Clinical Tests of Gastric Secretion
CLINICAL TESTS OF GASTRIC SECRETION

History, methodology and interpretation

J. H. Baron, D.M., F.R.C.P.

Senior Lecturer and Honorary Consultant, Departments of Surgery and Medicine, Royal Postgraduate Medical School and Hammersmith Hospital, Consultant Physician, St Charles’ Hospital and Associate Teacher, St Mary’s Hospital Medical School, London
## Contents

**Preface** vii  
**Acknowledgements** ix  
**Introduction** xi  

1 Regulation of gastric secretion 1  

### GASTRIC SECRETION TESTS

1 Test procedure 5  
2 Collection of gastric secretion 8  
3 Gastric analysis 13  
4 Basal secretion 19  
5 Meal stimuli 22  
6 Maximal stimuli 25  
7 Vagal stimuli 36  
8 Measurements of maximal acid output 50  
9 Biological factors 56  
10 Tubeless tests 66  
11 Pepsins 68  
12 Gastrins 74  

### DIAGNOSTIC VALUE

13 Gastritis, anaemia and hyposcretion 79  
14 Gastric ulcer and carcinoma 86  
15 Duodenal ulcer 98  
16 X-Ray-negative dyspepsia 120  
17 Gastric hypersecretion and hypergastrinaemia 123  
18 Upper gastrointestinal bleeding 137  
19 Gastric and duodenal folds 139  
20 Children 143  

### MANAGEMENT OF PATIENTS WITH PEPTIC ULCER

21 Duodenal ulcer—management 149  
22 Selective surgery for duodenal ulcer 152  

Preface

The plan of this book is based on my inaugural Quadrennial Review at the World Congress of Gastroenterology in Copenhagen in 1970 on *The Clinical Use of Gastric Function Tests*. The regulation of human gastric secretion is briefly discussed, after which the conduct of gastric secretion tests is described in detail, with chapters on the measurement of basal and stimulated secretion with maximal and vagal stimuli, and on gastrin, pepsin and tubeless tests. The second part of the book assesses the clinical usefulness of measurements of gastric secretion in different diseases—anaemia and gastritis, gastric ulcer and carcinoma, duodenal ulcer and its complications, and X-ray negative dyspepsia. The final section considers the value of secretion tests in patients after the various gastrectomies and vagotomies. An appendix by Mr R. F. McCloy provides precise instructions for the basal-insulin–pentagastrin intravenous infusion test.

Throughout this book SI units have been used. Fortunately mmol/l and mol are numerically equal to mEq/l and mEq. Gastrin concentrations have, for convenience, been expressed throughout in pmol/l GI7 equivalents, assuming 1 pmol/l = 2.1 pg/ml, irrespective of assay. Blood glucose is shown both in mg per 100 ml and in the SI unit mmol/l. The two adjectives ‘maximal’ and ‘maximum’ have identical meanings in English, but in this book *maximal* has been used for the highest observed secretory response irrespective of stimulant or route of administration, and *maximum acid output* has been used for acid output in the period 0–60 minutes after the injection of a stimulant such as histamine or pentagastrin.

The references are a personal selection from my files. Most are recent; older literature is available in books by Ivy, Grossman and Bachrach, James, Gregory, Code and Connell, as well as in early volumes of *Index Medicus*. The references are numbered in the text and tables and listed alphabetically at the end of the book, where the pages on which it is cited are given with each reference.

J. H. Baron

*Royal Postgraduate Medical School,*
*Hammersmith Hospital*
I owe debts of gratitude to many.

My interest in gastroenterology and gastric secretion started in 1952 at Central Middlesex Hospital with Sir Francis Avery Jones and Sir Richard Doll. Dr Hadley at the Middlesex Hospital not only taught me gastroenterology but encouraged me in my studies of peak acid output with an augmented histamine test, so that as a Leverhulme Research Scholar at the Institute of Clinical Research I could complete my D.M.thesis. Professor J. N. Hunt guided me through these early years. The Lilly Foundation awarded me a travelling fellowship to the United States where I worked in the Mount Sinai Hospital, New York with Dr Janowitz in his division of Gastroenterology, and with Dr Dreiling in Dr Kark's Department of Surgery. Dr Ball and Dr Nabarro urged me to continue with exocrinology while I was their senior registrar.

For the past ten years I have been made more than welcome by Professor Welbourn in his Department of Surgery at the Royal Postgraduate Medical School, Hammersmith Hospital, and helped by colleagues in medical gastroenterology (Professor Booth, Dr Neale, Dr Dowling, Dr Thompson, Dr Peters and Dr Chadwick), surgical gastroenterology (Mr Cox and Mr Spencer), endocrinology (Dr Bloom) and histochemistry (Professor Pearse and Dr Polak). The secretion tests were performed by the nursing staff of the gastric clinic under the supervision of a succession of senior registrars and research fellows, especially J. Tinker, F. I. Iweze, L. V. Gutierrez, D. P. Girvan, D. J. Cowley, S. Nundy, W. M. Cooke, R. J. Gaskin, C. M. S. Royston, S. N. Joffe, A. A. J. Barros d'Sa and R. F. McClay. Gastric secretion has been analysed by the staff of the laboratories of the Department of Surgery whose chief technician Mr Gains produces an answer to every problem. Mr Clark and Mr Simmonds and their artists, and Mr Brecknell and his photographers, have provided most of the figures. Over the years financial support has been provided by the late Dr Adler, Boots, I.C.I., the Mason Medical Research Foundation, the Medical Research Council, the Peel Medical Research Trust, the Wellcome Trust, and above all Pfizer (U.K.).

I cannot list here all the many gastroenterologists who have shown me their laboratories and their secretion tests, and have discussed their problems with me. I must, however, single out Dr Grossman for his trenchant criticisms of all my work.
Acknowledgements

A succession of secretaries have battled with my inaudible tapes and illegible writing.

Several authors and journals have kindly allowed me to reproduce their illustrations, and they are acknowledged in the legends to the figures.

Dr S. R. Bloom, Dr G. P. Crean, Professor M. Hobsley and Dr W. Taylor have looked at drafts of various chapters, and Mr J. Spencer has read the whole text, but they must not be held responsible for my inaccuracies. Mr Fry and Mr Milford of The Macmillan Press have given valuable advice in the preparation of this book for publication. My wife has corrected the English and retyped the whole book. She and my children have patiently suffered my neglect of them for gastric acid.
Introduction

In 1777, just 200 years ago, Stevens\textsuperscript{1126} studied the proteolytic activity of gastric secretion in man.\textsuperscript{313–14} In 1824 Prout\textsuperscript{934} first demonstrated and measured hydrochloric acid in human gastric juice, and in 1871 von Leube\textsuperscript{747} designed the first clinical gastric secretion test. Since then hundreds of thousands, if not millions, of patients all over the world have suffered the very real discomfort of fasting, intubation, and one or more unpleasant stimuli as tests of their gastric secretion. Each of these early tests was thought reasonable at the time, but in retrospect all are seen to have been of little clinical value.

I believe that today’s gastric tests are neither so valuable that they ‘should be included in every periodic physical examination’,\textsuperscript{1010} nor so useless ‘that no reading can be pathognomonic of any disease’.\textsuperscript{1185} In this monograph I have described the limited, but specific, role of gastric secretion tests in clinical medicine, and the even more important place of these tests in clinical surgery.