# ABLATION FOR PAROXYSMAL SUPRAVENTRICULAR TACHYCARDIA (PSVT)

# **KEY POINTS:**

- Paroxysmal supraventricular tachycardia (PSVT) is a common condition effecting about 125,000 patients in the UK. Some patients with PSVT are at risk of sudden cardiac death, but most of the impact is on quality-of-life, employment, exercise, pregnancy and social life. Attacks of tachycardia are frequently very unpredictable. In WPW Syndrome there is about a 2% annual risk of sudden cardiac death.
- 2. PSVT can usually be completely cured with a success rate of over 95% in the majority of cases, and a very low risk, using catheter ablation techniques.
- 3. Patients of all ages with PVST can be cured, but the timing of catheter ablation in children has to be carefully judged, (see chapter 27).
- 4. In patients with suspected PSVT, symptom/ECG correlation is vital. When this is available, it is usually possible to investigate the precise cause of the PSVT and proceed to curative catheter ablation at the same invasive procedure.
- 5. A catheter ablation procedure is undertaken under local anaesthetic with conscious sedation in most cases, through tiny needle-punctures into the veins or arteries, takes about 2-3 hours, and increasingly can be undertaken as a day case.
- 6. Catheter ablation for PSVT should be undertaken by appropriately trained cardiac electrophysiologists working in well-equipped centres undertaking at least 150 ablations a year. Ideally two or more electrophysiologists should share the catheter laboratory and other facilities.
- 7. Other arrhythmias can also be treated by catheter ablation techniques, including atrial arrhythmias such as atrial flutter and atrial fibrillation. In some cases these procedures are just as effective as for PSVT, but generally, the more complex the arrhythmia, the lower the cure-rate.
- 8. In patients with structural heart disease, catheter ablation has a small but important role in conjunction with treatment with antiarrhythmic and heart failure drugs and implantable devices. This is called hybrid therapy.
- 9. In such cases catheter ablation is not designed to be curative, but is used to assist the overall management of a patient's arrhythmias, and also reduce ICD discharges in some cases.
- 10. For these uses, catheter ablation approaches will usually be undertaken in specialist centres, rather than local hospitals, but the staffing, equipment and skills-base are developed from the core ablation training for PSVT.
- 11. The need for catheter ablation for PSVT is approximately 150-250/million per annum in order to reduce the overall prevalence and cope with new cases.

# **PSVT - HEADINGS**

- 1) Definition of PSVT.
- 2) Impact of PSVT on health.
- 3) How many people are affected?
- 4) Influence of age on therapeutic options.
- 5) Assessment of Patients with suspected PSVT.
- 6) Treatment of PSVT.
- 7) Special clinical situations.

# DELIVERING EFFECTIVE MANAGEMENT OF PSVT IN THE UK

- 1) Specific Goals.
- 2) Milestones.
- 3) Responsibility for the delivery and monitoring of progress.

# **DEFINITION OF PSVT**

PSVT is an intermittent rhythm disturbance lasting from several seconds to hours at a time where the source of the arrhythmia includes rhythms emanating from the sinus node and from atrial tissue. Most cases are due to AVNRT or AVRT or accessory pathway -mediated tachycardia. This excludes arrhythmias where the origin is from the main pumping chambers of the heart – the ventricles, that is VT and VF Also excluded are atrial fibrillation and atrial flutter, as these are also dealt with separately.

# IMPACT OF PSVT ON HEALTH

PSVT is relatively common, tends to recur, and is occasionally persistent. PSVT is rarely life threatening, unless associated with the WPW Syndrome. At presentation in primary care or a hospital outpatient setting most patients with PSVT will be in normal sinus rhythm and in the majority there will be no evidence of structural heart disease.

PSVT causes:

- Rapid regular palpitations
- > Fatigue
- Light-headedness.
- Chest discomfort or pain.
- Shortness of breath.
- Syncope in 15% of patients at some point during their history<sup>1</sup>. This usually occurs just after the arrhythmia has started or in association with a long pause in the beating of the heart between the arrhythmia stopping and the resumption of normal rhythm.
- PSVT may persist for weeks or months may lead to weakening of the heart muscle (tachycardiomyopathy)<sup>23</sup>

PSVT is very disruptive very disruptive to the pattern of normal life. A trip to the shops or to pick up children from school is often affected by the anxiety that shortly after leaving home the rhythm may suddenly occur resulting in embarrassing and disabling symptoms or even an emergency hospital admission. Some patients are required to give up driving <sup>4</sup>. Many patients fear that exertion will provoke an episode and so give up normal exercise and activity. Other PSVT sufferers are forced to take recurrent days off work, with a deleterious impact on their careers and financial status.

## HOW MANY ARE AFFECTED, AND HOW MANY SHOULD BE TREATED?

The prevalence of PSVT in the UK population is unknown. A survey  $^5$  of a mainly Caucasian population of 58,820 in Wisconsin, USA sampled 3.5% of medical records and found a prevalence of 2.25 people per thousand. They estimated an incidence of 350 new patients per million. The mean age at onset was 57 years, with a range from infancy to over 90 years. Patients with PSVT and no structural heart disease were younger, with mean age 37, and had faster heart rates than patients with structural heart disease (186 v 155 beats per minute) and were more likely to first present to an emergency department (69% v 30%). PSVTs were also twice as common in females as in males.

Applying these data to a mixed urban and rural population of 750,000 in the Southwest Peninsula of the UK, the expected incidence of PSVT would be 223 people a year, (assuming that 15% of the patients would be children). In this population there is a stable waiting list for PSVT catheter ablation of 50 ablations annually for this population. This is only 22% of the numbers calculated from the Wisconsin figures.

Possible explanations for this disparity are:

- 1) The Wisconsin data overestimate the incidence of PSVT for a UK population this seems very unlikely.
- 2) Only a small proportion of eligible patients are being referred to secondary or tertiary care or curative catheter ablation this seems very likely.
- 3) The great majority of patients are insufficiently symptomatic to warrant ablation.

Or a combination of all three factors.

Data from the CCAD, (kindly provided by Dr D Cunningham), has used HES returns from hospital trusts to assess current activity. These data may not be reliable, but indicate that about 3,800 ablations were carried out in the UK in 2003, giving a current ablation rate of about 60/million. The HES data also suggested that about 3,000 diagnostic electrophysiological studies were also carried out. As a proportion, this seems very high, since time-constraints determine that many ablations are done immediately a diagnostic study has identified the arrhythmia substrate causing PSVT. It is quite likely that about 5,000 ablations are being undertaken, but many procedures are being miscoded. Perhaps ablation is being offered at a rate of 80-100/million.

The prevalence of PSVT is thought to be about 2/1000<sup>5</sup>, in the population, or about 125,000 patients in the UK. The incidence has previously been estimated at about 60 new cases/million. It is additionally thought that there are about 50,000 new cases of atrial flutter per annum, (see chapter 16).

# An ablation rate of 150/million may contain the growth of symptomatic patients with PSVT and other common arrhythmias that can be ablated, but it is unlikely to greatly reduce the prevalence of the problem, and the drain on healthcare resources, for which rates of approximately 250/million are probably needed. More staff, training and facilities are needed if more patients are to be cured.

Some patients undergo EPS but are found to be non-inducible or to have PSVTs unsuitable for ablation such as Multifocal Atrial Tachycardias. About 20% EP studies do not proceed to ablation (personal and personal communication data sets). Recurrence rates after ablation are about 5%. Depending upon raised awareness

and patient preference, an approximate target for invasive diagnostic EP studies with a view to curative catheter ablation in the UK is 150-250/million per annum.

# INFLUENCE OF AGE ON MANAGEMENT OF THE ADULT POPULATION WITH PSVT

A tendency to avoid invasive therapy in elderly patients is unwarranted as there is evidence of considerable benefit from ablation in the elderly with drug-refractory symptoms <sup>6</sup> <sup>7</sup>. The elderly also tolerate PSVT less well than younger patients. Therefore, there should be no upper age limit for catheter ablation. This may further increase in the numbers requiring catheter ablation annually.

# **ASSESSMENT OF PATIENTS WITH SUSPECTED PSVT**

Patients may present with probable PSVT by:

- 1) 999 call from the community initial assessment by ambulance paramedic crew.
- 2) Directly to an Emergency department with friends or relatives.
- 3) GP home visit (may be advised to call 999).
- 4) At GP surgery after an episode has resolved.
- 5) To a hospital physician with a GP referral with an unexplained symptom.
- 6) Presentation during a hospital admission for another condition.
- 7) Out of hospital cardiac arrest.

Principles of investigation of symptoms are found in chapter 5.

The key principle of investigation and treatment is the need to achieve symptom/ECG correlation.

This may be achieved by:

- 1) 24 hour ambulatory ECG. This is rarely of benefit unless patients have very frequent symptoms.
- Patient retained event recorders (e.g. 'King of Hearts' event recorders). Useful for symptomatic, but well tolerated episodes occurring on average once every 2-3 weeks. Limited ECG traces retained as records.
- 3) 7 day loop recorders (e.g. Novacor recorders) Useful for detection of less clearly symptomatic or poorly tolerated episodes. Automatic recording of sudden rate change episodes. Limited ECG traces and problems in some patients with wearing electrodes for one week (allergic reactions, problems with electrode adhesion).
- 4) Implantable loop recorders (e.g. Reveal recorders) Effective for obtaining an ECG diagnosis where severely symptomatic infrequent episodes occur.
- 5) Open access to GP surgery or A&E department for 12 lead ECG recording during a sustained episode.
- 6) ECG recording by paramedic crew following 999 call. An ECG is often recorded by paramedic crews, but not infrequently goes astray before the patient comes to a cardiac electrophysiologist for consideration of catheter ablation.

## TREATMENT OF PATIENTS WITH SUSPECTED PSVT

#### Advice on avoidance of triggering factors

All patients should be advised about the potential triggering effects of high intake of alcohol, smoking, caffeine containing drinks and proprietary medications and recreational drugs.

## Advice on simple reflex manoeuvers

Information sheets should be available to all patients explaining the valsalva manoeuver and use of other vagal manoeuvers, such as gagging, facial water immersion and carotid sinus massage.

#### Pill in the pocket approach

There is a small amount of evidence supporting the use of single dose oral therapy taken at the time of an attack<sup>8</sup>. This should be reserved for patients with:

- ➤ A normal 12 lead ECG in SR.
- > Infrequent, haemodynamically well tolerated attacks.
- > Absence of contraindications to the drugs involved.

One recommendation in the ACC/AHA/ESC guidelines for the management of patients with PSVT is for the use of a combination of Diltiazem 120mg and Propranolol 80mg.

## Long term antiarrhythmic drug therapy

More frequent episodes of PSVT unsuitable for curative catheter ablation and sufficiently symptomatic to warrant daily drug therapy can be managed with antiarrhythmic drugs such as verapamil or diltiazem, B blockers, or other antiarrhythmic drugs. The decision to manage PSVT with long term daily drug therapy should be taken by or in consultation with a cardiac electrophysiologist. Certain drugs will require supervision of dose titration and or follow-up by a cardiac electrophysiologist.

#### Invasive assessment with a view to Catheter Ablation

EPS with a view to catheter ablation will be the preferred approach to therapy in most patients with documented sustained recurrent PSVT. Catheter ablation procedures are curative in 95% of patients with re-entrant PSVT such as AVNRT and AVRT, with a lower rate of success in focal atrial tachycardias. The procedure related mortality from reported series is 1:500 or lower although significant complications have been reported to occur in up to 4.4% in registry data<sup>9 10</sup>.

#### Other invasive approaches (Surgery, Devices)

Very rarely anti-tachycardia pacing devices or cardiac surgical approaches may be the only way of controlling particular types of PSVT. Such patients should be managed at specialist tertiary referral centres.

# **SPECIAL CLINICAL SITUATIONS**

#### Pregnancy, Inter-current Illness, Congenital Heart disease

PSVT is commoner in patients with underlying congenital cardiac disease, with intercurrent illnesses, during pregnancy and after childbirth. Special assessment is required in such situations and approaches to management are dealt with in detail in the ACC/AHA/ESC guidelines<sup>1</sup>. They are not considered further here in this document.

## **Specific Goal 1**

# Symptom/ECG Correlation.

A full range of ECG technologies should be available to Primary Care and to hospital based cardiologists to facilitate symptom/ECG correlation to assist management of the patient.

#### Milestones

#### **Rapid Response Mobile PSVT service**

A new type of service should be piloted and with a view to be put in place in all areas within three years to provide a 24 hour dedicated paramedic crew or GP based call out service with a 12 lead ECG recorder and training in acute arrhythmia management. Such a service should be able to transmit ECGs to a central facility such as a District General Hospital Coronary Care Unit for advice and to inform discussion related to the need or advisability of emergency admission. The service should cover a sufficiently limited area for the team to reach a patient who is suffering from a sustained PSVT within 30 minutes from receipt of the call. Records of ECGs in sinus rhythm and in the arrhythmia should be retained in hospital notes, A&E records (if separate) and in GP notes.

Such an ECG service may be possible for all ambulances using existing technology, and the development of primary PCI for acute myocardial infarction might be a further indication for improved handling and transmission of ECGs. The available options need to be explored urgently.

## 'Ambulatory' monitoring services

The results from a full range of the different recording modalities outlined on page 6 above should be available within six weeks from referral to a cardiac electrophysiologist. This milestone should be achieved within two years from the introduction of the program.

#### A&E

All patients admitted to A&E with a suspected PSVT should have a 12 lead ECG performed within 15 minutes of arrival and a copy of the ECG should be given to the patient for safekeeping and further distribution by the patient to GP, Cardiac Electrophysiologist etc. before they leave the department.

# Specific Goal 2

# **Referred to a Cardiac Electrophysiologist**

Indications for referral for evaluation for ablation:-

- 1) Any patient with ventricular pre-excitation on 12 lead ECG
- 2) Any observation of wide complex tachycardia
- 3) sustained narrow complex tachycardia and failed medical therapy
- 4) History suggesting PSVT with syncope, or other severe symptom
- 5) History suggestive of PSVT with structural heart disease
- 6) History suggestive of PSVT with history of sudden cardiac death or other serious arrhythmic events at young age in other family members
- 7) Any patient with symptoms suggestive of PSVT interfering with the patient's quality of life and unresponsive to simple therapeutic approaches in primary care.

## Milestone

All Primary Care Trusts should be required to submit audit data within two years drawn from a sample of GP records and A&E records to ensure that a target of 90% of patients with the criteria above are being referred to a Cardiac Electrophysiologist for specialist assessment.

Primary Care Trusts should demonstrate that where the demand for assessment by a Cardiac Electrophysiologist is too great for patients to be seen within Out-patient waiting time targets, that a program of expansion of Cardiac EP services to redress this is in place and delivers the target within three years from the publication of the arrhythmia directive.

## Specific Goal 3

Primary care trusts should aim to achieve a minimum target of 150 per million population per annum of invasive electrophysiological procedures with a view to curative catheter ablation for PSVT, and excluding atrial and ventricular arrhythmias.

Waiting times should be within normal government waiting time targets. Clinically urgent procedures should take precedence over routine admissions when necessary. Reasons for delays beyond government target deadlines for routine cases should be specifically documented and reviewed annually.

## Milestone

Achievement of the minimum level of 150 per million target and the waiting time targets should be demonstrated within two years of the publication of the document. Within two years each regional group should demonstrate effective surveying of the level of PSVT in their population and matching of the provision of EP services to the population requirement. This should involve patients of all ages and may result in a requirement for provision above the minimum target of 150 per million.

## Specific Goal 4

## Information Resources

The Arrhythmia Alliance and Department of Health should jointly produce patient and non-specialist physician information sheets and web and recorded telephone message based resources giving information on the identification and management of PSVT related issues.

#### Milestones

A working group constituted by the AA and the DoH with patient groups, paramedic and primary care input should decide on the most useful topics to address within 3 months from the publication of the document and the information base written and made available in the public domain within six months from the publication of the document.

#### Auditing and Monitoring Progress

#### Regional and UK audits

Registry audit data should be collected using the minimum data set and submitted to mandatory audit in the public domain on a regional basis annually starting 12 months from the publication of this document. A sufficient audit should represent a population between 1 and 3 million people convened with advance notice in a hospital department or other agreed location within the region concerned and all Cardiologists, Cardiac Technicians of Senior Chief Technician grade, Strategic Health Authority leads, Clinical Network leads, Primary Care Trust leads and Chief Executives or their representatives should be invited. Other groups that should be invited to participate would be representatives from A&E, Ambulance services, patient groups and Clinical Liaison Services. Attendance by a minimum quorum from the groups above should be recorded and forwarded in an official report to the DoH. At the audit the results from the cardiac electrophysiology service to the region as well as the progress in meeting the PSVT 'milestones' should be reviewed and were deficiencies are identified, steps to address problem issues agreed. The decisions made should be recorded and forwarded in the report to the DoH.

Regional audit data and review of progress should be submitted to a central audit which should be held on a UK basis annually starting at 18 months following the publication of the document. The meeting should be in the public domain, and a similar cross-section of key personnel should participate.

# LAY SUMMARY

Paroxysmal supraventricular tachycardia is a common condition effecting about 125,000 patients in the UK. In a few patients with PSVT there is an abnormal conduction pathway in the heart which causes a short-circuit that not only causes PSVT, but may also cause sudden cardiac death. Most of these patients have the WPW Syndrome, and the annual risk of sudden cardiac death affects about 2 patients in every hundred with WPW. The skills built-up in training and in practice for curative catheter ablation of such arrhythmias, can be deployed in other areas, such as for the ablation of atrial and ventricular arrhythmias. These cases are more challenging, and are likely to be undertake in specialist centres. "Routine" catheter ablation is expected to be developed in local hospitals in time, according to the vision of the British Cardiac Society and the Royal College of Physicians.

Althoug not life -threatening for most patients, PSVT can have a very significant on normal life. PSVT effects quality-of-life, employment, exercise, pregnancy and social life. Attacks of tachycardia are frequently very unpredictable.

Fortunately, PSVT can be completely cured in the majority of sufferers, however the technique of curative catheter ablation requires special training and equipment which is much less available in the UK than in Western Europe and the USA. Many patients will therefore be offered medical treatment with tablets in the first incidence, but should be referred to a cardiac electrophysiologist for ablation if the drugs are unsatisfactory.

When there are symptoms of rapid regular palpitations, it is vital that an ECG is recorded during an attack so that the cause can be confirmed and appropriate treatment planned. Where curative catheter ablation is appropriate and available, it can be undertaken under local anaesthetic with sedation in about 2-3 hours with a very low risk and a high chance of success, often as a day-case or with an overnight stay. Centres where catheter ablation is undertaken should aim to perform 150 ablations each year and should plan to employ at least two cardiac electrophysiologists.

Planning for 150-250 ablations/million will probably be required for the UK to deal with new cases of PSVT and reduce the overall socio-economic and healthcare costs of PSVT.

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