The Surgical Management of Atrial Fibrillation

Jason Arya Varzaly
MBBS

Centre for Heart Rhythm Disorders, The School of Medicine, University of Adelaide
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# Table of Contents

## Chapter 1  
**Introduction**

1.1. Burden of Atrial Fibrillation  
1.1.1. Risk Factors of AF  
1.1.2. Consequences of AF  
1.1.3. Economic Burden of AF  
1.2. Mechanisms of Atrial Fibrillation  
1.2.1. Multiple Wavelets  
1.2.2. Focal Triggers  
1.2.3. Anatomical Structures as Sources of Foci  
1.2.4. Cardiac Autonomic Nervous System  
1.2.5. Endocardial to Epicardial Connections  
1.2.6. Rotors  
1.3. Management options available  
1.3.1. Risk Factor Modification  
1.3.2. Anticoagulation  
1.3.3. Rate Control  
1.3.4. Rhythm Control  
1.3.4.1. Catheter Ablation  
1.4. Role of surgery  
1.5. Available technologies  
1.6. Previous Meta-Analyses  

## Meta-Analysis and Literature Review

## Chapter 2  
**Surgical Ablation of Atrial Fibrillation Concomitant to Mitral Valvular Repair or Replacement – Analysis of Valvular Disease and Intervention, Ablation Method, Safety and Success in Sinus Rhythm Maintenance**

2.1. Introduction  
2.2. Methods  
2.2.1. Definitions  
2.2.2. Statistical Analysis  
2.3. Results  
2.3.1. Study & Patient Characteristics
2.3.2. Mitral and Concurrent Valvulopathy 25
2.3.3. Surgical Ablation Procedures 25
   2.3.3.1. Approach and Technique 25
   2.3.3.2. Lesion Set 26
   2.3.3.3. Operative Parameters 28
2.3.4. Post-Procedure Follow-up 28
2.3.5. Recurrent Arrhythmia 28
2.3.6. Antiarrhythmic Drug Use 29
2.3.7. Outcomes 29
2.3.8. Procedural Complications 30
2.3.9. Subgroup Analysis 30
   2.3.9.1. Lesion Set 30
   2.3.9.2. Energy Source 31
   2.3.9.3. LAA Exclusion 32
   2.3.9.4. Randomised Controlled Data 32
2.4. Discussion 32
   2.4.1. Valvular Disease, Surgery and AF 32
   2.4.2. Surgical Ablation Technique 34
   2.4.3. Complications 34
   2.4.4. Clinical Implications 35
   2.4.5. Study Limitations 35
2.5. Conclusions 36
2.6. Figure and Tables 37

Chapter 3  Surgical Ablation of Atrial Fibrillation with Concurrent Cardiac Surgery – Assessment of the Safety and Efficacy of Ablation procedures during any other Cardiac Surgical Intervention

3.1. Introduction 47
3.2. Methods 48
   3.2.1. Definitions 50
   3.2.2. Statistical Analysis 50
3.3. Results 51
   3.3.1. Study & Patient Characteristics 51
3.3.2. Concurrent Cardiac Surgical Procedures 52
3.3.3. Surgical Ablation Procedures 52

3.3.3.1. Approach and Technique 52
3.3.3.2. Lesion Set 54
3.3.3.3. Operative Parameters 55

3.3.4. Post Procedure Follow-up 56
3.3.5. Definitions of Recurrent Arrhythmia 56
3.3.6. Antiarrhythmic Drug Use 57
3.3.7. Outcomes 57
3.3.8. Procedural Complications 57
3.3.9. Sub-Group Analysis 58

3.3.9.1. Baseline Characteristics 58
3.3.9.2. Lesion Set Comparison 59
3.3.9.3. Energy Source Comparison 59
3.3.9.4. LAA Exclusion 60
3.3.9.5. Randomised Control Trial Data 60

3.4. Discussion 60

3.4.1. Concomitant Cardiac Surgery and AF 61
3.4.2. Comparison to Studies of Concomitant Mitral Valve Procedures 63

3.4.3. Surgical Ablation Technique 64
3.4.4. Clinical Implications 64
3.4.5. Study Limitations 65

3.5. Conclusions 66
3.6. Figures and Tables 67

Chapter 4 Isolated Surgical Ablation for Atrial Fibrillation – The Methodology, Safety and Success in Sinus Rhythm Maintenance of Sole Cardiac Surgical Procedures

4.1. Introduction 80
4.2. Methods 81

4.2.1. Definition 82
4.2.2. Statistical Analysis 82

4.3. Results 83
4.3.1. Study & Patient Characteristics 83
4.3.2. Surgical Ablation Procedures 84
  4.3.2.1. Surgical Access 84
  4.3.2.2. Energy Source 84
  4.3.2.3. Lesion Set 85
  4.3.2.4. LAA Exclusion 86
  4.3.2.5. Procedural Endpoints 86
4.3.3. Post Procedure Follow-up 87
4.3.4. Outcomes 88
4.3.5. Sub-group Analysis 89
  4.3.5.1. Lesion Set 89
  4.3.5.2. Energy Source 89
  4.3.5.3. LAA Exclusion 90
  4.3.5.4. Procedural Complications 90
4.4. Discussion 91
  4.4.1. Catheter vs Surgical Ablation for Isolated AF 92
  4.4.2. The LAA Dilemma 94
  4.4.3. Clinical Implications: Developing Superior Results 94
  4.4.4. Study Limitations 95
4.5. Conclusions 96
4.6. Figures and Tables 97

Chapter 5  Hybrid Ablation (Surgical and Electrophysiological) of Atrial Fibrillation – The Methodology, Safety and Success of Sinus Rhythm Maintenance

5.1. Introduction 110
5.2. Methods 111
  5.2.1. Definitions 112
  5.2.2. Statistical Analysis 113
5.3. Results 113
  5.3.1. Study & Patient Characteristics 113
  5.3.2. Surgical Ablation Procedures 114
    5.3.2.1. Surgical Approach 114
    5.3.2.2. Energy Utilised 115
5.3.2.3. LAA Management and Additional Approaches

5.3.2.4. Endpoints

5.3.3. Catheter-base Electrophysiological Procedures

5.3.3.1. Timing after Surgery

5.3.3.2. Endocardial Procedure Type

5.3.3.3. Procedural Endpoints

5.3.3.4. Procedural Time

5.3.4. Post-Procedural Follow-up

5.3.5. Outcomes

5.3.5.1. Univariate Predictors of Outcome

5.3.5.2. Sequential vs Staged

5.3.5.3. Block Analysis

5.3.5.4. Surgical Approach

5.3.5.5. Surgical Lesion Set

5.3.5.6. Energy Type

5.3.5.7. Device Type

5.3.5.8. Left Atrial Appendage

5.3.5.9. Ganglionated Plexi Ablation

5.3.5.10. AAD Management

5.3.6. Procedural Complications

5.3.6.1. Sub-Group Analysis of Complications

5.4. Discussion

5.4.1. Outcomes and Complications of Hybrid Ablation

5.4.2. Lessons from Early Experiences

5.4.3. Clinical Implications

5.4.4. Study Limitations

5.5. Conclusions

5.6. Figure and Tables

Chapter 6 The Contact Force Effect of Bipolar Radio-Frequency Clamps on Lesion Formation in the Surgical Management of Atrial Fibrillation

6.1. Introduction
6.2. Methods

6.2.1. Pressure Assessment

6.2.1.1. Surgical Equipment

6.2.1.2. Tissue Selection

6.2.1.3. Clamp Pressure Assessment Methodology

6.2.1.4. Contact Force

6.2.1.5. Pressure Film and Analysis

6.2.2. Ablation Lesion Analysis

6.2.2.1. Experimental Preparation

6.2.2.2. Tissue Selection

6.2.2.3. Ablation and Evaluation of Transmurality

6.2.3. Statistical Analysis

6.3. Results

6.3.1. Pressure Analysis

6.3.2. Lesion Analysis

6.3.3. Total RF Time and Impedance

6.3.4. Lesion Depth

6.3.5. Fat Presence and Effect

6.3.6. Transmurality

6.4. Discussion

6.4.1. Major Findings

6.4.2. Importance of Contact Force

6.4.3. Number of Burns

6.4.4. The Interaction of Fat

6.4.5. Impedance as a Measure of Ablation Endpoint

6.4.6. Clinical Implications

6.5. Conclusion

6.6. Figures

Chapter 7 Conclusions and Discussion

Chapter 8 Future Directions

Chapter 9 References
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 transmurality, 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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PRESENTATIONS TO LEARNED SOCIETIES

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a) The Pressure Effect of Bipolar RF Clamps on Ablation for Atrial Fibrillation
   
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c) Surgical Contact Force Effect in Creating RF Lesions in the Isolated and Hybrid Ablation of Atrial Fibrillation

*JA Varzaly, DH Lau, D Chapman, F Viana, J Edwards, RG Stuklis, M Worthington and P Sanders*

Presentation at Heart Rhythm Society 2016

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

*JA Varzaly, DH Lau, D Chapman, F Viana, J Edwards, RG Stuklis, M Worthington and P Sanders*

Presentation at Asia Pacific Heart Rhythm Society 2015

e) Feasibility, Efficacy and Safety of isolated Surgical Ablation for Atrial Fibrillation: A Systematic Review

*JA Varzaly, DH Lau, D Chapman, R Mahajan, F Viana, J Edwards, RG Stuklis, M Worthington and P Sanders*

Presentation at Asia Pacific Heart Rhythm Society 2015

f) Surgical ablation of isolated atrial fibrillation – a systematic review of the literature

*JA Varzaly, DH Lau, D Chapman, R Mahajan, F Viana, J Edwards, RG Stuklis, M Worthington and P Sanders*

Presentation at Heart Rhythm Society 2015

g) Hybrid approach for ablation of Atrial Fibrillation – a Meta-Analysis and review of the literature

*JA Varzaly, DH Lau, D Chapman, AG Brooks, J Edwards, RG Stuklis, M Worthington*
and P Sanders

Presentation at American Heart Association 2014

h) Surgical ablation of “lone” atrial fibrillation – a systematic review of the literature

JA Varzaly, A Brooks, J Edwards, RG Stuklis, P Sanders and M Worthington

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i) Hybrid approach for ablation of Atrial Fibrillation – a systematic review of the literature

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