



ORIGINAL ARTICLE

Evaluation of the ability of an experimental model to induce bacterial rhinosinusitis in rabbits^{☆,☆}



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KEYWORDS

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Abstract

Introduction: For decades, animals have been used in sinonasal experimental models, and the practice has increased substantially in the last few years. This study aimed to assess the pathogenesis of infectious process and medication efficiency to treat rhinosinusitis.

Objective: To evaluate the efficiency of the proposed experimental model to induce an acute bacterial sinonasal infectious process through histological analysis and sinus secretion cultures.

Methods: This was an experimental study with 22 New Zealand rabbits, divided into: group A (six rabbits), group B (seven rabbits), group C (seven rabbits), and group D (control group with two rabbits). Rhinosinusitis was induced by the insertion of a synthetic sponge into the right nasal cavity of 20 animals (study groups), followed by the instillation of bacterial strains (50% *Staphylococcus* sp. and 50% *Streptococcus* sp.). The groups were euthanized within 10 days (group A), 17 days (group B), and 30 days (groups C and D).

Results: All the rabbits of the study group developed acute bacterial rhinosinusitis, which was diagnosed through macroscopic evaluation, histological analysis, and sinus secretion culture.

Conclusion: The proposed model is technically simple to perform, it is similar to the rhinogenic model in human beings, and it is highly efficient to reproduce an acute bacterial sinus infection.

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PALAVRAS CHAVE

Sinusite;
Modelos animais;
Coelhos

Avaliação da capacidade de um modelo experimental para indução de rinossinusite bacteriana em coelhos**Resumo**

Introdução: A realização de modelos experimentais nasossinusais em animais vem sendo realizada há décadas, com substancial aumento nos últimos anos. Tem como objetivos identificar as alterações fisiopatológicas ocasionadas pelo processo infeccioso sinusal e avaliar a eficácia de medicamentos no tratamento da rinossinusite.

Objetivo: Avaliar a eficácia do modelo experimental proposto para a indução de um processo infeccioso nasossinusal agudo bacteriano, utilizando parâmetros histopatológicos e cultura da secreção sinusal.

Método: Estudo experimental com 22 coelhos da raça Nova Zelândia, divididos em: grupo A (6 coelhos), grupo B (7 coelhos), grupo C (7 coelhos) e grupo D (controle com 2 coelhos). Induzido quadro de rinossinusite através da inserção de esponja sintética nas fossas nasais direita dos 20 coelhos (grupos de estudo), seguido por instilação de toxoide bacteriano (50% estreptocócico, 50% estafilocócico). Os grupos foram sacrificados com 10 dias (grupo A), 17 dias (grupo B) e 30 dias (grupos C e D).

Resultados: Todos os coelhos do grupo de estudo apresentaram quadro de rinossinusite aguda bacteriana, através da identificação macroscópica, análise histológica e cultura das secreções.

Conclusão: O modelo proposto apresenta simplicidade técnica para sua execução, similaridade ao quadro rinogênico que acomete os humanos e é altamente eficaz na produção de um quadro infeccioso bacteriano agudo sinusal.

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Introduction

Rhinosinusitis is currently one of the most prevalent diseases; it is the fifth most common disease that requires antibiotics.¹ Approximately 25 million people are diagnosed with sinusitis each year in the United States, making it one of the main diseases that require medical attention with otorhinolaryngologists and general practitioners. The direct and indirect costs associated with rhinosinusitis are high, and include diagnostic methods, therapy, procedures, medications, and decreased productivity.²

The prevalence of acute rhinosinusitis (ARS) and chronic rhinosinusitis (CRS) in the general population is quite high, but it is difficult to accurately estimate this prevalence, primarily because many of the episodes are self-limited and mildly symptomatic, and do not compel the patient to seek health care. Rhinosinusitis is responsible for 9% of all antibiotics prescribed to the pediatric population and 21% of the total prescribed for the adult population in the United States, costing approximately US\$ 5.8 billion; US\$ 150 million are spent on antibiotics alone.^{3,4}

Several attempts to model the disease in animals have been made; studies with rabbits are the most frequent. These animals have sinonasal anatomy and physiology very similar to humans. They are well suited for studies involving surgical procedures, but they experience a high mortality when in prolonged stress. Other animals used for research are the Wistar and Sprague–Dawley rats, guinea pigs, and sheep.^{5–7}

Experimental models of rhinosinusitis discussed in the literature aim to induce inflammation in the paranasal sinuses

similar to that experienced by humans. Experimental models have been used to study the physiopathogenesis of inflammation and to evaluate treatment outcomes.^{8–10}

Studies have utilized obliteration of nasal passage maneuvers, sinus drainage ostium obstruction, and instillation of inflammatory process mediators and even materials that act as a culture medium in the nasal passages.^{11–14}

The literature search retrieved no detailed experimental model of acute bacterial rhinosinusitis that included a thorough histological analysis of both maxillary sinuses (induced side and contralateral side) and a microbiological analyses of both maxillary sinuses in the presence of a bacterial infection.

No studies that had analyzed the nasal packing when it was used as the method for bacterial rhinosinusitis induction were retrieved. Such an analysis could correlate the microbiological findings of the nasal cavity with those of the maxillary sinus. The few studies that have assessed this correlation did not find significant results.¹⁵

It was also observed that many studies aimed to produce an infectious picture or to evaluate the therapeutic efficacy of drugs. Therefore, few studies have evaluated the histological and microbiological alterations in the period following the diagnosis of acute sinus infection process without the use of any medication, after removal of the nasal packing, i.e., they did not analyze the recovery period.

Therefore, the literature lacks a simple to perform, easily reproducible, and highly effective experimental model to induce acute rhinosinusitis in animals that has been used to assess microbiological and histopathological parameters on both maxillary sinuses and to analyze nasal packing to study

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