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Surgical Catheter Ablation for Management of Atrial Tachycardia; Review

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Abstract: **This article will review the recent progress made in surgical catheter for atrial tachycardia and determine the efficacy and safety of particularly radiofrequency catheter ablation. Comprehensive searching strategy through Well-known medical databases (MIDLINE/ PubMed, and Embase) searching articles that published in English language up to November 2017, and discussing the Surgical catheter ablation for atrial tachycardia, Mesh Terms used in search method as following; "atrial tachycardia", "management", "surgical ablation". Because of the remarkable safety and efficacy of catheter ablation, it is currently taken into consideration as first line therapy for most types of supraventricular arrhythmias. These include AVNRT, AVRT, atrial tachycardia, and atrial flutter. It is anticipated that the desire for treating atrial fibrillation with ablation methods will likewise be recognized sometime throughout the next five years. Radiofrequency ablation is remarkably less invasive than the surgical procedure. It could be repeated in case of reappearance or in situation of emergence of new atrial tachycardias that could occur in patients with diffuse atrial illness. These encouraging outcomes of direct ablation of atrial substrate to treat atrial tachycardia are announcing a new era in ablation catheter techniques with the hope of curing even more complex atrial tachycardias.**

Keywords: **Surgical Catheter Ablation, atrial tachycardia.**

1. INTRODUCTION

Current developments in catheter ablative treatment, specifically radiofrequency (RF) ablation, have had a dramatic impact on the method to the therapy of a selection of cardiac arrhythmias [1], [2], [3].This is especially obvious in the case of arrhythmias complicating Wolff-Parkinson-White syndrome and atrioventricular (AV) nodal reentrant tachycardia, where RF catheter ablation of accessory paths and AV nodal slow pathway s has come to be first-line therapy, basically replacing antiarrhythmic medication treatment over the past a number of years [2], [3], [4].In these arrhythmias, RF catheter ablation has proven to be really safe and highly effective.

In contrast, RF catheter ablation for the therapy of atrial tachycardia, including atrial flutter (AFL), focal automatic atrial tachycardia, and intra-atrial reentrant tachycardia, has presented a greater challenge. This has greatly been due to the fact that of a less total understanding of details arrhythmogenic mechanisms in these situations. However, by making use of electronic mapping systems intraoperatively and described catheter mapping at electrophysiology research, a better understanding of arrhythmia devices has now permitted application of RF catheter ablation techniques to the therapy of type 1 AFL, focal automatic atrial tachycardia, and intra-atrial reentrant tachycardia.

This article will review the recent progress made in surgical catheter for atrial tachycardia and determine the efficacy and safety of particularly radiofrequency catheter ablation.

2. METHODOLOGY

Comprehensive searching strategy through Well-known medical databases (MIDLINE/ PubMed, and Embase) searching articles that published in English language up to November 2017, and discussing the Surgical catheter ablation for atrial tachycardia, Mesh Terms used in search method as following; "atrial tachycardia", "management", "surgical ablation". Furthermore, references list of each article were searched for more eligible papers for present review.

3. DISCUSSION

- **Atrial tachycardia:**

Atrial tachycardia appears to be caused by one of two systems, either focal automated task that might be unrelenting scientifically or intraatrial reentry that is typically paroxysmal [7], [5], [6].Atrial tachycardia could happen in the existence or absence of underlying heart disease, is frequently refractory to antiarrhythmic drugs, and, if relentless and rapid, might cause a dilated cardiomyopathy.Intra-atrial reentrant tachycardia, just like AFL, seems brought on by a reentry circuit linked with an area of slow transmission or block [7], [5], [6].The reason for localized sluggish transmission or block is unclear in several cases [7], [5], [6].Atrial anisotropy creating slow-moving conduction, in the absence of certain atrial pathology, might play some function in the growth of intra-atrial reentry [10].However, overt or occult atrial pathology might be a more probable description of slow-moving conduction or block for the most parts, specifically in those patients with congenital heart condition or a history of cardiac surgery [7], [5], [6].The mechanism of intra-atrial reentrant tachycardia suggests that it must be open to endocardial mapping and RF catheter ablation strategies just like those used to deal with AFL.

The mechanism of focal automatic atrial tachycardia is much less well recognized, [8], [9].The resistance of focal automated atrial tachycardia to certain antiarrhythmic medications and DC cardioversion and the nature of its electrophysiologic features recommend that it is not created by microscopic reentry or triggered task yet instead by uncommon automaticity [8], [9]. Most likely, focal atrial pathology is accountable for the automatic atrial activity sometimes, although overt atrial illness is absent in the majority of patients with this arrhythmia [8], [9].In the past, surgical resection or cryoablation of arrhythmogenic atrial loci has been made use of effectively to cure automated atrial tachycardia [11], [12].AV node ablation with long-term VVIR pacemaker implantation has also been utilized as an alternative in medically immune cases where surgery was not appropriate [1].

For the exact same reasons cited above in the situation of AFL, the development of RF catheter ablation in theory gave a much more secure, if not more efficient, technique for treating automated atrial tachycardia as compared to surgery or various other methods such as DC shock ablation, which were utilized to a limited level in the past.

- **Technique of Ablation:**

Catheter ablations are performed in cardiac electrophysiology laboratories specially equipped with recorders, programmed stimulators and ablators. Ever before since 1989, radiofrequency current has been utilized for ablation, while earlier efforts were with straight existing. The treatment is typically performed making use of aware sedation. Two to five multipolar electrode catheters are put percutaneously under regional anaesthesia into a femoral, brachial, subclavian, or internal throaty capillaries and placed in the heart under fluoroscopic support. Each electrode catheter has four or more electrodes. One of the most distal electrode pair is generally made use of for pacing and the shipment of seriously timed added stimulations, while all of the electrodes are utilized to videotape electrograms from localised regions within the heart. As much as 50 W of radiofrequency energy is supplied for 30-60 seconds as a continuous, unmodulated, sinusoidal waveform with a frequency of roughly 500,000 Hz, between the 4 mm tip of a deflectable ablation catheter and a ground plate placed on the patient's back or chest. The temperature of the ablation electrode can be checked and the power result instantly gotten used to achieve a targeted electrode temperature of between 60-70 ° C. Knowledge of the electrode temperature at a particular ablation site works in establishing whether a not successful application of radiofrequency energy fell short because of incorrect mapping or inadequate heating [13].If the failing was as a result of inadequate home heating, extra applications of energy at the same website with enhanced catheter stability could prosper. Automatic change of power result using closed loophole temperature level control has been shown to lower the occurrence of coagulum advancement. This minimizes the number of times the catheter has to be taken out from the body to have a coagulum eliminated from the electrode idea. Thermal injury is the main device of tissue devastation throughout radiofrequency catheter ablation. Elevation of tissue temperature causes desiccation and the denaturation of healthy proteins, and coagulation of tissue and blood. Permanent tissue injury takes place at temperature levels above 50 ° C. When temperature level gets to 100 ° C, plasma healthy proteins denature to create a coagulum. The coagulum triggers a sharp surge in the impedance and an equivalent autumn in the present thickness, thereby restricting additional sore growth. Techniques for boosted air conditioning of the electrode have been established to permit distribution of higher radiofrequency power without the formation of coagulum. These consist of making use of larger (8 mm) electrodes, which obtain higher convective air conditioning by the blood, and saline irrigated electrode ideas, in which the electrode is actively cooled. Biplane fluroscopic imaging provides a three dimensional positioning of catheter setting, allowing better localization. Non

fluroscopic imaging systems using magnetic fields and ultrasound are being established. These modalities stay clear of the inherent risk of radiation exposure to the patient and the treating physician.

- **Ablation of Atrial Tachycardias:**

Catheter ablation of continual regular atrial tachycardias can additionally be performed with high safety and efficacy. Focal atrial tachycardia, whether reentrant, automatic, or caused could be ablated with success rates above 90%. The site for ablation is generally picked based upon early activation. Common atrial flutter is also responsive to treat with catheter ablation. This macroreentrant arrhythmias is localized to the right atrium. Atrial flutter can be cured by developing a continual, transmural, linear lesion between the tricuspid annulus and the substandard vena cava. This treatment is generally described as an "isthmus" ablation. Catheter ablation of atrial flutter could be carried out with an efficiency more than 90% and a < 5% danger of recurrence of atrial flutter. Non-isthmus dependant atrial flutter could likewise be treated with catheter ablation. These normal atrial tachycardias, with rates between 250 and 350 bpm commonly include scars created throughout previous cardiac surgery. The treatment could be accomplished by specifying a critical area of transmission which is essential for maintenance of the arrhythmia. The creation of a linear lesion in this area could lead to remedy of the tachycardia. Catheter ablation of non-isthmus dependant atrial flutter could be completed with an effectiveness of higher than 80% and a < 5% threat of significant problems.

- **Radiofrequency catheter ablation:**

Catheter ablation by direct-current shocks directed to atrial loci wased initially reported in 1985 [16].The possible threat of perforation of the thin-walled room (although not reported in people) and the high portion of reoccurrence have limited its application [14].On the various other hand, the outstanding outcomes and safety of radiofrequency ablation in the cure of supraventricular tachycardias has led to its modern application to atrial emphases [15], [16].Mapping of atrial tachycardia might be time consuming due to the facility style of the atrium and problems of catheter contact. The simultaneous use two mapping catheters sequentially relocated to locate the emphasis has enhanced the efficacy of the ablation procedure and has been called the enclosing strategy. It appears from our collection of 36 patients with atrial tachycardia that radiofrequency energy is safe and has an efficacy that is sufficient and equivalent to that reported by previous restricted series [15].The success rate is higher in one of the most current patients, most likely due to the systematic use of the surrounding strategy and the evaluation of both unipolar and bipolar recordings. The success rate seems to be near 100% for sinus node reentry [18].Sinus node reentry was diagnosed in 3 of our 36 patients. These patients were treated successfully by radiofrequency application, without late sinus node disorder. We used a small number of pulses to ablate sinus node reentry; our results suggest that a localized area is responsible for the tachycardia. Various other scientists have reported a greater variety of pulses and covering a huge surface to prevent reoccurrence [17].

Electrophysiologic features at the ablation website. There is no arrangement regarding the individualization of a details electrogram marker to center the site of origin of atrial tachycardia (i.e., a comparable to accessory path potential or slow-moving path capacity for the ablation ofAV reentrant and AV nodal reentrant tachycardia). Lots of requirements have been recommended to identify the optimum target. Early local activation time at the successful ablation site has been reported regularly around 20 to 40 msec prior to P-wave onset yet with an excellent variation in between patients. In one instance radiofrequency application achieved success in terminating tachycardia at a site where local activation time came before P-wave start by just 15 msec. In one more patient the neighborhood activation time to P-wave onset was as lengthy as -75 msec at the successful ablation site, whereas radiofrequency pulse had actually stopped working at -60 msec. We additionally noticed that the final effective site is not always the site where the earliest endocardial activation in reference to P-wave onset is observed. This searching for can be discussed by a minor deplacement of the emphasis after the pulse, recommending that the area to ablate could be wider compared to formerly thought or by the advancing effect of previous pulses.

Fractionated electrograms or dual spikes have additionally frequently been found at the ablation website, [18] yet this requirement lacks both level of sensitivity and uniqueness. Fractionation has been reported in both reentrant atrial tachycardia (where it may represent the slow-moving conduction zone) and in 64% successful ablation websites of automatic atrial tachycardia by Lash et al. [19] The duration of the local electrogram at the effective ablation website was regularly prolonged in our research study population. We kept in mind, along with Kay et al. 1° and Sanders et al., [18] that all electrograms were significantly fractionated at the ablation site in sinus node reentry, however this was not a finding in other series. Ultimately, it appears that neighborhood electrogram duration and morphologic features do not seem to be trustworthy markers. Fractionated electrograms may be more depictive of diffuse atrial condition compared to

of the departure website of the atrial tachycardia. In enhancement, uncommon electrograms could be seen less in ablation in children. Ultimately, we and various other writers believe that the unipolar recording mode is a really helpful device, and we use it routinely [20].A pure adverse deflection of the unipolar atrial electrogram with a rapid preliminary inherent slope theoretically localizes the site of origin of the tachycardia. Experimental job by Spach et al. [21] has shown that a QS-like wavefront is taped in a circumscribed location situated in the area of the excitation beginning (100 to 200 pm along the fast axis [21].

Clinical effects. As recommended by the surgical experience, failing of ablation occurred in relieves of several atrial sites of beginning [22].On the basis of this experience, authors assume that His package ablation could be suggested as the initial line of treatment when multiple atrial tachycardias have been documented before the ablation procedure. When several emphases are successively unmasked throughout the ablation session, ablation of the AVjunction as opposed to the atrial foci must be taken into consideration. During the follow-up, event of a brand-new tachycardia was noted in 2 patients of our populace. This phenomenon, which has also been reported after surgical ablation, is either associated with dynamic atrial condition or could be caused by the long-lasting arrhythmogenic potential of the ablation procedure itself. The reappearance rate in our collection was 6% after a mean follow-up of 18 months; in the literary works the rate is between 5% and 20% [17], [18].

4. CONCLUSION

Because of the remarkable safety and efficacy of catheter ablation, it is currently taken into consideration as first line therapy for most types of supraventricular arrhythmias. These include AVNRT, AVRT, atrial tachycardia, and atrial flutter. It is anticipated that the desire for treating atrial fibrillation with ablation methods will likewise be recognized sometime throughout the next five years. Radiofrequency ablation is remarkably less invasive than the surgical procedure. It could be repeated in case of reappearance or in situation of emergence of new atrial tachycardias that could occur in patients with diffuse atrial illness. These encouraging outcomes of direct ablation of atrial substrate to treat atrial tachycardia are announcing a new era in ablation catheter techniques with the hope of curing even more complex atrial tachycardias.

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