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# Evaluation of Gastrointestinal Motility and its Disorders

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Uday C. Ghoshal  
Editor

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 Springer

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*Dedicated to the memory of my parents Shanti Sudha Ghoshal (10.10.1926–12.12.2005) and Nalini Ranjan Ghoshal (7.12.1919–29.11.2012) who taught me everything, particularly Sincerity, Simplicity and Struggling ability.*

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## Preface

Remarkable advances in modern medicine could not have been achieved without the advances in sciences and technologies, which have provided big breakthroughs in our understanding, diagnosis, and management of diseases. Thanks to the development of new technologies, such as endoscopy, ultrasonography, computerized tomography, and magnetic resonance imaging, gastroenterologists are now enlightened by the new concepts and are armed with revolutionary and powerful weapons for diagnosis and management of patients with gastrointestinal (GI) diseases. It is difficult to imagine today the degree of limitation that gastroenterologists had in the past when such technologies were not available, or were only in their primitive stages of development. One example of such technology is the GI motility study and related investigative techniques. These techniques help in evaluating abnormalities in normal GI motility in patients presenting with various functional gastrointestinal disorders, which made remarkable advances in our understanding on GI motility and related disorders. If these investigative techniques were not available, it would not have been possible to demonstrate the abnormalities in physiology in patients suffering from so-called functional GI disorders, which are mistakenly thought to be entirely psychogenic in origin.

We remember the first appearance of the GI manometry system which was equipped with a high-pressure nitrogen tank, low-compliance pneumohydraulic infusion capillaries, external pressure transducers, and a water-perfused catheter. Pressure tracings were recorded on a long paper usually several meters in length. Manual analysis of the pressure tracings took a long time. In those days, it was really time- and effort-consuming work for the motility experts to perform and interpret the manometry studies. With the advance of technology, the long recording paper was replaced by digital recording in a computer, displayed on a monitor. Manual analysis of the pressure tracings was replaced by computer analysis using software. With these technological advances, though the workload of the motility experts was reduced, their understanding enormously improved.

A revolutionary advance of the manometry system appeared in this new millennium with the development of high-resolution manometry (HRM). The difference of HRM from conventional manometry was not a simple change in resolution from an increase in the number of pressure sensors. The HRM system was a great game changer and led our concepts in 2D analog dimension into the 3D digital world. It provided us a new insight in this field and eventually led to a completely new

classification of motility disorders. Development of an impedance measuring technique and its integration into the HRM system provided us another breakthrough in understanding an actual status of the bolus transports with the pressure events.

Ambulatory esophageal pH monitoring system provided us with a confirmatory tool for diagnosis of gastroesophageal reflux, although not perfect. This system combined with impedance sensors could measure movements of the contents and their natures (pH and gas/liquid). This technique enabled us to develop our ideas on the movements of weakly acidic or non-acidic and even gaseous contents which could not have been measured before.

Techniques to evaluate lower GI functions including motility were also developed by pioneers in this field. These are colonic transit study using radio-opaque markers, anorectal manometry and balloon expulsion test, defecography, and hydrogen breath test. Of course, these advances in technologies led us to broaden our understanding in lower GI physiology and pathophysiology, followed by subsequent advances in patient management.

In this book, principles, techniques, interpretations, and clinical applications of these GI motility tests are reviewed and discussed by experts, mostly from Asia, who have enormous expertise in this field. Therapeutic as well as diagnostic strategies in managing patients with GI motility and functional disorders are also discussed by well-known authors who have experience in managing patients with these disorders.

This book is recommended to be included and read as one of the important reference books at GI clinics and motility laboratories in Asia and the rest of the world.

I highly appreciate the efforts of Dr. Uday C. Ghoshal for his excellent weaving and writing of this book and all the authors who willingly agreed to share their up-to-date knowledge and experiences for the meticulous writings of their chapters.

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# Contents

<b>1 Overview of the Manometry Machine</b> . . . . .	1
Geoffrey S. Hebbard	
<b>2 High-Resolution Esophageal Manometry: Principles, Technique, and Interpretation</b> . . . . .	11
Abhai Verma, Asha Misra, and Uday C. Ghoshal	
<b>3 Colonic Transit Study by Radio-Opaque Markers</b> . . . . .	23
Yang Won Min and Poong-Lyul Rhee	
<b>4 Technique, Interpretation and Clinical Application of Anorectal Manometry and Balloon Expulsion Test</b> . . . . .	31
Kee Wook Jung and Seung-Jae Myung	
<b>5 Defecography: Technique, Interpretation and Clinical Application</b> . . . . .	49
Ah Young Kim	
<b>6 Therapeutic Application of Manometry: Biofeedback for Management of Fecal Evacuation Disorders</b> . . . . .	63
Tanisa Patcharatrakul and Sutep Gonlachanvit	
<b>7 Approach to Patients with Refractory Constipation</b> . . . . .	79
Kok-Ann Gwee, Xiaorong Gong, and Kewin Tien Ho Siah	
<b>8 Overview of Hydrogen Breath Tests in Gastroenterology Practice</b> . . . . .	87
Uday C. Ghoshal	
<b>9 Catheter-Based 24-h pH-Metry and Impedance: Technique, Interpretation, and Clinical Application</b> . . . . .	95
Uday C. Ghoshal and Rajan Singh	
<b>10 Summary of Criteria for Diagnosis of Motility Disorders</b> . . . . .	107
Rajesh Sainani	
<b>11 Manometry Report Format</b> . . . . .	131
Sanjeev Sachdeva and Asha Misra	

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## Abbreviations

ARA	Anorectal angle
ARJ	Anorectal junction
ARM	Anorectal manometry
CDP	Contractile deceleration point
CFV	Contractile front velocity
DL	Distal latency
EAS	External anal sphincter
EGJ	Esophago-gastric junction
EMG	Electromyography
GERD	Gastroesophageal reflux disease
GI	Gastrointestinal
HBT(s)	Hydrogen breath test(s)
HRM	High-resolution manometry
IAS	Internal anal sphincter
IBS	Irritable bowel syndrome
IBS-C	Irritable bowel syndrome-constipation
IRP	Integrated relaxation pressure
LES	Lower esophageal sphincter
PCL	Pubococcygeal line
PFD	Pelvic floor dyssynergia
PIP	Pressure inversion point
PPI	Proton pump inhibitor
RAIR	Recto-anal inhibitory reflex
ROC	Receiver operative characteristic
SI	Symptom index
SIBO	Small intestinal bacterial overgrowth
STC	Slow transit constipation
TLESR	Transient lower esophageal sphincter relaxation
UES	Upper esophageal sphincter