Focal atrial tachycardias are a relative rare rhythm disorder, seen in less than 10% of electrophysiological studies. In general, two types of atrial tachycardias can be defined based on their electrophysiological mechanisms [33]:

- Focal atrial tachycardia (due to an automatic, triggered, or microreentrant mechanism)
- Macroreentrant atrial tachycardia (including typical isthmus-dependent atrial flutter) and other macroreentrant tachycardia (in the right and left atrium).

This chapter concentrates on focal mechanisms although in some instances a clear distinction between a circumscribed reentrant circuit and a focal pattern of atrial activation cannot be made.

### 8.1 Definition

Focal atrial tachycardia is due to an automatic, triggered or microreentrant mechanism [3].

- Enhanced (or abnormal) automaticity cannot be initiated or terminated by programmed electrical stimulation. It cannot be entrained but it may be transiently suppressed with atrial overdrive stimulation but will resume with a gradual increase in rate. It usually can be elicited by administration of intravenous isoproterenol. A classical phenomenon is “warming up” and “cooling down” of the arrhythmia.
- Triggered activity is clinically less well characterized. It can be initiated and terminated by pacing but no entrainment is found. Tachycardia initiation is cycle length dependent. Verapamil and adenosine may suppress triggered activity.
- Atrial tachycardias based on microreentrant mechanisms are inducible by techniques of programmed electrical stimulation and are circumscribed to small areas of scar or fibrosis. In these regions, entrainment stimulation may be possible. It may respond to adenosine.

On clinical grounds these distinctions are not very helpful. The electrophysiological characteristics of focal atrial tachycardia are based on accepted criteria [26]:

- Radial spreading in all directions from a single site of earliest activation
- Range of activation less than the tachycardia cycle length (in macroreentrant tachycardia it would span over the whole tachycardia cycle length)
- Elimination of atrial tachycardia by focal ablation at the site of earliest activation.

Focal atrial tachycardias may be unifocal or multifocal (10%) and may have confusing electrocardiographic features. Posteroseptal atrial tachycardia may mimic fast-slow AV nodal reentrant tachycardia or AV reentrant tachycardia involving an accessory bypass tract, e.g., permanent junctional reentry tachycardia. The atrial rate is less than 250 beats per minute with an isoelectric baseline between P waves (in contrast to atrial flutter). They occur with and without structural heart disease and can be incessant or paroxysmal. The following electrophysiological criteria are used to make a diagnosis of focal atrial tachycardia:

- P wave configuration different from that of sinus rhythm (for clarification of P wave morphology brief ventricular pacing (Figure 8.1) or intravenous adenosine may be helpful)
- Occurrence of tachycardia independent of critical atrial-His interval
- Spontaneous termination in the absence of AV block
Fig. 8.1. Brief right ventricular stimulation (S) to clarify P wave morphology. After cessation of pacing, the onset of the P wave in lead I can clearly be delineated.

Fig. 8.2. The response to ventricular pacing with 1:1 ventriculoatrial conduction during tachycardia in a patient with atrial tachycardia. Shown are the leads I, II, III and V1 and the intracardiac electrograms recorded at the high right atrium (HRA), His bundle electrogram (HBE) and the right ventricular apex (RVA). The tachycardia cycle length is 260 ms. Ventricular pacing at a cycle length of 230 ms results in 1:1 ventriculoatrial conduction. The electrogram response upon cessation of ventricular pacing is atrial-atrial-ventricle (A-A-V). From Knight et al. [4] with permission.

Upon cessation of ventricular pacing with a cycle length shorter than the tachycardia cycle length and retrograde capture of the atria an “A-A-V” response [21] occurs (Figure 8.2).

This is highly sensitive and specific and virtually diagnostic of atrial tachycardia [31]. The atrioventricular node is refractory for anterograde conduction for the last retrograde atrial complex (resulting from ventricular pacing) leading to an “A-A-V” response.

- In case of VA conduction, the atrial activation sequence is different from that of the tachycardia.
- A variable VA relationship during tachycardia. In AVNRT or AVRT, the VA interval is fixed as this retrograde limb is an integral part of the reentry circuit.
- VA dissociation (Figure 8.3) during ventricular pacing. The inability to capture the atria retrogradely during ongoing tachycardia had a positive predictive value of 80% for atrial tachycardia [31].
- Exclusion of accessory pathways, AV nodal reentrant tachycardia. Positive P waves in inferior leads (inferior P wave axis) excludes AVNRT and AVRT because this suggests a superior origin of an atrial tachycardia. A potential exception is the retrograde limb of an anteroseptal bypass tract which may result in an inferior P wave axis. Negative P waves in the inferior leads (superior P wave axis) and a long R-P interval occur in atypical AVNRT and a concealed bypass tract with a slow ret-