INDIRECT ASSESSMENT OF SINUS NODE FUNCTION IN MAN

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<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE</td>
<td>1</td>
</tr>
<tr>
<td>CONTENTS</td>
<td>2</td>
</tr>
<tr>
<td>SUMMARY</td>
<td>8</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>11</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>12</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>I</th>
<th>INTRODUCTION</th>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I) History</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>b) Background</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Sick Sinus Syndrome</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Objectives</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>II</th>
<th>METHODS</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) Patient Selection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Non-invasive Investigation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Intracardiac Electrophysiology Study</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Analysis of Data</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e) Errors in Measurement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f) Statistical Methods</td>
<td></td>
</tr>
</tbody>
</table>
III THE SINUS NODE AND OVERDRIVE SUPPRESSION

a) Introduction
b) Clinical Application
c) Methods
d) Results
e) Discussion

IV MATHEMATICAL MODEL OF SINUS NODE RECOVERY FOLLOWING OVERDRIVE SUPPRESSION

a) Experimental Background
b) Mathematical Model
c) Methods
d) Results
e) Discussion
V EFFECT OF PACING RATE AND SITE ON POST-PACING SINUS NODE SEQUENCES 106

a) Introduction
b) Methods
c) Results
d) Discussion

VI SINOATRIAL CONDUCTION TIME 123

a) Introduction
b) Methods
c) Results
d) Discussion
VII  AUTONOMIC EFFECTS  

a) Introduction 
b) Methods 
c) Results 
d) Discussion 

VIII  COMPARISON OF TESTS AND INDICES OF  

SINUS NODE FUNCTION  

a) Comparison of "conventional" tests 
b) Post-pacing sequences 
c) Mathematical model 
d) Clinical and Research Implications
APPENDIX A  STUDY PROTOCOL

APPENDIX B  MATHEMATICAL MODEL OF OVERDRIVE SUPPRESSION OF THE SINUS NODE (DR. A. HELFGOTT)

APPENDIX C  TABLE OF COMPARISON OF CONVENTIONAL INDICES

APPENDIX D  TABLE OF COMPARISON OF COMPUTED INDICES

REFERENCES
APPENDIX A  STUDY PROTOCOL

APPENDIX B  MATHEMATICAL MODEL OF OVERDRIVE SUPPRESSION OF THE SINUS NODE (DR. A. HELFGOTT)

APPENDIX C  TABLE OF COMPARISON OF CONVENTIONAL INDICES

APPENDIX D  TABLE OF COMPARISON OF COMPUTED INDICES

REFERENCES
SUMMARY

Current tests of sinus node function in man lack sufficient sensitivity and specificity to be of use in patients with equivocal sinus node function. This study was performed with the aim of closely re-examining, in man, these tests of sinus node function, looking particularly at the phenomenon of overdrive suppression of the sinus node and at the post-pacing sequence, in order to improve objective assessment using intracardiac electrophysiology study. The study group consisted of 22 subjects with normal sinus node function, 35 subjects with the sick sinus syndrome, and 123 subjects who failed to meet strict pre-study criteria for either of the former subgroups. The major initial finding was that the majority of sequences following overdrive atrial pacing in each of the three groups of patients followed a typical pattern of a maximally prolonged first post-pacing interval, and progressive but decreasing reduction in subsequent intervals.
The first post-pacing interval, unlike the other post-pacing intervals, contained a component of sinoatrial conduction. Such sequences were observed i) at all rates of pacing tested (60 to 200 beats per minute), ii) with pacing from the high right atrium and from the coronary sinus, iii) both before and after cardiac vagal blockade with atropine and "total" cardiac autonomic blockade with atropine and propranolol, and iv) with pacing duration from one beat to one minute. Particularly in patients with sinus node dysfunction, secondary cycle length prolongations were observed. The extent of suppression of the sinus node as measured by the first post-pacing interval, increased with increase in the rate of pacing only in patients with sinus node dysfunction.

The typical post-pacing sequences were suitable for fitting to a mathematical model of overdrive suppression of the sinus node, which had been developed at the time of the initial part of this study by Dr. A. Helfgott.
Application of this model allowed computation of indices of both sinoatrial conduction and of sinus node automaticity, the mean values of many such indices being significantly greater in patients with sinus node dysfunction. In subjects with normal sinus node function, computed indices of both sinoatrial conduction and of automaticity showed little or no change with different pacing rate, site, or duration of pacing. In contrast, in subjects with the sick sinus syndrome, with higher pacing rates and with longer duration of pacing, computed indices of sinoatrial conduction and of automaticity increased. Application of these new indices for the first time clearly separated sinoatrial conduction from sinoatrial automaticity, and has the potential for better discrimination of normal and abnormal sinus node function by intracardiac electrophysiology study.
DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

[Signature]

William F. Heddle
ACKNOWLEDGMENTS

This work was performed under the supervision of Dr. A. M. Tonkin during my tenure of a Postgraduate Research Studentship of The Life Insurance Medical Research Fund of Australia and New Zealand. I express my sincere thanks to Dr. Tonkin for his assistance, advice and encouragement, and to the Life Insurance Medical Research Fund for their support.

The work to be presented was performed by me while a member of a research group, consisting principally of Dr. A. M. Tonkin, Dr. A. Helfgott, and myself. The major contributions of the other members of this group must be fully acknowledged, in particular the original contribution of Dr. Helfgott in development of the mathematical model to be described.
In addition I wish to acknowledge the assistance of Lyn Bartlett, R.N., both in the catheterisation laboratory and with preparation of figures. Last, but in no way least, I wish to acknowledge the unfailing support and encouragement of my wife.