CATHETER ABLATION FOR VENTRICULAR TACHYCARDIA

This chapter sets out standards and treatment models for non-drug therapy of ventricular tachycardia excluding device therapy (ICD therapy). It covers both catheter-based ablation and surgical treatments but should be considered in conjunction with chapters on ICD therapy and prevention of sudden death

KEY POINTS:

1. Ventricular tachycardia may arise through a variety of mechanisms and no single treatment will be effective or appropriate for all.
2. All patients with VT should be referred for specialist arrhythmia (electrophysiological) assessment.
3. In patients with VT but without evidence of structural heart disease, the outlook is good.
4. Radiofrequency catheter ablation is the treatment of choice for symptomatic patients especially for those inadequately controlled, or intolerant of, medical therapy. This can be performed in any specialist EP centre.
5. In those whose VT arises in the context of structural heart disease, it is crucial to evaluate and treat each aspect of their condition which may include:-

    - heart failure
    - hypertension
    - coronary heart disease
    - congenital heart disease
    - valve disease
    - cardiomyopathy

    and not to focus solely on the arrhythmia.

6. In scar-related VT (typically after a previous healed heart attack), catheter ablation should be considered if there are contraindications to, or problems after, defibrillator therapy
7. If there is a separate indication for heart surgery (e.g. need for surgical revascularization, LV aneurysmectomy, mitral valve repair or replacement), surgical ablation should be considered.
8. Such techniques will likely be confined to a limited number of specialist arrhythmia management centres so that clustering of experience can improve outcomes.

Steve Furniss, Freeman Hospital, Newcastle / A J Camm, St George's Hospital Medical School

AIMS

This chapter details the roles of catheter and surgical therapy in patients with either normal heart ventricular tachycardia (VT) and scar–related VT.

Standards

1. In patients with structurally normal hearts and symptomatic VT or frequent ectopy despite medical therapy, catheter ablation should be recommended.

2. In patients with scar-related VT catheter ablation should be strongly considered in particular circumstances:

    - Incessant VT.
    - Before or instead of ICD implantation if arrhythmia frequency is high.
    - after defribrillator implantation if shock frequency is unacceptably high for the patient frequent shocks.
    - Patient choice.

3. Surgical therapy for VT should be considered in occasional patients particularly those requiring additional surgical therapy.

Rationale

Ventricular tachycardia (VT) presents as palpitations, dizzy spells, cardiac arrest or sudden death and causes considerable anxiety in patients, their relatives and medical personnel alike. Patients may complain of palpitations due to awareness rapid heart activity but may also present with collapse or even cardiac arrest due to loss of effective cardiac output causing a fall in blood pressure.

VT may arise through abnormal firing of a small group of cells in an otherwise normal heart ("normal heart VT"). If these small critical areas can be located, (they are usually in certain well-defined anatomical regions), focal, "point" catheter ablation can cure the problem [1,2].

VT most commonly arises in people with scarred ventricles (e.g. after myocardial infarction or congenital heart disease surgery or in heart muscle disorders) as a result of the heart's electrical activity short-circuiting within or around an area of scarring within the heart (scar-related VT).

The prognosis of patients with scar-related VT is determined by the extent of LV dysfunction, residual ischaemic burden and the arrhythmia. All patients with VT should have an assessment of LV function and every effort made to optimise LV function and treat heart failure if present. Although the ICD is very effective and reduces mortality it is not curative and for some patients with scar-related VT a curative ablation strategy should be considered.

The rationale for effective treatment of scar-related VT is very different from normal heart VT. The primary strategy is to target the arrhythmogenic zone and not just a particular VT morphology or exit pattern. This can be performed by either surgical resection of the abnormal region of heart muscle or by linear catheter ablation. Catheter or surgical ablation approaches require close team work and a critical mass of experienced specialists, usually only available in specialist units. Complex mapping equipment is often required for best results in catheter ablation and it is impractical to have these located everywhere.

EFFECTIVE INTERVENTIONS

Normal heart VT

VT may arise in people with structurally normal hearts from particular locations within the heart. The sites are either small areas of the outflow tract region of the ventricles (idiopathic outflow tract VT) or from a small zone of the specialised conducting tissue within the left ventricle (fascicular VT) [1,2]. Both these arrhythmias tend to occur in younger patients and are often exercise related. Catheter ablation is highly effective and curative with >90% success and low complication rates. It is now the treatment of choice for symptomatic patients. It is important that these patients are recognised by:

- History of exercise induced palpitations in a young patient with documented VT at symptom times, and
- Characteristic 12 lead ECG pattern

Symptomatic patients, especially those who fail to respond to, or are intolerant of medical therapy should be offered catheter ablation despite the benign prognosis of these conditions.

Catheter ablation may also be effective in highly symptomatic patients with monomorphic ectopics arising from the outflow tract regions of the heart [3].

Idiopathic outflow tract VT has a characteristic single ECG appearance and needs to be distinguished from VT due to right ventricular dysplasia/cardiomyopathy (RVD/C). RVD/C is an inherited, progressive form of predominantly RV cardiomyopathy. It presents with complex ventricular ectopy, sustained VT or cardiac arrest. An ICD is usually appropriate in this condition. Diagnostic criteria have been published for RVD/C [4].

Scar-related VT - VT late after myocardial infarction

Catheter ablation

Early studies showed that catheter based ablation is acutely effective in well tolerated VT in 60-70% of patients. However such patients make up only about 10% of the VT population and 20% of patients with well tolerated VT will also be capable of sustaining poorly tolerated VT; hence an ICD is the treatment of choice for most patients with VT late after a myocardial infarction. Early series of catheter ablation end-points were poorly defined and outcomes were poor [5]. As a result many patients defined as having had a “successful ablation” went on to experience further VT and many cardiologists lost faith in the ability of catheter ablation to make any meaningful contribution to the management of patients with post-infarction VT. However linear ablation strategies that target the scar rather than a particular VT, the availability of more effective ways of creating lesions, better mapping systems and much more rigorous definition of outcomes[6] have yielded acute and long term success in 70% of patients, including those with poorly tolerated VT [7-9].

The current indications for catheter ablation of post MI VT are:

- incessant VT
- shock frequency unacceptable to the patient
- frequent VT that would lead to frequent ICD therapies
- patient choice

VT surgical ablation

Surgical resection of the arrhythmogenic scar zone is very effective in the management of patients with VT and can be performed in selected patients with risk comparable to conventional coronary surgery (mortality <10%).

Surgery, unlike catheter ablation, not only targets the arrhythmia but may also address revascularization issues and remodels the ventricle producing a significant improvement in overall left ventricular performance.

VT surgery should be considered [10,11]

- in anterior infarction particularly with an aneurysm present
- in patients with low co-morbidities
- with ≥3 of 9 normally contracting LV segments [10]
- in patients requiring additional surgical therapy

VT associated with Cardiomyopathies.

In patients with cardiomyopathies such as right ventricular cardiomyopathy, which may be progressive, catheter ablation has a much more limited, palliative role and is reserved for patients with frequent ICD shocks. Surgery may have a role in occasional patients with intractable cardiomyopathic VT.

Service Models

Catheter ablation of VT is an important cost-effective [12,13], curative option for some patients and all patients with VT should be referred to an EP centre for further assessment.

VT ablation in patients with normal heart VT can be performed in well equipped EP centres performing standard narrow complex tachycardia ablations

Scar related VT ablation has important implications for the NHS. These patients although not very common are big consumers of NHS resources. They have frequent, often prolonged admissions and require complex management plans and multiple procedures. A skilled team comprising at least two experienced electrophysiologists, trained technicians and nurses is essential to achieving consistently high quality outcomes for patients. Access to surgical therapy for VT should be available in such centres. Complex VT ablation is currently performed in approximately 7 centres and the specialist nature of this work needs to be recognised and referral routes clarified. Facilities for transport of electrically unstable patients to specialist centres will be a priority for the ambulance services.

Immediate Priority

Establish and properly staff and resource specialist VT treatment centres with clear referral routes covering the country.

LAY SUMMARY

Runaway heart rhythms arising in the main pumping chamber of the heart (ventricular tachycardia) may reflect serious heart disease and all patients should be referred for assessment in specialist centres experienced in the management of patients with heart rhythm problems.

When ventricular tachycardia arises as an isolated electrical disturbance of the heart without any evidence of muscle damage the treatment of choice is cautery of the small culprit area of abnormal heart tissue, a technique called catheter ablation.

In most patients ventricular tachycardia reflects heart muscle damage and in certain situations curative ablation, be it by catheter or surgery, should be considered and the patient should be referred to a specialist centre with particular experience in this complex form of treatment.

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