ABSTRACT

Objective: Demonstration of nasofrontal duct and mucosal formation in a goat model. A pilot study was performed to investigate whether a goat is a suitable model for creating nasofrontal duct obstruction and mucocele formation.

Methods: Three adult goats underwent frontal sinus anterior and posterior table incisions with exposure and identification of the nasofrontal outflow tract. The anterior table was osteotomized using osteotomes. Frontalis muscle was dissected from the skin flap. All mucosa, to include that on the osteoplastic flap, was left intact. Exposed frontal sinus. Anterior is at top of picture.

Results: All animals demonstrated mucocele formation on gross examination and histologic sectioning. There was no gross or histologic evidence of bony invasion. The nasofrontal outflow tract remained intact.

Conclusions: The study provides a suitable animal model for the investigation of nasofrontal outflow tract obstruction and mucosal formation with occluded nasofrontal outflow tract.

INTRODUCTION

Animal models for investigation of the frontal sinus have been described previously. The anterior table of the frontal sinus was occluded in rabbits, cats, pigs, dogs, sheep, and goats. As endoscopic sinus surgery has become widely used, similar studies have been performed on postsurgical problems. In some animals, the nasofrontal duct cannot be easily accessed with standard endoscopic instruments. Cats and dogs have become the preferred model due to ethical issues. The adult sheep and goat sinus anatomy has been shown to be of similar size, and the mucosa similar histologically to that of humans.1,2

Schenck et al. were the first to describe an animal model for occlusion of the nasofrontal duct.3 In four dogs, via a lateral rhinotomy approach, the nasofrontal outflow tract was obstructed. They were not able to demonstrate mucocele formation, but nonspecific changes were evident two to twelve months after the duct was obstructed.4 Hybels et al demonstrated mucocele formation in cats when the nasofrontal duct was obstructed.4 The findings of these reports on studies concerning anterior table osteotomies have been the foundation for treatment algorithms for frontal sinus fractures for the past thirty years.

METHODS AND MATERIALS

This study was approved by the Institutional Animal Care and Use Committee, Institutional Review Board, Wilford Hall Medical Center, Lackland AFB, Texas. Three adult Spanish Cross Goats (Capra Hircus) over 2 years of age were used in the study. All were Q-fever, Tuberculosis, Brucellosis and Caprine Arthritis Encephalitis negative and all had appropriate health papers. Animals were cared for by an attending veterinarian and certified veterinary technician.

Prior to induction of anesthesia animals were sedated with a combination of acepromazine, ketamine, and atropine. Cephalic, saphenous or tail vein intravenous access was completed. Animals were intubated with low cuff pressure endotracheal tubes and manual breaths were placed. General anesthesia was induced with 2.5% isoflurane and maintained with 2.5% isoflurane. Animals were monitored with EKG and tidal volume and appropriate crystalloid fluids were administered. Postoperatively each animal received one dose of antibiotics and Buprenex for post surgery analgesia.

SURGICAL TECHNIQUE

The goats were anesthetized and placed in a supine position. A 10 cm incision was made in the soft tissue of the frontal sinus area. A posterior table incision was then performed. Prior to the incision the frontalis muscle was dissected free. The anterior bone flap was then raised in a subaponeurotic plane. The anterior bone flap healed well in all instances and new bone was evident. Each goat tolerated the surgical procedure and the perioperative procedure well. The anterior bone flap healed well in all instances and new bone was evident. The frontal sinus of the adult goat provides for an excellent model for investigation of the frontal sinuses. The results provide evidence of mucocele formation with occluded nasofrontal outflow tract.

RESULTS

After three months the goats were euthanized and grossly examined on the same day. The overlying skin and peristium were removed. An osteome was used to remove the anterior table and the frontal sinus was inspected for postoperative changes. Gross mucocele specimens were removed and prepared as permanent histologic specimens.

CONCLUSIONS

This study has demonstrated an approach for obstructing the nasofrontal outflow tract in adult goats. Previous studies on cats and dogs have revealed similar models, yet due to ethical issues cats and dogs are difficult to include in studies. The frontal sinus of the adult goat provides for an excellent model, as the size and mucosa are similar to humans. The study provides a suitable animal model for the obstruction of the nasofrontal duct and formation of mucoceles. The goat sinus anatomy is similar to humans and serves as an excellent model for investigation of the frontal sinuses.

REFERENCES


