HAEMOSTASIS AND WOUND HEALING FOLLOWING ENDOSCOPIC SINUS AND SKULL BASE SURGERY

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By

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The work described in this thesis was performed within
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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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Rowan Valentine

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PREFACE

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