

# **FACTORS AFFECTING MUCOSAL HEALING, RECILIATION, AND CILIARY FUNCTION AFTER ENDOSCOPIC SINUS SURGERY IN THE SHEEP**

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by

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The work described in this thesis was performed within  
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# ABSTRACT

The effect of absorbable packing on the healing of nasal respiratory epithelium after endoscopic sinus surgery (ESS) was examined in a diseased sheep model. Full thickness injuries were created on the lateral nasal wall of sheep infested with *Oestrus ovi*. Sites of injury were packed on one side with hyaluronic acid (HA) packing or hyaluronic acid packing impregnated with insulin-like growth factor-1 (HA+IGF1) in a randomized fashion. The opposite side was left unpacked as a control. Biopsies were obtained for light microscopy, scanning electron microscopy, and ciliary beat frequency (CBF) analysis over a period of 16 weeks. Statistical analysis of results was performed in order to determine if any intervention had any impact on healing and to determine if there was any correlation between extent of regeneration as assessed by electron microscopy and CBF. Furthermore assessment of the effect of isotonic and hypertonic saline on ciliary beat frequency was performed in healthy human volunteers.

Reepithelialization was increased in the HA+IGF1 group compared to the HA group and controls at eight weeks after injury but not at later time points. Cilial regeneration was improved in the HA+IGF1 group compared to the HA group and controls at 16 weeks. CBF was noted to be worse at the eight week time point with the HA+IGF1 group compared to the HA group and controls, but no other statistically significant effects on CBF were noted. This most likely represents a spurious finding. Wide distributions of CBF results were noted, reflecting numerous missing data points due to methodological difficulties. There was a trend noted toward increased CBF with improved grades of reciliation, although this correlation



was not statistically significant. However this trend was supported by the finding of statistically significant differences between individual and combined grades of reciliation. Hypertonic saline was found to have a ciliostimulatory effect when compared to normal saline at 5 minutes after administration in healthy human subjects. This effect had disappeared by 60 minutes after administration.

It is suggested that the presence of insulin-like growth factor-1 at the time of mucosal injury improves epithelial regeneration in the short term, but is not sufficient for this effect to be sustained. This improved early epithelial regeneration forms a foundation for ciliary regeneration, as is reflected in an improved grade of reciliation at 16 weeks. Our interventions had no effect on CBF, and various experimental problems made it difficult to provide further comment on CBF results. There is evidence that CBF improves as the grade of ciliary regeneration improves following ESS. Furthermore, hypertonic saline appears to also have a positive impact on CBF, which is likely to reflect changes in the rheological properties of mucous. A number of possible avenues of enquiry are delineated and recommendations for future research are outlined.

# 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, and that to the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

I further consent to the thesis being made available for photocopying and loan if applicable, if accepted for the award of the degree.

David Alexander Michael Wabnitz

# PREFACE

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

Wabnitz DAM, Wormald PJ (2005). A blinded randomised controlled study on the effect of buffered 0.9% and 3% sodium chloride intranasal sprays on ciliary beat frequency. *Laryngoscope* [in press].

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