

## Barrier Function of Gastric Mucus

Jonathan D. Kaunitz

Department of Medicine, School of Medicine, University of California Los Angeles, Los Angeles, CA, USA

(Received for publication on October 19, 1998)

**Abstract.** A viscoelastic mucus gel layer covers the gastric mucosa in a continuous sheet. The functions of the mucus gel have been one of the least studied aspects of gastric barrier function. Although the role of gastric mucus in providing physical protection against ingested particles, and preventing contact between digestive enzymes such as pepsin and the underlying mucosa is generally accepted, the barrier role function of gastric mucus with regard to luminal acid is still conjectural. The modest proton diffusion barrier that mucus provides is negligible in relation to the overall barrier properties of the gastric mucosa; nevertheless, stabilization of unstirred layers and damping of rapid shifts in luminal pH are potentially important functions. Associative studies have suggested a possible role of a hydrophobic barrier in strengthening the barrier functions of mucus. One of the most actively investigated areas of mucus function in recent times has been the mechanism by which secreted acid traverses the gel. Although compelling and complementary data obtained *in vivo* and *in vitro* have been consistent with secretion of acid under pressure, creating temporary viscous fingers through the gel, recent evidence obtained with *in vivo* confocal microscopy suggests that secreted acid diffuses through the gel. Since *Helicobacter pylori* exists solely in the juxtamucosal portion of the gastric mucus gel, detailed knowledge concerning the pH microenvironment in which the organism thrives is important in understanding the pathophysiology of peptic ulcer disease and related conditions. (Keio J Med 48 (2): 63–68, June 1999)

**Key words:** stomach, acid, diffusion, injury, bicarbonate

### Introduction

The gastric mucosal barrier to acid is a laminar structure, consisting of a pre-epithelial mucus-bicarbonate layer, an epithelial layer, and a post-epithelial layer consisting of blood vessels, non-epithelial cells and enteric nerves. Of these layers, the role of the pre-epithelial mucus-bicarbonate gel is the least well understood. In this review, I will discuss the protective function of the mucus gel in delaying the flux of protons between lumen and the epithelium. Furthermore, the mechanism by which secreted acid traverses the mucus gel en route to the gastric lumen will be addressed. This paper is intended to update the reader on recent developments in the understanding of proton diffusion through gastric mucus; the reader is directed to an excellent general review of gastroduodenal mucosal protection,<sup>1</sup> and to several reviews of the protective role

and barrier function of gastric mucus<sup>2–5</sup> to obtain further details.

### Proton Back Diffusion

#### *Trans mucus gel permeability*

A millionfold proton concentration gradient can exist between the gastric lumen and the blood. The concept of back diffusion embodies the notion that, due to the high concentration gradient, secreted acid diffuses through the gastric mucosa into the blood stream by a process known as back-diffusion. The first barrier encountered by back-diffusing acid is the mucus gel. To understand the role that mucus may play in the overall barrier function of the gastric mucosa, the proton permeability ( $D_{H^+}$ ) of mucus has been measured *in vitro* in Ussing chambers. Most studies suggest that  $D_{H^+}$  for

Presented at the 1063rd Meeting of The Keio Medical Society in Tokyo, December 19, 1997.

Reprint requests to: Dr. Jonathan D. Kaunitz, Department of Medicine, School of Medicine, University of California Los Angeles, Bldg. 114, Room 217, West Los Angeles VA Medical Center, 11301 Wilshire Blvd., Los Angeles, CA 90073, USA, e-mail: jake@ucla.edu