Arrhythmias Originating in the Atria

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KEYWORDS

• Atrial arrhythmias • Atrial flutter • Atrial fibrillation • Atrial tachycardia • Scar-related arrhythmias • ECG

KEY POINTS

- ECG, thanks to its low cost and accessibility, remains a valuable tool in the diagnosis of arrhythmias.
- The relationship between ECG morphology and atrial activation, as well as wavefront progression, has been clarified by intracardiac mapping.
- The ECG definition of atrial arrhythmias is based on recognition of specific patterns related to definite sequences of atrial activation.
- Atrial flutter (AFL), with its main variants, is a complex macro-reentry. Its mechanism and activation path can often be identified by an attentive analysis of the ECG tracing.
- The site of origin of focal atrial tachycardias due to enhanced automaticity or micro-reentry can be reliably identified on ECG although their mechanism remains often unknown.
- Despite that atrial fibrillation's origin, persistence, and mechanisms have been largely explained, these advances have not translated into a more meaningful analysis of the ECG of this arrhythmia.

INTRODUCTION

ECG and Electrophysiology: The Advantage of Intracardiac Recordings

ECG remains the most useful noninvasive tool in the diagnosis of atrial tachyarrhythmias (**Figs. 1–3**). The diagnostic criteria of each arrhythmia have been elucidated over many years of observation and deductive analysis; with the advent of animal studies, arrhythmias' mechanisms were also fully defined. The concepts of reentry, abnormal automaticity, and triggered activity were postulated and demonstrated in animal studies over the past 50 years. These observations were extrapolated to human arrhythmias when clinical and experimental data coincided. Human intracardiac recordings, followed by sophisticated 3-D reconstructions of cardiac electrical activity, have opened the doors to confirmations and revisions of previous understanding of arrhythmias. Abnormal automaticity and triggered activity are difficult to diagnose even during electrophysiology studies and require assessing the response to multiple intravenous drugs and, at times, monophasic action potential recordings. There are some observations made during invasive studies also present during ECG analysis that may help differentiate between these 2 mechanisms. The clinical usefulness of this information is debatable

No relevant conflicts to disclose.

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Card Electrophysiol Clin 9 (2017) 383–409
http://dx.doi.org/10.1016/j.ccep.2017.05.002

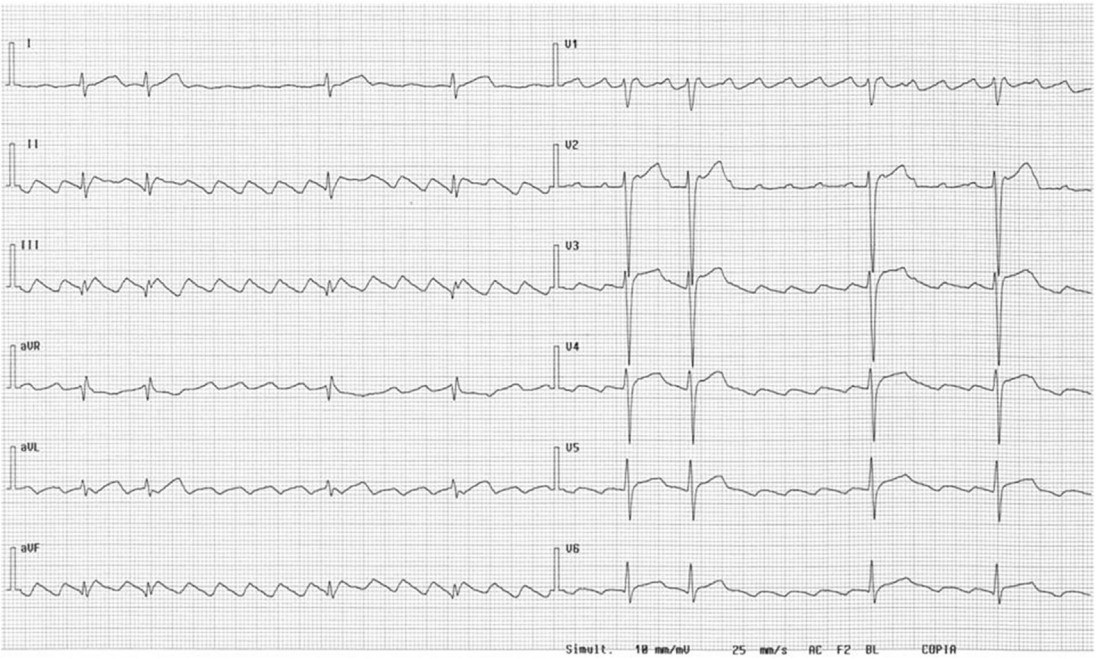

Fig. 1. AFL, common type, with the typical sawtooth pattern in the inferior leads.

because there are no consistent data supporting a specific drug regimen based on the mechanism of either arrhythmia. The study and characterization of reentry, on the other hand, has been one of the most rewarding electrophysiologic endeavors. From its initial concept in a ring of jellyfish to the analysis of fibrillatory conduction in animals and humans, reentry has been defined and understood in almost its entirety. Transfer of this knowledge to the realm of ECG, has helped understand, for example, the genesis of ECG waveforms during typical flutter and better define reentrant atrial

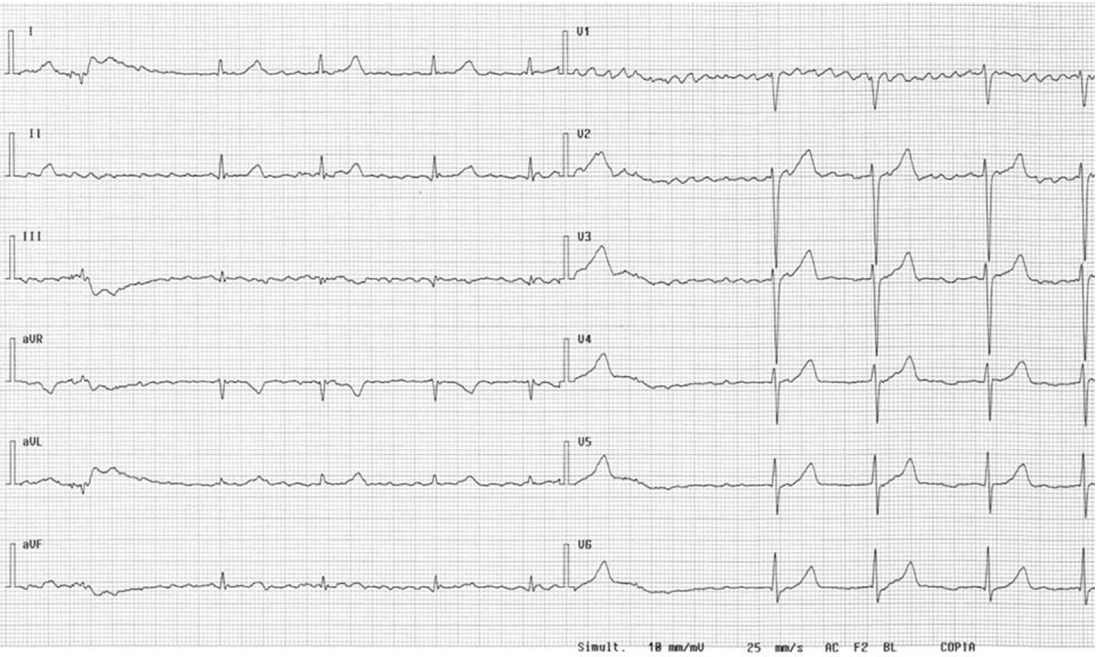

Fig. 2. Atrial fibrillation: fibrillation waves are well evident, the QRS complexes are completely irregular.