, or variable (Fig. 3) if it is >120 ms. Ectopic beats with a fixed coupling interval are likely due to foci depending on the normal sinus rhythm, such as the normal beat influences the development of an ectopic beat. Ectopic beats displaying variable coupling intervals result from a protected ectopic focus, which is not related to the baseline rhythm. The ectopic focus is not depolarized by the sinus impulses, usually because of a unidirectional entrance block. Premature complexes with

variable coupling intervals originate in a so-called parasystolic focus (Fig. 4).

Post-extrasystolic Pause

The post-extrasystolic pause is the interval between the ectopic complex and the following sinus complex. Post-extrasystolic pause can be classified as follows:

- Fully compensatory (Fig. 5): the ectopic impulse frequently does not reach and reset the sinus node and the distance between the QRS complex preceding the premature beat and the following complex is twice the sinus cadence
- Not fully compensatory (Fig. 6): the ectopic impulse reaches and depolarizes the sinoatrial (SA) node, therefore resetting the sinus cycle. In this scenario, a pause following the ectopic beat does not compensate its prematurity
- Absent because of interpolation of the premature beat into 2 perfectly normal cardiac cycles (Fig. 7)

Distribution

On the basis of timing distribution, premature beats can display a repetitive sequence and be classified as follows (Fig. 8):

- Bigeminal: a repetitive sequence of a sinus and a premature beat
- Trigeminal: a repetitive sequence of 2 sinus and a premature beat
- Quadrigeminal: a repetitive sequence of 3 sinus and a premature beat Complexity (Fig. 9):
- Couplet: in the occurrence of 2 consecutive ectopic beats
- Tachycardia: if there are 3 or more consecutive ectopic beats

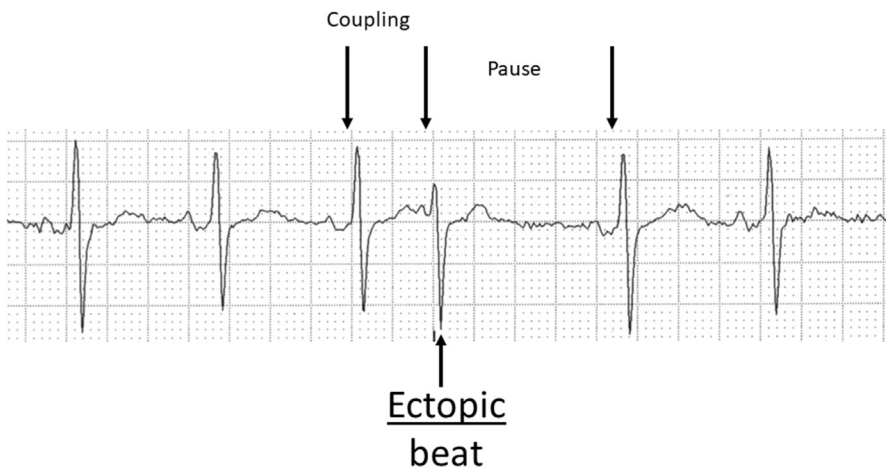


Fig. 1. How to measure the coupling interval and the post-extrasystolic pause of an ectopic beat.

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