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# **Capsule Endoscopy**

## **In**

# **Gastrointestinal Bleeding Disorders**

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An Essay Submitted For Partial Fulfillment of  
Master Degree in Internal Medicine

By

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# Front Note

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Luther L. Gendy

# Introduction

"Fantastic Voyage" is an Oscar-winning science fiction movie, produced in 1966, telling a fictional story, in which a submarine is shrunk to a microscopic size and injected into a man's blood stream in attempt to save his life after he has been assassinated.<sup>1</sup> All who had watched this movie wondered; *Would it ever be possible to have a chance to walk through the interior lanes of the living body to explore the mysterious regions and hidden spheres?* At this time, it was only a sheer of fantasy. Nowadays, much of these dreams have become true with the introduction of wireless capsule endoscopy (WCE) since the outset of the new millennium. Using this prodigious technology, it became possible to have real time explorative imaging of the small bowel that have been traditionally considered a mysterious segment of the gastrointestinal tract as it lies beyond the scope conventional endoscopic modalities. According to some authors, much of the contemporary understanding of small bowel disorders is attributed to knowledge gained by WCE that is currently playing a pivotal role in diagnosis and monitoring of treatment response of many small bowel diseases. Moreover, the success of the technology encouraged expanding of its role as a patient-friendly alternative to conventional endoscopy for exploration of esophagus and colon.

Like novel diagnostic modalities, since the introduction of WCE, it has been submitted to extensive research work, in attempts to evaluate its clinical utility as well as its absolute and comparative significance in various arenas. The conventional research cycle of novel diagnostic modalities passes with **three principle phases**; **individual studies** (*having different aims, targets, designs, methods and very heterogeneous results and conclusions*), **meta-analyses** (*using the large pool of raw data generated by individual studies for withdrawing more solid conclusions*) and **review articles** (*providing summary of the current status and showing the concurred and debated areas of research, thus directing future plans of research*). Review of literature pertinent to WCE reveals presence of huge number of individual studies, numerous meta-analytic studies and much less review articles and status reports. The essay submitted today is a sort of status report that provides an update overview of technology of WCE, with emphasize on the so-far proven clinical utility, global and comparative significance of WCE in the arena of obscure gastrointestinal bleeding (OGIB) that still represent a real challenge to gastroenterologists and a true health and financial burden to the patients. Motivated by the fact that more than one-third of OGIB is underlain by non-vascular lesions (*i.e., neoplastic,*

*inflammatory, drug-related and others*), a special attention has been paid to the significance of small bowel WCE in diagnosis of particular OGIB-underlying lesions; notably, small bowel tumors, Crohn's disease, Celiac disease and NSAIDs-related enteropathy. To fulfill the scope of significance of WCE in gastrointestinal bleeding, the promising role of esophageal WCE in management of esophageal varices is tackled in this essay.

The essay comes in four sections; I, II, III & IV as well as a summary and appendices. Section (I) of the essay provides a brief history of the evolution of WCE with essential description of the components of the technology and various aspects of the procedure; including the preparation protocols, technical and clinical limitations, and potential complications of WCE. Section (II) of the essay is meant to discuss anatomical and clinical approaches to gastrointestinal bleeding, with attention paid to the phenomenon of obscurity; defining it, explaining it, and providing an update evidence-based anatomical, clinical and pathological profiling of OGIB. Section (III) of the essay is principally concerned with the current status of small bowel WCE as a diagnostic modality of OGIB. Initially, the other endoscopic and radiographic modalities are overviewed. Consequently, the significance parameters of small bowel WCE in diagnosis of OGIB (*sensitivity, specificity, diagnostic yield, long term outcome and cost-effectiveness*), are globally and comparatively described versus significance parameters of other modalities. Finally, section (III) provides the various algorithms that have been proposed by recognized gastroenterology associations and peer authors, for investigation of OGIB. Section (IV) of the essay targets the current opinion on the application of esophageal and colonic WCE in diagnosis of gastrointestinal bleeding disorders, notably, esophageal varices and colonic neoplasms. The summary of the essay provides a brief outline of the proven significance of WCE in diagnosis of GIT bleeding disorders and highlights the areas of uncertainty that warrants further research efforts.

# Aim of the Work

The aim of this work is to provide an up-to-date review of the technology of wireless capsule endoscopy as a novel modality for explorative imaging of the gastrointestinal tract, with emphasize on the history, prospects, agreed and debated areas in the field of research work pertinent to the application of this novel modality in diagnosis of gastrointestinal bleeding disorders. Such approach is assumed to be very helpful for planning future researched works in this fast-growing field of endoscopy.

# Index of Contents

|                                                                 | Page     |
|-----------------------------------------------------------------|----------|
| <b>Section I</b>                                                |          |
| <b>Wireless Capsule Endoscopy</b>                               | <b>1</b> |
| <b>The Technology &amp; The Procedure</b>                       |          |
| I.1: Evolution of Wireless Capsule Endoscopy                    | 3        |
| I.2: Technology of Wireless Capsule Endoscopy                   | 5        |
| I.2.a: <u>Ingestible Capsule Endoscope</u>                      | 6        |
| ■ Structure of the Ingestible Capsule Endoscope                 |          |
| ■ Imaging Technology of Capsule Endoscope                       |          |
| ■ Progression and Excretion of Capsule Endoscope                |          |
| I.2.b: <u>External Receiver/Recorder Unit of WCE</u>            | 9        |
| ■ Antenna Array                                                 |          |
| ■ External Recording Device                                     |          |
| I.2.c: <u>Computer Workstation of WCE</u>                       | 11       |
| I.2.d: <u>Accessory Elements of WCE</u>                         | 13       |
| ■ Patency Capsule (PC)                                          |          |
| ■ Real-Time Viewer (RTV)                                        |          |
| ■ Delivery Devices of Capsule Endoscopes                        |          |
| I.2.e: <u>Limitations, Complications &amp; Prospects of WCE</u> | 17       |
| ■ Technical Limitations of WCE                                  |          |
| ■ Clinical Limitations of WCE                                   |          |
| ■ Complications of WCE : Capsule Retention                      |          |
| ■ Future Expectations of WCE                                    |          |
| I.3: Procedure of Wireless Capsule Endoscopy                    | 23       |
| ■ Administration of WCE                                         |          |
| ■ Intestinal Preparation Prior to Administration of WCE         |          |
| ■ Cleansing Score System Evaluating Preparation Protocols       |          |
| I.4: Indications of Wireless Capsule Endoscopy                  | 29       |

|                                                        |           |
|--------------------------------------------------------|-----------|
| <b>Section II</b>                                      |           |
| <b>Gastrointestinal Bleeding</b>                       | <b>31</b> |
| <b>Insight Into The Phenomenon of Obscurity</b>        |           |
| II.1: Anatomical Approach to Gastrointestinal Bleeding | 34        |
| II.2: Clinical Approach to Gastrointestinal Bleeding   | 37        |
| II.2.a: <u>Overt Gastrointestinal Bleeding</u>         | 38        |
| ■ Hematemesis, Melena & Hematochezia                   |           |
| II.2.b: <u>Occult Gastrointestinal Bleeding</u>        | 40        |
| ■ Recognition of Occult Gastrointestinal Bleeding      |           |
| ■ Closer Look to Fecal Occult Blood Tests (FOBTs)      |           |
| ❖ Guaiac-based Fecal Occult Blood Tests (G-FOBT)       |           |
| ❖ Immunochemical Fecal Occult Blood Tests (I-FOBT)     |           |
| ❖ Heme–Porphyrin Fecal Occult Blood Tests (HP-FOBT)    |           |

|                    |                                                                       |            |
|--------------------|-----------------------------------------------------------------------|------------|
|                    | ❖ <i>Cr-Radiolabeled Erythrocytes Fecal Occult Blood Tests</i>        |            |
|                    | ■ <b>Closer Look to Iron Deficiency Anemia (IDA)</b>                  |            |
| <b>II.3</b>        | <b>Phenomenon of Obscure GI Bleeding (OGIB)</b>                       | <b>52</b>  |
|                    | ■ <b>Possible Explanations of Obscurity Phenomenon</b>                |            |
|                    | ■ <b>Evidence-Based Profiling of Obscurity Phenomenon</b>             |            |
|                    | ❖ <i>Clinical Presentations Commonly Associated with OGIB</i>         |            |
|                    | ❖ <i>Anatomical Origins Commonly Associated with OGIB</i>             |            |
|                    | ❖ <i>Pathological Lesions Commonly Associated with OGIB</i>           |            |
| <b>Section III</b> | <b>In Pursuit of Definitive Diagnosis of OGIB</b>                     | <b>59</b>  |
|                    | Global & Comparative Significance of Small Bowel Capsule Endoscopy    |            |
| <b>III.1</b>       | <b>Diagnostic Modalities For Investigation of OGIB</b>                | <b>63</b>  |
|                    | ■ <b>Second Look EGD &amp; Colonoscopy</b>                            |            |
|                    | ■ <b>Sonde Endoscopy</b>                                              |            |
|                    | ■ <b>Push Enteroscopy</b>                                             |            |
|                    | ■ <b>Double-Balloon Enteroscopy</b>                                   |            |
|                    | ■ <b>Single-Balloon Enteroscopy</b>                                   |            |
|                    | ■ <b>Spiral Enteroscopy</b>                                           |            |
|                    | ■ <b>Intraoperative Endoscopy</b>                                     |            |
|                    | ■ <b>Single &amp; Multi Phase CT Enterography &amp; Enteroclysis</b>  |            |
|                    | ■ <b>Nuclear Scans: Bleeding Scan &amp; Meckel's Scan</b>             |            |
|                    | ■ <b>CT-Angiography &amp; Catheter-Directed Angiography</b>           |            |
| <b>III.2</b>       | <b>Current Status of SB-WCE in Diagnosis of OGIB</b>                  | <b>88</b>  |
| <b>III.2.a</b>     | <b>Significance Parameters of SB-WCE in OGIB</b>                      | <b>90</b>  |
|                    | ■ <b>Sensitivity &amp; Specificity of SB-WCE in Diagnosis of OGIB</b> |            |
|                    | ■ <b>Diagnostic Yield (DY) of SB-WCE in OGIB</b>                      |            |
|                    | ❖ <i>Impact of Study-Related Factors on DY of SB-WCE in OGIB</i>      |            |
|                    | ❖ <i>Variability of DY of SB-WCE in Overt &amp; Occult OGIB</i>       |            |
|                    | ❖ <i>DY of SB-WCE in OGIB Presented with Isolated IDA</i>             |            |
|                    | ❖ <i>Impact of Timing on Diagnostic Yield of SB-WCE in OGIB</i>       |            |
|                    | ❖ <i>Impact of Preparation on DY of SB-WCE in OGIB</i>                |            |
|                    | ❖ <i>Impact of Clinical Factors on DY of SB-WCE in OGIB</i>           |            |
|                    | ❖ <i>Impact of Repeating SB-WCE on DY in OGIB</i>                     |            |
|                    | ■ <b>Long-Term Outcome of SB-WCE in OGIB</b>                          |            |
| <b>III.2.b</b>     | <b>Comparative Significance of SB-WCE</b>                             | <b>101</b> |
|                    | ■ <b>SB-WCE vs Push Endoscopy</b>                                     |            |
|                    | ■ <b>SB-WCE vs Double-Balloon Endoscopy</b>                           |            |
|                    | ■ <b>SB-WCE vs Single-Balloon &amp; Spiral Enteroscopy</b>            |            |
|                    | ■ <b>SB-WCE vs Angiography</b>                                        |            |
|                    | ■ <b>SB-WCE vs CT Enterography &amp; Enteroclysis</b>                 |            |
|                    | ■ <b>Cost-Effectiveness of SB-WCE</b>                                 |            |
| <b>III.3</b>       | <b>Update Approaches To Investigate OGIB</b>                          | <b>114</b> |

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- ASGE Algorithms for Investigation of OGIB (2010)
  - Other Algorithms for Investigation of OGIB

|                       |                                                                             |                |
|-----------------------|-----------------------------------------------------------------------------|----------------|
| <b>Section IV</b>     | <b>Esophageal &amp; Colonic WCE</b><br>Related Applications to GIT Bleeding | <b>123</b>     |
| IV.1                  | Esophageal WCE in Diagnosis of Esophageal Varices                           | 124            |
| IV.2                  | Colonic WCE in Diagnosis of Colonic Disorders                               | 129            |
| <b>Summary</b>        |                                                                             | <b>131-139</b> |
| <b>Color Plates</b>   |                                                                             | <b>140-151</b> |
| <b>References</b>     |                                                                             | <b>152-165</b> |
| <b>Arabic Summary</b> |                                                                             |                |

## List of Abbreviations & Acronyms

|          |                |                                                                         |
|----------|----------------|-------------------------------------------------------------------------|
| <b>A</b> | <b>AEF</b>     | <i>Aorto-Enteric Fistula</i>                                            |
|          | <b>AGA</b>     | <i>American Association of Gastroenterology</i>                         |
|          | <b>ANCA</b>    | <i>Anti-Neutrophilic Cytoplasmic Antibodies</i>                         |
|          | <b>ASGE</b>    | <i>American Society of Gastroenterology and Endoscopy</i>               |
|          | <b>ASIC</b>    | <i>Application-Specific Integrated Circuit</i>                          |
|          | <b>AVWS</b>    | <i>Acquired Von Willebrand Syndrome</i>                                 |
|          |                |                                                                         |
| <b>B</b> | <b>BRBN</b>    | <i>Blue Rubber Bleb Nevus Syndrome</i>                                  |
|          |                |                                                                         |
| <b>C</b> | <b>CCS</b>     | <i>Cronkhite-Canada Syndrome</i>                                        |
|          | <b>CD</b>      | <i>Crohn's Disease</i>                                                  |
|          | <b>CDA</b>     | <i>Catheter-Directed Angiography</i>                                    |
|          | <b>CE</b>      | <i>Capsule Endoscopy</i>                                                |
|          | <b>CECDAI</b>  | <i>Capsule Endoscopy Crohn's Disease Activity Index</i>                 |
|          | <b>CeD</b>     | <i>Celiac Disease</i>                                                   |
|          | <b>CMOS</b>    | <i>Complementary Metal Oxide Semiconductor</i>                          |
|          | <b>CMUSE</b>   | <i>Cryptogenic Multifocal Ulcerous Stenosing Enteritis</i>              |
|          | <b>COX</b>     | <i>Cyclooxygenase Enzyme</i>                                            |
|          | <b>CSI</b>     | <i>Cleansing Scoring Index</i>                                          |
|          | <b>CTA</b>     | <i>Computed Tomographic Angiography</i>                                 |
|          | <b>CTE</b>     | <i>CT Enterography</i>                                                  |
|          | <b>CTEc</b>    | <i>CT Enteroclysis</i>                                                  |
|          | <b>CTVE</b>    | <i>CT Virtual Endoscopy</i>                                             |
|          | <b>Cr-FOBT</b> | <i>Cr-radiolabeled erythrocytes fecal occult blood test</i>             |
|          |                |                                                                         |
| <b>D</b> | <b>DBE</b>     | <i>Double-Balloon Enteroscopy</i>                                       |
|          | <b>DSB®</b>    | <i>Discovery Small Bowel® : the overtube used in spiral enteroscopy</i> |
| <b>E</b> | <b>EATL</b>    | <i>Enteropathy Associated T-Cell Lymphoma</i>                           |
|          | <b>EGD</b>     | <i>Esophageo-Gastro-Duodenoscopy (Upper GIT Endoscopy)</i>              |
|          | <b>ES-WCE</b>  | <i>Esophageal Wireless Capsule Endoscopy</i>                            |
|          | <b>ESGE</b>    | <i>European Society of Gastrointestinal Endoscopy</i>                   |
|          |                |                                                                         |
| <b>F</b> | <b>FAP</b>     | <i>Familial Adenomatous Polyposis</i>                                   |
|          | <b>FOBT</b>    | <i>Fecal Occult Blood Test</i>                                          |
|          | <b>fps</b>     | <i>Frame Per Second</i>                                                 |
|          |                |                                                                         |
| <b>G</b> | <b>GAVE</b>    | <i>Gastric Antral Vascular Ectasia</i>                                  |
|          | <b>GANTs</b>   | <i>Gastrointestinal Autonomic Nerve Tumors</i>                          |
|          | <b>GERD</b>    | <i>Gastro-Esophageal Reflux Disease</i>                                 |

|                 |                                             |
|-----------------|---------------------------------------------|
| <b>G-FOBT</b>   | <i>Guaiac-based Fecal Occult Blood Test</i> |
| <b>GIT (GI)</b> | <i>Gastrointestinal Tract</i>               |
| <b>GISTs</b>    | <i>Gastrointestinal Stromal Tumors</i>      |
| <b>GTT</b>      | <i>Gastric Transit Time</i>                 |

|          |                |                                                                           |
|----------|----------------|---------------------------------------------------------------------------|
| <b>H</b> | <b>H2RA</b>    | <i>Histamine (H2) Receptor Antagonist</i>                                 |
|          | <b>HHT</b>     | <i>Hereditary Hemorrhagic Telangiectasia (Osler-Weber-Rendu Syndrome)</i> |
|          | <b>HP-FOBT</b> | <i>Heme-Porphyrin Fecal Occult Blood Test</i>                             |
|          | <b>HVPg</b>    | <i>Hepatic Venous Pressure Gradient</i>                                   |

|          |               |                                              |
|----------|---------------|----------------------------------------------|
| <b>I</b> | <b>IDA</b>    | <i>Iron Deficiency Anemia</i>                |
|          | <b>I-FOBT</b> | <i>Immunological Fecal Occult Blood Test</i> |
|          | <b>IOE</b>    | <i>Intra-Operative Endoscopy</i>             |
|          | <b>ITT</b>    | <i>Intestinal Transit Time</i>               |

|          |           |                           |
|----------|-----------|---------------------------|
| <b>J</b> | <b>JP</b> | <i>Juvenile Polyposis</i> |
|----------|-----------|---------------------------|

|          |             |                                        |
|----------|-------------|----------------------------------------|
| <b>L</b> | <b>LID</b>  | <i>Light Emission Diode</i>            |
|          | <b>LGIB</b> | <i>Lower Gastrointestinal Bleeding</i> |

|          |             |                                                                 |
|----------|-------------|-----------------------------------------------------------------|
| <b>M</b> | <b>MCTD</b> | <i>Mixed Connective Tissue Disease</i>                          |
|          | <b>MDCT</b> | <i>Multi-Detector Computerized Tomography</i>                   |
|          | <b>MENS</b> | <i>Multiple Endocrine Neoplasia Syndrome</i>                    |
|          | <b>MGIB</b> | <i>Middle Gastrointestinal Bleeding (of small bowel origin)</i> |
|          | <b>MREc</b> | <i>Magnetic Resonance (MR) Enteroclysis</i>                     |

|          |               |                                              |
|----------|---------------|----------------------------------------------|
| <b>N</b> | <b>NO</b>     | <i>Nitric Oxide</i>                          |
|          | <b>NSAIDs</b> | <i>Non-Steroidal Anti-Inflammatory Drugs</i> |

|          |             |                                                                           |
|----------|-------------|---------------------------------------------------------------------------|
| <b>O</b> | <b>OIP</b>  | <i>Original Ingestion Protocol (of the esophageal capsules)</i>           |
|          | <b>OGIB</b> | <i>Non-Steroidal Anti-Inflammatory Drugs</i>                              |
|          | <b>OWR</b>  | <i>Osler-Weber-Rendu Syndrome (Hereditary Hemorrhagic Telangiectasia)</i> |

|          |            |                                        |
|----------|------------|----------------------------------------|
| <b>P</b> | <b>PAN</b> | <i>Polyarteritis Nodosa</i>            |
|          | <b>PHG</b> | <i>Portal Hypertensive Gastropathy</i> |
|          | <b>PC</b>  | <i>Patency Capsule</i>                 |
|          | <b>PE</b>  | <i>Push Enteroscopy</i>                |
|          | <b>PEG</b> | <i>Polyethylene Glycol (purgative)</i> |
|          | <b>PGs</b> | <i>Prostaglandins</i>                  |
|          | <b>PJS</b> | <i>Peutz-Jeghers Syndrome</i>          |

|          |               |                                                                   |
|----------|---------------|-------------------------------------------------------------------|
| <b>R</b> | <b>RAPID</b>  | <i>Reporting and Processing of Images and Data (software)</i>     |
|          | <b>RFID</b>   | <i>Radiofrequency Identification Tag</i>                          |
|          | <b>RTV</b>    | <i>Real Time Viewer</i>                                           |
| <b>S</b> | <b>SB</b>     | <i>Small Bowel</i>                                                |
|          | <b>SBE</b>    | <i>Single-Balloon Enteroscopy</i>                                 |
|          | <b>SBFT</b>   | <i>Small Bowel Follow-Through</i>                                 |
|          | <b>SBTT</b>   | <i>Small Bowel Transit Time</i>                                   |
|          | <b>SBTs</b>   | <i>Small Bowel Tumors</i>                                         |
|          | <b>SB-WCE</b> | <i>Small Bowel Wireless Capsule Endoscopy</i>                     |
|          | <b>SE</b>     | <i>Spiral Enteroscopy</i>                                         |
|          | <b>SIP</b>    | <i>Simplified Ingestion Protocol (of the esophageal capsules)</i> |
|          | <b>SLE</b>    | <i>Systemic Lupus Erythromatosus</i>                              |
|          | <b>SP</b>     | <i>Sodium Phosphate (purgative)</i>                               |
| <b>T</b> | <b>TIPS</b>   | <i>Transjugular Intrahepatic Porto-Systemic Shunt</i>             |
| <b>U</b> | <b>UGIB</b>   | <i>Upper Gastrointestinal Bleeding</i>                            |
| <b>W</b> | <b>WCE</b>    | <i>Wireless Capsule Endoscopy</i>                                 |
| <b>Y</b> | <b>YAG</b>    | <i>Yttrium Aluminium Garnet (YAG LASER)</i>                       |
| <b>Z</b> | <b>ZES</b>    | <i>Zollinger-Ellison Syndrome</i>                                 |

| <b>List of Tables</b> |                                                                                   | <b>Page</b> |
|-----------------------|-----------------------------------------------------------------------------------|-------------|
| <b>Table I.1</b>      | <i>Technical specifications of Different Brands of Small Bowel Capsules.</i>      | 7           |
| <b>Table I.2</b>      | <i>Contraindications of Wireless Capsule Endoscopy.</i>                           | 19          |
| <b>Table I.3</b>      | <i>Currently Approved Indications of Wireless Capsule Endoscopy.</i>              | 30          |
| <b>Table II.1</b>     | <i>Commonly Identified Causative lesions of Occult GI Bleeding.</i>               | 41          |
| <b>Table II.2</b>     | <i>Clinically-Evident Manifestations Raising Suspicion of Occult GI Bleeding.</i> | 43          |
| <b>Table II.3</b>     | <i>Comparison Between Different Types of FOBTs.</i>                               | 49          |
| <b>Table II.4</b>     | <i>Commonly Identified Causes of GIT-Related IDA.</i>                             | 50          |
| <b>Table II.5</b>     | <i>Evidence-Based Association Between OGIB and Occult GI Bleeding.</i>            | 55          |
| <b>Table II.6</b>     | <i>Regional Enlistment of the Common OGIB-Underlying Lesions.</i>                 | 58          |
| <b>Table III.1</b>    | <i>Diagnostic Modalities Applied for Investigation of OGIB.</i>                   | 62          |
| <b>Table III.2</b>    | <i>Diagnostic Yield of PE in Settings of OGIB.</i>                                | 69          |
| <b>Table III.3</b>    | <i>Diagnostic Yield of DBE in Settings with OGIB.</i>                             | 73          |
| <b>Table III.4</b>    | <i>Clinical Studies of Single-Balloon Enteroscopy (SBE).</i>                      | 75          |
| <b>Table III.5</b>    | <i>Clinical Studies of Spiral Enteroscopy (SE).</i>                               | 78          |
| <b>Table III.6</b>    | <i>Diagnostic Yield of IOE in Patients with OGIB.</i>                             | 80          |
| <b>Table III.7</b>    | <i>Current Status of SB-WCE in Diagnosis of OGIB.</i>                             | 89          |
| <b>Table III.8</b>    | <i>Diagnostic Yield of SB-WCE for Different Presentations of OGIB.</i>            | 93          |
| <b>Table III.9</b>    | <i>Survey of Patient Acceptance to SB-WCE in Comparison to Enteroscopy.</i>       | 101         |
| <b>Table III.10</b>   | <i>Push Enteroscopy Compared With Small Bowel Wireless Capsule Endoscopy.</i>     | 102         |
| <b>Table III.11</b>   | <i>Studies Comparing DY of SB-WCE &amp; DBE in Patients of OGIB (2004-2006)</i>   | 104         |
| <b>Table III.12</b>   | <i>Various Lesions Identified by SB-WCE &amp; and DBE in Patients with OGIB.</i>  | 105         |
| <b>Table IV.1</b>     | <i>Common Causes of Portal Hypertension and Gastroesophageal Varices.</i>         | 126         |

| <b>List of Figures</b> |                                                                                    | <b>Page</b> |
|------------------------|------------------------------------------------------------------------------------|-------------|
| <b>Figure I.1</b>      | <i>Principal Components of Wireless Capsule Endoscopy.</i>                         | 5           |
| <b>Figure I.2</b>      | <i>Sensor Location Guide for Different Types of Capsule Endoscopes.</i>            | 9           |
| <b>Figure I.3</b>      | <i>Set of Sensors and the Newly Introduced Sensor Belt.</i>                        | 10          |
| <b>Figure I.4</b>      | <i>The Original Ingestion Protocol (OIP) of the Esophageal Capsule Endoscope.</i>  | 24          |
| <b>Figure II.1</b>     | <i>Anatomical Clusters of GI Bleeding.</i>                                         | 36          |
| <b>Figure II.2</b>     | <i>Clinical Clusters of GI Bleeding.</i>                                           | 37          |
| <b>Figure II.3</b>     | <i>Obscure GI Bleeding.</i>                                                        | 53          |
| <b>Figure III.1</b>    | <i>Sensitivity, Specificity, Predictive Values of SB-WCE in Diagnosis of OGIB.</i> | 91          |
| <b>Figure III.2</b>    | <i>Rebleeding Rates for Each SB-WCE Finding + / - Intervention.</i>                | 100         |
| <b>Figure III.3</b>    | <i>Comparative DY of SB-WCE, According to Triester et al.</i>                      | 103         |
| <b>Figure III.4</b>    | <i>Algorithm for Diagnosis of OGIB Using SB-WCE &amp; DBE.</i>                     | 106         |
| <b>Figure III.5</b>    | <i>ASGE Algorithm for Investigation of Overt Active &amp; Inactive OGIB.</i>       | 117         |
| <b>Figure III.6</b>    | <i>ASGE Algorithm for Investigation of Occult OGIB.</i>                            | 118         |
| <b>Figure III.7</b>    | <i>Klaus Mönkemüller et al. Algorithm for Investigation of OGIB.</i>               | 119         |
| <b>Figure III.8</b>    | <i>Cristina Carretero et al Algorithm for Investigation of OGIB.</i>               | 120         |
| <b>Figure III.9</b>    | <i>Jonathan A. Leighton Algorithm for Investigation of OGIB.</i>                   | 120         |
| <b>Figure III.10</b>   | <i>J. Westerhof et al Algorithm for Investigation of OGIB.</i>                     | 121         |
| <b>Figure III.11</b>   | <i>Elizabeth EJ et al Algorithm for Investigation of OGIB in Children.</i>         | 122         |