

The Surgical Management of Atrial Fibrillation

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ABSTRACT

Atrial fibrillation (AF) is the most common atrial arrhythmia with an increasing prevalence identified worldwide. Symptomatic episodes have resulted in increasing hospitalisations such that this is now one of the dominant cardiovascular reasons for hospital admission in Australia. Beyond this, AF predisposes to heart failure, stroke and increasing cognitive decline. While medical therapy is available for the treatment of this condition the use of medication has not always proven sufficient for its management leading to the development of catheter and surgical ablation therapies. However, while surgical ablation procedures are widely utilised, the true efficacy of these approaches has not been well understood due to the wide variety of methodologies, concomitant procedures, technologies utilised and follow-up implemented. This thesis evaluates the current state of surgical ablation for AF.

Chapter 1 provides an overview of the burden of AF on our community, the mechanisms of arrhythmia, a summary of medical and catheter based therapies and an in-depth analysis of how surgical therapies for atrial fibrillation were developed and the current approaches to surgical ablation with the current technologies available for use. Chapters 2 through 5 examine the efficacy and safety of the surgical ablation of AF when performed concurrent to mitral valve disease intervention, concomitant cardiac surgery in general, as a standalone procedure and as part of an emerging technique of hybrid ablation (joint surgical and cardiology electrophysiology) procedure. This evaluation has been performed through systematic literature review and meta-analyses identifying that surgical ablations procedures offer good medium term results in sinus rhythm maintenance (SRM) on and off antiarrhythmic drugs(AAD) achieving 79.6% SRM concurrent to mitral valve intervention, 79.6% on AAD and 65.3% off AAD concurrent to general cardiac surgical procedures, 85.3% on and 65.5% off AAD as a standalone procedure, and 79.4% on AAD and 70.7% off AAD when performed as a hybrid ablation procedure. The complication rates were low across all series, with the

lowest complication rates associated with the hybrid procedure. Chapter 6 then presents the results of a series of experiments analysing the properties of surgical bipolar RF clamps and how ablation lesions are formed, with the identification that the efficacy of these surgical ablative tools is subject to the effects of contact force for the delivery of transmural lesions, increased numbers of ablation increase the likelihood of a transmural lesion irrespective of the device indicating transmural, the presence of fat significantly attenuates the ability to deliver of a transmural lesion and these effects are amplified with increased thickness of the tissue being ablated. The observations of this thesis thus provide insight into the optimal conditions under which the surgical ablation of AF may obtain the best results in sinus rhythm maintenance.

Declaration of Authorship

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint award of this degree.

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c) Surgical Contact Force Effect in Creating RF Lesions in the Isolated and Hybrid Ablation of Atrial Fibrillation

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d) The Efficacy of Joint Catheter and Surgical Ablation for Atrial Fibrillation – a Review of the Literature and Meta-Analysis

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