The use of catheter ablation to treat symptomatic atrial fibrillation (AF) has increased substantially in recent years. As a cardiac electrophysiologist, what encouraged you to refine and improve procedural outcomes for patients undergoing catheter ablation for AF?

The number of AF procedures conducted worldwide has indeed increased dramatically over the last decade. During this time, there has been continual refinement of tools and techniques to improve the cornerstone of this treatment, namely pulmonary vein isolation. However, its Achilles’ heel is the recurrence of atrial arrhythmias, commonly due to electrical reconnection of the pulmonary veins. The accuracy of these indirect measures is subjective and has not been well validated. Novel CF sensing technology has now been developed that can measure the CF between the catheter tip and the target myocardial tissue via a unique sensor located at the distal tip of an ablation catheter (ThermoCool® SmartTouch™, Biosense Webster, USA). Evidence from animal studies has shown that there is a strong correlation between CF and the resultant lesion size, while a recent study has shown this technology to be safe for use in humans. Our study was therefore based on the hypothesis that using this technology could improve pulmonary vein isolation and make it more durable, with less acute pulmonary vein reconnection.

How has your partnership with Biosense Webster – developer of the ThermoCool® SmartTouch™ technology – benefited the study?

Firstly, it is important to appreciate that the study was not industry driven; we designed and conducted it on clinical grounds alone. However, our partnership with Biosense Webster was invaluable to evaluate this new technology. As with all new technology, there is a need for early constructive feedback from clinicians to help optimise its potential. Not only were we able to liaise with Biosense Webster to collect the data we needed to conduct this study, we were able to help them improve the software with regards to ease of data collection and analysis to facilitate future research work using their CF technology.

Ineluctable limitations often plague prospective case control studies. Could you share any obstacles you encountered over the course of your study, highlighting how you surmounted these problems?

The fact that it is a prospective case-control study design may of course result in unmeasured systematic differences between its two patient groups. However, despite the fact that sequential patients were recruited, there were no statistical differences between the clinical characteristics of the two groups. In this study, we were fortunate not to encounter any of the major obstacles that can occur with the case-control design.

Over the course of your primary study, you collaborated with Dr Tom Wong, Consultant Cardiologist and Electrophysiologist at the Heart Rhythm Centre, Royal Brompton & Harefield NHS Foundation Trust, Imperial College London, UK. How has your combined expertise contributed to the success of this research?

Dr Wong was in fact the principle investigator for this study and has a special interest in the interventional management of arrhythmias. He is a very experienced researcher who has a wide-ranging portfolio of research activities including work to further characterise atrial fibrillation in patients with chronic heart failure, and tachyarrhythmias in adult congenital heart disease. Dr Wong has a very strong academic record with many publications in high profile international journals such as Circulation, Journal of the American College of Cardiology, and the European Heart Journal. As his clinical research fellow, his expert guidance has been instrumental in making the projects a great success.
ATRIAL FIBRILLATION (AF) is a heart condition that causes an irregular and often abnormally fast heart rate. It happens when the upper chambers of the heart contract randomly and quickly, such that the heart cannot relax fully between contractions. Although the cause of AF is not fully understood, it is linked to abnormal electrical impulses firing in the heart’s upper chambers. These impulses interfere with the heart’s natural pacemaker, preventing it from controlling the rhythm of the heart and consequently reducing the heart’s efficiency and performance. AF can lead to a number of unpleasant symptoms, such as dizziness, shortness of breath and fatigue; however, some individuals may not experience any symptoms. It is a common condition, particularly among older people, with 50,000 cases diagnosed each year in the UK alone.

One treatment for AF that has become more widely used in recent years is catheter ablation. As pulmonary veins (PVs) play an important role in the pathophysiology of AF, catheter ablation involves the electrical isolation of PVs from the left atrium of the heart. Usually conducted under general anaesthetic, this minimally invasive procedure lasts around a few hours. Thin, flexible tubes called catheters are inserted into the veins in the patient’s groin and are then moved into the correct position in their heart. Radiofrequency energy is delivered through these catheters to destroy the affected area that is causing the arrhythmia, helping to block the abnormal electrical impulses in that area of the heart. While this technique has been refined over the years, one of its notable weaknesses is the post-procedural recurrence rate of atrial arrhythmias, predominantly caused by the electrical reconnection of PVs.

CONTACT FORCE TECHNOLOGY

Dr Tom Wong, Consultant Electrophysiologist, and Dr Shouvik Haldar, Electrophysiology Research Fellow at the Royal Brompton & Harefield NHS Foundation Trust in London, UK, have participated in cutting-edge research into AF treatment over the past several years. In partnership with Biosense Webster – an industry leader in the development of electrophysiological technologies – they have recently completed an important study that evaluated the clinical impact of contact force (CF) technology in catheter ablation treatment. They have published the results of the study in the International Journal of Cardiology.

Their study was based on the premise that eliminating acute electrical reconnection of PVs would enhance the long-term success rates of catheter ablation – something that could be achieved through the application of more durable radiofrequency lesions that are both transmural and permanent. In essence, CF sensing technology facilitates real-time CF measurement during the catheter ablation procedure. In turn, this allows the delivery of better ablation lesions that could prove more durable, reducing the need for recurrent procedures. As operators can access CF information in real-time throughout the ablation procedure, they are able to apply radiofrequency energy against the myocardial tissue with greater stability. “CF has been shown to improve outcomes, because poor and inconsistent tissue contact may result in incomplete lesion formation, which could result in recurrences of atrial arrhythmia and the need for additional treatment, while too much contact may cause tissue injury, which can lead to procedural complications,” Haldar explains.

MAPPING THE METHODOLOGY

40 patients between the ages of 18 and 80 who were due for de novo AF ablation for standard clinical indications were recruited to participate in the study. They were divided equally into two groups: the ‘un-blinded group’ and the ‘blinded group’. Experienced electrophysiologists conducted AF ablation on the patients in both groups, using the Biosense Webster’s ThermoCool® SmartTouch™ catheter. “In the ‘un-blinded’ group, the operator was able to view the force sensor value, reflecting the applied CF between the catheter and the myocardial tissue, during both mapping and ablation phases in real-time,” explains Haldar. “In the ‘blinded group’, the operator was ‘blinded’ to this force sensor value during the procedure, although this data was recorded.” After the procedure, Haldar compared both the rate of acute PV reconnection and a detailed analysis of the CF data between the two groups. Encouragingly, the CF data successfully identified the key areas of acute PV reconnection, and the availability of real-time CF information during PV isolation positively correlated with lower acute electrical reconnection rates.

SURGICAL ABLATION

Haldar’s second area of research involves investigating the comparative advantages of surgical and catheter ablation techniques in longstanding, persistent cases of AF. His current pilot study – ‘Catheter Ablation Versus Thorascopic Surgical Ablation in Longstanding Persistent Atrial Fibrillation’ (CASA-AF) – aims to assess the relatively new thoracoscopic (keyhole) surgical ablation technique and compare it to conventional catheter ablation in patients with longstanding persistent AF. These patients are often the most difficult to treat as they have suffered with AF for longer and hence they generally display poorer responses to catheter ablation and often need repeated treatment procedures.

Although this study is ongoing, Haldar recently presented his preliminary results at the Heart Rhythm Society’s Annual Scientific
Session in San Francisco, USA. Excitingly, these initial results demonstrate that compared to catheter ablation, thoracoscopic surgical ablation has superior single procedure success rates, albeit with a slightly higher risk of procedural complications. Haldar and Wong have been awarded a £1.2 million research grant from a major UK funding body to conduct a multicentre randomised control trial to explore these techniques in greater detail. Haldar intends to publish the results of the CASA-AF pilot study, along with complete 12-month follow-up data, in a leading cardiology journal in 2015.

PUSHING FORWARD

Haldar and Wong’s research into treatments for AF has already flagged up some promising results; for instance, data already suggest that the use of CF sensing technology improves both the safety and acute success of the catheter ablation procedure. However, with the introduction of the technology still in its infancy, there is a need to conduct more randomised controlled trials that continue to evaluate its safety and efficacy. Looking ahead, the results of Haldar and Wong’s initial CF ablation study could have significant implications for the future treatment of AF, should the reduced rate of PV reconnection translate into improved long-term clinical outcomes for patients.

DO IT YOURSELF

Simply being aware of one’s heart rate is an easy way to lessen AF-related health issues. The World Heart Federation encourages individuals to perform DIY pulse tests on their wrist, arm or neck to check if their heart rate is abnormal. Individuals whose pulse is irregular or whose heart is beating at a rate of 100 beats per minute or higher should inform their healthcare provider immediately.

Atrial Fibrillation: The Facts

- People with AF are 5 times more likely to have a stroke than those without AF
- Each year, 3 million people worldwide have an AF-related stroke
- AF stroke victims are twice as likely to die
- At present, over 9 million people in the US and EU have AF. This number is expected to rise to 18 million in 2060

Statistics sourced from the American Heart Association and World Heart Federation

The Role of Contact Force Sensing in Electrical Pulmonary Vein Isolation When Conducting Atrial Fibrillation Ablation

OBJECTIVES
To assess the acute clinical efficacy of using novel contact force sensing technology when undertaking catheter ablation for atrial fibrillation.

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