ASSESSMENT OF THE ROLE OF CAPSULE ENDOSCOPY IN MANAGEMENT OF OBSCURE GASTROINTESTINAL BLEEDING

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بسم الله الرحمن الرحيم

" يرفعِ اللهُ الذين آمنوا منكم
و الذين أوتوا العلم درجات "

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LIST OF ABBREVIATIONS

5-HT4	5-hydroxytryptamine type-4
AIDS	Acquired Immunodeficency Syndrome
ASIC	Application Specific Integrated Circuit
AVM	Arteriovenous Malformation
CA 19-9	Cancer Antigen 19-9
CCD	Charge Coupled Device
CEA	CarcinoEmbryonic Antigen
CECDAI	Capsule Endoscopy Crohn's Disease Activity Index
CET	Cecal Entry Time
CETT	Capsule Endoscopy Transit Time
CMOS	Complementary Metal Oxide Semiconductor
CREST	Calcinosis, Raynaud`s disease, Esophageal dysmotility, Syndactily, Telangiectasia
CT	Computed Tomography
CTA	Helical CT Angiography
DBE	Double Balloon Enteroscopy
DCBE	Double Contrast Barium Enema
DSP	digital signal processor
ECG	Electro Cardiogram
EGD	Esophagogastroduodenoscopy "upper endoscopy"
EMILOC	Endoscopic MIcrocapsule LOcomotion and Control.
FAP	Familial Adenomatous Polyposis
FDA	Food and Drug Administration

FJP	Familial Juvenile Polyposis
FOBT	Fecal Occult Blood Test
Fps	Frame per second
GAVE	Gastric Antral Vascular Ectasias
GI	Gastrointestinal
GIST	Gastrointestinal Stromal Tumor
GTT	Gastric Transit Time
GVHD	Graft Versus Host Disease
ICCE	International Conference on Capsule Endoscopy
IDA	Iron Deficiency Anemia
IMC	Intelligent Microsystem Center
INR	International Normalized Ratio
IOA	Interobserver Agreement
IOE	Intra Operative Enteroscopy
LEDs	Light Emitting Diodes
LTB	Likely to bleed
M2A	Mouth to Anus
MEMS	Micro Electro Mechanical Systems
MIS	Minimally Invasive Surgery
Nd:YAG	Neodymium:Yttrium-Aluminium-Garnet
NEMO	Nano-based capsule-Endoscopy with Molecular Imaging and Optical biopsy
NETs	Neuroendocrine tumors
NSAIDs	Non Steroidal Anti Inflammatory Drsugs
OGIB	Obscure Gastrointestinal Bleeding
PBSCT	Peripheral Blood Stem Cell Transplantation

PEG	Polyethylene Glycol
Pill Cam ESO	Pill Cam Esophageal capsule
Pill Cam SB	Pill Cam Small Bowel capsule
PJS	Peutz-Jeghers Syndrome
RBC	Red Blood Cell
RTAs	Regional Transit Abnormalities
SB	Small Bowel
SBFT	Small Bowel Follow Through
SBI	Suspected Blood Indicator
SBT	Small Bowel Transit
SBTT	Small Bowel Transit Time
SMA	Superelastic Shape Memory Alloy
SSRIs	Slow Serotonin Re-uptake Inhibitors
SSSA	Scuola Superiore Sant'Anna
TRBC	Technetium 99m–labeled Red Blood Cell
ULTB	Unlikely to bleed
VCE	Video Capsule Endoscope
VECTOR	Versatile Endoscopic Capsule for gastrointestinal Tumor Recognition and therapy

INTRODUCTION

Obscure gastrointestinal bleeding is defined as bleeding of unknown origin that persists or recurs (either recurrent or persistent iron deficiency anemia, fecal occult blood test positivity, or visible bleeding) after a negative initial or primary endoscopy (upper and/or lower gastrointestinal endoscopy) **(Pennazio et al, 2005)**. This unidentified obscure bleeding represents 5% of gastrointestinal bleedings; with a unique, difficult and sometimes frustrating diagnostic challenge **(Bhasin and Rana, 2006)**.

The source of bleeding is frequently located in the small intestine and includes angiodysplasias, neoplasms, enteropathy resulting from nonsteroidal anti inflammatory drug intake, Meckel`s diverticulum associated ulcers as well as various inflammatory lesions. Still there are a proportion of missed lesions in the upper tract such as Cameron's erosions in large hiatal hernias, peptic ulcer disease and angiodysplasias. Similarly, missed lesions in colonoscopies include angiodysplasias and neoplasms **(Leighton et al, 2003)**.

Several diagnostic tools, targeted to the small intestine, were applied with unsatisfactory results. Endoscopic examination of the small intestine is limited by its significant length and distance from accessible orifices **(Mishkin et al, 2006)**. Till the end of the twentieth century, only indirect procedures using radiographic techniques or magnetic resonance techniques were available to provide rough imaging of the small bowel. These procedures were –and still are- used to detect large tumors, stenoses and fistulas. However, they do not allow direct intraluminal assessment of the mucosal situation. Nuclear medicine procedures, including radiographic angiography, also proved unsatisfactory, but in the absence of a better standard method were in widespread use in patients with suspicion of chronic or acute recurrent small bowel bleeding **(Ell and May, 2006)**.

Therefore, the desire to explore this relatively inaccessible area led to the development of capsule endoscopy, an ingestible miniature camera providing visualization of the small bowel by transmitting images wirelessly from a disposable capsule to a data recorder worn by the patient. The Food and Drug Administration (FDA) approved the first

capsule in August 2000, and since that time, more than 250.000 capsules have been ingested **(Mishkin et al, 2006)**.

The global diagnostic yield of the capsule endoscopy is about 65% **(Van Tuyl et al, 2003)**. As capsule endoscopy has the ability to provide views for the whole small intestine, it rapidly acquired several indications such as evaluation of obscure gastrointestinal bleeding, patients with malabsorptive, inflammatory and infiltrative conditions, as well as surveillance of patients with hereditary intestinal polyposis **(Viazis et al, 2005)**. Hence, in 2003, the FDA modified the previous labeling of the capsule endoscopy by removing its designation as an adjunctive tool and approving its use as a first line test **(Gay et al, 2004)**.

Concerning its role in cases of obscure bleeding, a recent pooled analysis of seven prospective studies showed a capsule yield of 71% for identification of a source of bleeding compared to 29% for the push enteroscopy **(Melmed and Lo, 2005)**. The detection rate of capsule endoscopy for this indication is dependent on the character of bleeding, with a higher detection rate in ongoing overt bleeding than in cases of heme positive stool and anemia and cases with prior overt bleeding **(Pennazio et al, 2004)**.

This high diagnostic yield in cases of obscure bleeding led to additional several advantages such as possibility of earlier diagnosis, assistance in achieving effective decision making concerning subsequent management, and a lower overall health care utilization and costs **(Pennazio et al, 2005)**.