

Advances in Experimental Medicine and Biology 1160
Neuroscience and Respiration

Mieczyslaw Pokorski *Editor*

Advances in Pulmonary Medicine: Research and Innovations

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Neuroscience and Respiration

Volume 1160

Series Editor

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Opole Medical School
Opole, Poland

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Preface

The book series Neuroscience and Respiration presents contributions by expert researchers and clinicians in the multidisciplinary areas of medical research and clinical practice. Particular attention is focused on pulmonary disorders as the respiratory tract is up front at the first line of defense for organisms against pathogens and environmental or other sources of toxic or disease-causing effects. The articles provide timely overviews of contentious issues or recent advances in the diagnosis, classification, and treatment of the entire range of diseases and disorders, both acute and chronic. The texts are thought as a merger of basic and clinical research dealing with biomedicine at both the molecular and functional levels and with the interactive relationship between respiration and other neurobiological systems, such as cardiovascular function, immunogenicity, endocrinology and humoral regulation, and the mind-to-body connection. The authors focus on modern diagnostic techniques and leading-edge therapeutic concepts, methodologies, and innovative treatments. Neuromolecular and carcinogenetic aspects relating to gene polymorphism and epigenesis as well as practical, data-driven options to manage patients also are addressed.

Body functions, including lung ventilation and its regulation, are ultimately driven by the brain. However, neuropsychological aspects of disorders are still mostly a matter of conjecture. After decades of misunderstanding and neglect, emotions have been rediscovered as a powerful modifier or even the probable cause of various somatic disorders. Today, the link between stress and health is undeniable. Scientists accept a powerful psychological connection that can directly affect our quality of life and health span.

Clinical advances stemming from molecular and biochemical research are but possible if research findings are translated into diagnostic tools, therapeutic procedures, and education, effectively reaching physicians and patients. All this cannot be achieved without a multidisciplinary, collaborative, bench-to-bedside approach involving both researchers and clinicians. The role of science in shaping medical knowledge and transforming it into practical care is undeniable.

Concerning respiratory disorders, their societal and economic burden has been on the rise worldwide, leading to disabilities and shortening of life-span. Chronic obstructive pulmonary disease and sleep apnea syndrome are cases in point. Concerted efforts are required to improve this situation, and part of those efforts are gaining insights into the underlying mechanisms of disease and staying abreast with the latest developments in diagnosis and treatment regimens. It is hoped that the articles published in this series will assume a leading position as a source of information on interdisciplinary medical research advancements, addressing the needs of medical professionals and allied health-care workers, and become a source of reference and inspiration for future research ideas.

I would like to express my deep gratitude to Paul Roos, and Cynthia Kroonen of Springer Nature NL for their genuine interest in making this scientific endeavor come through and in the expert management of the production of this novel book series.

Mieczyslaw Pokorski

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Lidocaine, a Non-selective Inhibitor of Voltage-Gated Sodium Channels, Blocks Chemically-Induced Cough in Awake Naïve Guinea Pigs

Simona Svajdova, Tomas Buday, and Mariana Brozmanova

Abstract

Pathological cough is an unwanted and debilitating symptom of a range of chronic respiratory diseases. Currently used antitussive therapies are ineffective and act largely through the central nervous system, having a number of dangerous adverse effects. There is an urgent need for new, better peripherally acting antitussive drugs with minimal adverse effects. Significant progress has recently been achieved in the understanding of voltage-gated sodium channels (NaVs), which points to the biological plausibility that blocking specific NaV subtypes (NaV1.1 – NaV1.9) in the airway sensory nerves may lead to the inhibition of pathological coughing. In this study we investigated the effect of lidocaine, a non-selective NaVs blocker, on citric acid- and capsaicin-induced cough in the awake naïve guinea pig

experimental model. We found that pre-inhalation followed by continuous inhalation of nebulized lidocaine (10 mM) during citric acid (0.8 M) cough challenge was effective in suppressing the cough response (number of coughs, median [IQR]) – (5 [3.8–6.3] pre-lidocaine vs. 1 [0.3–3.8] post-lidocaine; $p = 0.002$, $n = 11$). Likewise, lidocaine during capsaicin (50 μ M) cough challenge reduced the number of coughs (6 [4.1–7.9] pre-lidocaine vs. 1 [0.5–1.5] post-lidocaine; $p = 0.0005$, $n = 12$). We conclude that nebulized lidocaine effectively blocks chemically induced cough. These findings lend support to the notion that NaVs may become a novel neural target in antitussive treatment.

Keywords

Chemically-induced cough · Capsaicin · Citric acid · Cough · Guinea pig · Lidocaine · Voltage-gated sodium channels

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1 Introduction

Cough reflex is a physiological defensive mechanism that removes inhaled irritants from the airways. However, non-productive and excessive coughing is a primary symptom of chronic respiratory diseases such as bronchial asthma, chronic