

HAEMOSTASIS AND WOUND HEALING FOLLOWING ENDOSCOPIC SINUS AND SKULL BASE SURGERY

Thesis submitted in January 2012 for
The degree of Doctor of Philosophy
University of Adelaide

By

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ABSTRACT

Introduction

Endoscopic sinus surgery (ESS) is the gold standard treatment for medically refractory chronic rhinosinusitis (CRS), and endoscopic skull base surgery is rapidly becoming the treatment of choice for many skull base tumours. Intraoperative and postoperative bleeding can range from minor and troublesome, to catastrophic, increasing the risk of complications to the patient. Whilst there are a number of effective haemostats, they are associated with scar tissue formation, patient discomfort and risk disease transmission. Carotid artery haemorrhage during sinus and skull base surgery remains the most feared complication, with considerable challenges in controlling the surgical field and managing such an event. There is no prospective scientific investigation to guide the surgeon in how best to manage this scenario. The aim of this thesis is to explore different haemostatic techniques and agents that can be implemented during sinus and skull base surgery.

Methods

A novel haemostatic agent that has shown promise during *in vitro* investigation was identified and investigated in the sheep model of ESS. This randomized controlled trial (RCT) used the Boezaart surgical field grade scale to investigate the haemostatic efficacy. Macroscopic inspection of wound healing was performed for the first 2 post-operative weeks. Further evaluation of this agent was conducted in

patients undergoing ESS. Patient's symptoms were also investigated along with adhesion formation up to 3 months following surgery.

To investigate the catastrophic bleeding scenario, the sheep model of carotid artery injury was developed. Consecutive experience with this model allowed a retrospective review of surgical videos to be performed so that a number of important principles could be identified to control the surgical field. Following this the efficacy of various techniques at achieving haemostasis were compared in a prospective randomised fashion. Particular end points included time to haemostasis, total blood loss, and overall survival of the animal.

Results

Chitosan gel, in the sheep model of ESS, achieved rapid haemostasis at 2, 4 and 6 minutes after injury, with no adverse effects noted in the early post-operative period. These findings were replicated in patients following ESS, with the additional benefits of no adverse patient symptoms and prevention of adhesion formation.

The sheep model of carotid artery injury is a reproducible model of the high flow/high pressure vascular catastrophe that accurately recreates the anatomical constraints of the human nasal vestibule and is capable of training advanced endoscopic skull base surgeons in the techniques required to manage the surgical field. With specific instrumentation, the U-clip treatment and the muscle patch achieved complete haemostasis whilst maintaining vascular flow through the parent vessel.

Conclusions

Chitosan gel is the first effective haemostatic agent that improves macroscopic and microscopic features of wound healing, is well tolerated, and is rapidly dissolvable in the early post-operative period.

The sheep model of carotid artery injury is an important innovation that allows advanced skull base surgeons to be trained in the techniques required to control the surgical field during carotid injury. Additionally, in the sheep model, the U-clip treatment and muscle patch repair achieve rapid haemostasis and maintain vascular patency.

DECLARATION

I declare that this thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution, and that to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference is made in the text

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- Valentine R, Athanasiadis T, Moratti S, Hanton L, Robinson S, Wormald PJ. The efficacy of a novel Chitosan gel on hemostasis and wound healing after endoscopic sinus surgery. *Am J Rhino Allergy* 2010; 24(1):70-5
- Valentine R, Wormald PJ. A vascular catastrophe during endonasal surgery: an endoscopic sheep model. *Skull base* 2011; 11(2): 22-27
- Valentine R, Wormald PJ. Controlling the surgical field during a large endoscopic vascular injury. *Laryngoscope* 2011; 121(3):562-6
- Valentine R, Boase S, Jervis-Bardy J, Dones Cabral JD, Robinson S, Wormald PJ. The efficacy of haemostatic techniques in the sheep model of carotid artery injury. *Int Forum Allergy Rhinol* 2011; 1:118-122

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Rowan Valentine

24/1/12

PREFACE

A portion of the work described within this thesis has been submitted for publication, as listed below:

- Valentine R, Athanasiadis T, Moratti S, Robinson S, Wormald PJ. The efficacy of a novel Chitosan gel on haemostasis after endoscopic sinus surgery in a sheep model of chronic rhinosinusitis. *Am J Rhinology* 2009; 23(1): 71-5
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ACKNOWLEDGMENTS

The work described in this thesis was performed at the Department of Surgery; Otolaryngology, Head and Neck Surgery, at the University of Adelaide and The Queen Elizabeth Hospital.

This work was supported in part by the following scholarships

- The Queen Elizabeth Hospital Research Foundation Scholarship (2008)
- The Garnett Passe and Rodney Williams Memorial Foundation Postgraduate Scholarship in Otolaryngology (2009-2010)

I would like to thank the following people for their assistance and involvement in this study.

- Professor Peter-John Wormald, Chair of the University of Adelaide and Flinders University Departments of Otolaryngology – Head and Neck Surgery, my supervisor, for his never ending enthusiasm, leadership, inspirational guidance and endless support throughout this experience
- Dr Lorwai Tan – Chief Otolaryngology Research Scientist and laboratory supervisor for her patient guidance through and wise advice throughout my research years
- Lyn Martin and Tracey Nicholls – department staff and friends whose endless support, kind acts and moral support were unending to help see this project through

- Dr Sam Boase, Dr Josh Jervis-Bardy and Dr Theo Athanasiadis, my friends, my colleagues who joined me at different stages of this journey, and whose help was invaluable
- Mr Matthew Smith and Mrs Michelle Slawinski – staff of The Queen Elizabeth Hospital Animal House for their help during long theatre days, and their management and care of the animals involved in this study
- Dr John Field from the University of Adelaide Statistical support service for his invaluable statistical advice
- Judy and Steve Valentine, my parents, whose sacrifice enabled me to study medicine
- Harold and Nita Baggs, my parents-in-law, whose ongoing sacrifice and support has made all of this possible
- My wife Nyoli for her never ending love, daily support and sacrifice, and kind acts have provided me with the ongoing inspiration, and whom without none of this would have been possible