

Octa-nonagenarians can perform video capsule endoscopy safely and with a higher diagnostic yield than 65–79-year-old patients

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Abstract

Background: Video capsule endoscopy (VCE) is an effective, noninvasive modality for small bowel (SB) investigation. Its usage in the older adults is rising. However, data in octa-nonagenarians regarding diagnostic yield and motility are lacking. Our aim was to evaluate and compare safety and efficacy of VCE between age subgroups of older adult patients.

Methods: This was a retrospective study of prospectively documented data. All consecutive VCEs of patients ≥ 65 years (01/2010–12/2017) were included. Patients unable to swallow the capsule or videos with significant recording technical malfunction were excluded. The cohort was divided into the younger group aged 65–79 years old and octa-nonagenarians aged ≥ 80 years old. Indications for referral, diagnostic yield and transit times were compared between groups.

Results: A total of 535 VCEs were performed in 499 older adult patients (51.2% males); 82.8% were 65–79 years old and 17.2% were ≥ 80 years old. The ≥ 80 -year-old group had higher rates of clinically significant findings (52.7% vs. 40.0%, $p = 0.025$), active bleeding (12.5% vs. 6.5%, $p = 0.053$) and angioectasia (36.0% vs. 23.4%, $p = 0.014$). Crohn's disease was newly diagnosed in approximately 8% of the entire cohort and 12% of the ≥ 80 years old. Anemia was the most common indication in both groups, followed by overt bleeding in the ≥ 80 -year-old group (25% vs. 9.9% in 65–79-year-old group, $p < 0.001$) and Crohn's disease in the 65–79 years old (17.2% vs. 5.4% in ≥ 80 years old, $p = 0.004$). Groups were comparable in transit time and cecal documentation rates.

Conclusions: In octa-nonagenarians, VCE is as safe as in younger older-adults with a higher diagnostic yield of significant and treatable conditions.

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[Correction added after first online publication on October 14, 2022. Figures 3 and 4 have been switched.]

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KEYWORDS

anemia, capsule endoscopy, Crohn's disease, gastrointestinal bleeding, older adults

INTRODUCTION

Video capsule endoscopy (VCE) is an effective noninvasive modality for investigating the small bowel (SB).¹ Common indications for VCE include investigation of obscure gastrointestinal (GI) bleeding, suspected or known Crohn's disease, celiac sprue, protein losing enteropathy, polyposis syndromes, SB abnormalities on imaging studies and otherwise unexplained SB symptoms.²

VCE is particularly attractive for the older adult population as it is easy to perform, noninvasive, does not require anesthesia and thus can be completed in an outpatient setup. Indeed, studies have shown good feasibility of VCE in patients ≥ 65 years old, and VCE utilization is constantly rising in this population.³⁻⁶ The diagnostic yield of VCE in patients >70 years old was shown to be higher than in the young adult population, with an impact on the clinical management in up to 85% of patients with positive findings.^{6,7} Some studies address the specific challenges in diagnosis of SB pathologies in older population (>70 years) such as increased transit times and newly diagnosed neoplasia.^{5,8,9} Following the rising life expectancy and aging of the population, the proportion of octa-nonenarians (≥ 80 years old) is growing. Being an "older adult" is not a biologic or physiologic characteristic but solely a chronologic one. Nevertheless, there is no one universally applicable definition or cutoff for the age of older adults. In most medical, legal and economical definitions, older adults are aged 65 years or older.¹⁰ The World Health Organization has defined two categories for the older adult age group: >65 years old and oldest-old (≥ 80).¹¹ In the year 2000 the percentage of the population aged >65 years was 18% and it is estimated that by 2050 it could reach 38 percent.¹² The aim of our study was to evaluate the safety and efficacy of SB investigation by VCE in octa-nonenarian (≥ 80 years old) compared to younger older adults (65–79 years old).

METHODS**Study population**

Data regarding all VCE studies of patients age ≥ 65 years performed in our center from 1/1/2010 to 31/12/2017 were collected retrospectively. Data retrieved included age, gender, cause of referral, completion of the study,

Key points

- Video capsule endoscopy (VCE) was safely performed in octa-nonenarians and 65–79 years old with similar transit times and very low complication rates.
- A higher diagnostic yield was observed in octa-nonenarians compared to the 65–79 years old, especially regarding diagnosis of active bleeding and angioectasia.
- Crohn's disease was newly diagnosed in approximately 8% of the entire cohort and 12% of the octa-nonenarians.

Why does this paper matter?

VCE was found to be both safe and effective in octa-nonenarians as in younger older-adults. This study can reassure the referring physicians encountering an older adult patient with a solid indication for VCE and capability to perform this simple ambulatory procedure.

quality of bowel preparation, transit times, adverse events, and findings. Patients referred for investigation of iron deficiency anemia or GI bleeding were scheduled for a VCE study only after negative upper and lower endoscopy studies as recommended by American gastroenterological association (AGA) guidelines¹³ and mandatorily required by local reimbursement protocols regardless of patient age. Although retrospectively collected, all data including VCE reports were prospectively documented. Patients unable to swallow the capsule were excluded, as were studies with significant recording technical malfunction. Patients with esophago-gastro-duodenoscopy (EGD) assisted insertion were included and the reason for EGD assisted insertion was noted. All studies were performed with SB PillCam capsules (GIVEN Imaging, Ltd., Yokneam, Israel). SB2 PillCam was used in all studies from 1st January 2010 until 1st May 2014 and SB3 PillCam was used thereafter until the end of the study (31st December 2017). Our bowel preparation protocol was based on low residue diet, liquid diet and a 12 h fast as instructed by the manufacturer. The study was approved by the local Institutional

Review Board (IRB number: 0198-18-TLV), data were anonymous and informed consent for participating in the study was waived. Nevertheless, all patient signed an informed consent form prior to performing the VCE study.

Primary and secondary outcomes

Primary outcome was defined as diagnostic yield of the study according to documentation of clinically significant findings. Clinically significant findings included active bleeding or oxygenated blood, erosions, ulcerations, angioectasias, polyps, masses, and submucosal lesions (a patient could have more than one significant finding on a single VCE). Clinically insignificant findings included small lymphangiectasia, Brunner gland hyperplasia, local redness, venous bleb etc. We also collected data regarding incidental VCE findings in the stomach and colon. Secondary outcomes were defined as transit times and safety of the procedure. A complete SB study was defined by cecum visualization. Failure to reach the cecum within the VCE recording time (average of 12 h) and subsequent interventions (i.e., abdominal X-ray, endoscopic/surgical capsule removal) were recorded and data of any adverse events were collected (hospitalization, surgery, death).

Statistical analysis

All statistical analyses were performed using SPSS version 25.0 for Windows (SPSS Inc., Chicago, IL). Continuous variables are presented as mean \pm SD, while categorical variables are presented as percentage. The independent samples *t*-test was performed to test differences in continuous variables between the two groups while the Pearson chi-square was performed to test the differences in categorical variables. Correlation was evaluated by the Pearson correlation coefficient. *p* value <0.05 was considered statistically significant for all analyses.

RESULTS

Study population

During the study period (2010–2017) we performed 547 VCEs in the older adults (≥ 65 years old), comprising 31.0% of 1765 consecutive studies performed in adults (age ≥ 18 years) during this time. Twelve VCEs (2.2%) were

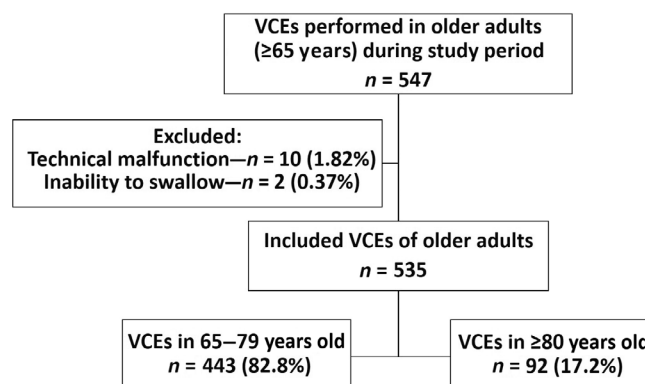


FIGURE 1 Study flowchart. VCE, video capsule endoscopy

excluded from analysis: two patients (0.4%) could not swallow the VCE (both were 73 years old), and in 10 cases (1.8%) there was a recording malfunction (nine patients were 65–79 years old and one patient was 83 years old). A total of 535 included VCE studies were performed in 499 older adult patients, 51.2% were males. Thirty-six patients (6.7%) performed the VCE twice within the study period with an average time span of 23.1 months between VCEs (range 1.05–85.7 months). The VCEs were carried out in 443 (82.8%) 65–79-year-old patients (median age 71 years) and 92 (17.2%) ≥ 80 -year-old patients (range 80–93 years, median 83 years) (Figure 1). The prevalence of male gender was comparable between groups (65–79 years old—52.1% vs. ≥ 80 years old—46.7%, $p = 0.345$) (Table 1). Three patients with two VCE studies crossed the age cutoff and therefore were included in both groups (patient 1—79 and 81 years; patient 2—79 and 83 years; patient 3—77 and 84 years).

Indications for VCE

The most common indication for referral was anemia/obscure occult GI bleeding (63.4%). This was the case in both age groups (65–79 years old—62.8% vs. ≥ 80 years old—66.3%, $p = 0.554$). However, the second most common indication, suspected or established Crohn's disease, was 3-fold more prevalent in the 65–79-year-old group compared to the ≥ 80 -year-old group [76/443 (17.2%) vs. 5/92 (5.4%), respectively, $p = 0.004$]. Most of these patients were referred for investigation of chronic diarrhea and suspected Crohn's disease (65–79 years old 66/76 (86.8%) vs. ≥ 80 years old 4/5 (80%), $p = 0.528$) while only 10 patients in the 65–79-year-old group and one patient in the ≥ 80 -year-old group were already diagnosed with Crohn's disease. The prevalence of obscure overt bleeding for investigation was 2.5-fold higher in the ≥ 80 -year-old group compared to

TABLE 1 Patients' characteristics

	Total (n = 535)	65–79 years old (n = 443)	≥80 years old (n = 92)	p value
Male gender, n (%)	274 (51.2)	231 (52.1)	43 (46.7)	0.345
Age (years)	73.4 ± 6.2	71.3 ± 4.1	83.8 ± 3.2	<0.001
Primary indication for VCE, n (%)				
Anemia	339 (63.4)	278 (62.8)	61 (66.3)	0.520
Overt bleeding	67 (12.5)	44 (9.9)	23 (25.0)	<0.001
Established/suspected Crohn's disease (chronic diarrhea)	81 (15.1)	76 (17.2)	5 (5.4)	0.004
Radiologic finding	16 (3.0)	15 (3.4)	1 (1.1)	0.239
Weight loss	11 (2.1)	10 (2.3)	1 (1.1)	0.472
Abdominal pain	21 (3.9)	20 (4.4)	1 (1.1)	0.123
Patency capsule, n (%)	20 (3.7)	18 (4.1)	2 (2.2)	0.385
Endoscopy assisted VCE Insertion	6 (1.1)	5 (1.1)	1 (1.1)	0.972

Abbreviation: VCE, video capsule endoscopy.

the 65–79-year-old group (25% vs. 9.9%, $p < 0.001$) (Table 1).

Completion rates and transit times

Complete SB endoscopy (i.e., cecal documentation within 12 h of recording on average) was achieved in 515/535 VCEs (96.3%). VCE completion rate was similar between the groups (65–79 years old—96.8% vs. ≥80 years old—93.5%, $p = 0.132$). Of the 20 incomplete VCEs, 15 were last documented in the SB (65–79 years old (2.3%) vs. ≥80 years old (5.4%) patients, $p = 0.154$) while 5 were last documented in the stomach (four patients—65–79 years old (0.9%) vs. one patient ≥80 years old (1.1%) patients, $p = 1.000$). Three (two patients—65–79 years old and one patient ≥80 years old) of the 15 patients with delayed SB passage had normal passage of a patency capsule prior to the VCE.

True capsule retention was rare. Video capsule was cleared in abdominal X-rays performed in 17/20 patients. Only one patient (0.2%) showed a retained capsule in the stomach on abdominal X-ray, necessitating EGD assisted removal of the capsule from the stomach, 28 days after the capsule swallowing, with no further adverse events. Two patients with delayed SB passage received verbal and written instructions to complete abdominal X-ray and return for follow-up, but did not return to our hospital, thus data regarding their X-ray findings and outcomes were not available for analysis. To our knowledge no patient required hospitalization or surgical intervention and no deaths were recorded.

Twenty patients (4.1% 65–79 years old vs. 2.2% ≥80 years old, $p = 0.385$) completed a successful patency

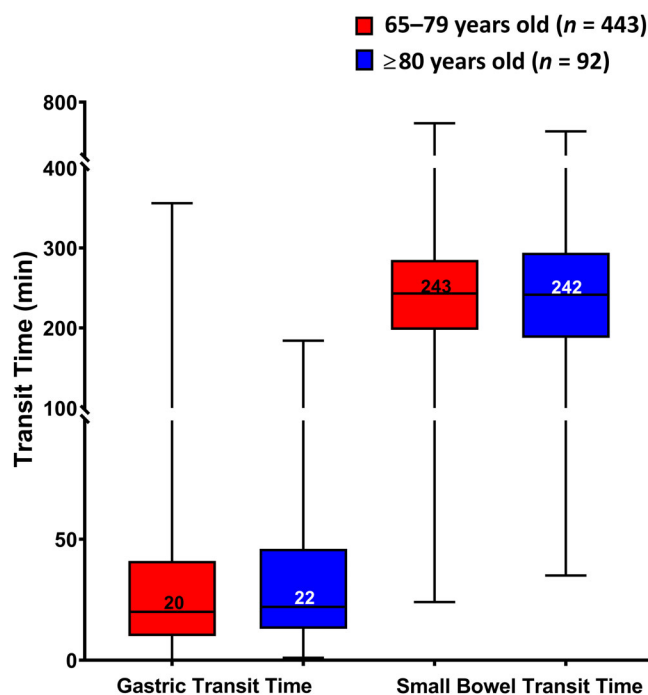


FIGURE 2 Transit times of video capsule in older adult patients ($p > 0.05$). Whiskers, min-max; box, 25%–75%; numbers in box, median

(dissolvable) capsule study prior to the VCE. Indications for patency capsule included suspected stricture (11 patients 65–79 years old vs. one patient ≥80 years old), known SB polyps/tumor (one patient 65–79 years old, one patient ≥80 years old) and prior intestinal surgery (six 65–79-year-old patients).

Gastric and SB transit times were comparable between the two groups (gastric: 65–79 years old 32.6

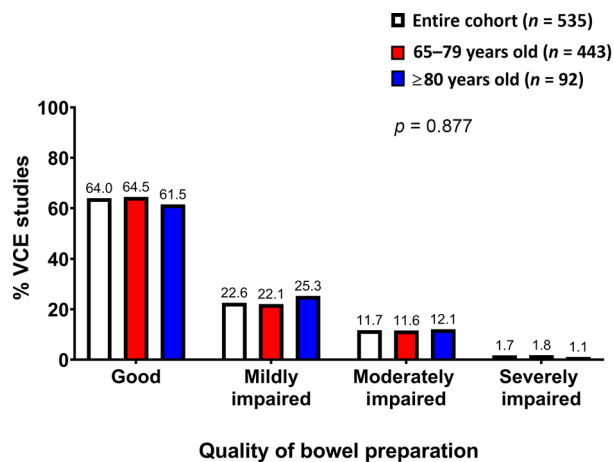


FIGURE 3 Quality of bowel preparation in older adult patients

± 37.1 vs. ≥ 80 years old: 33.8 ± 30.9 min, $p = 0.775$; SB: 65–79 years old 244.4 ± 84.9 vs. ≥ 80 years old 249.2 ± 94.9 min, $p = 0.635$) (Figure 2). In fact, there was no correlation between age in years and gastric transit time ($r = 0.014$, $p = 0.752$) or age in years and SB transit time ($r = 0.032$, $p = 0.465$).

The capsule was introduced into the SB via EGD in six patients (1.1%, five patients 65–79 years old and one patient ≥ 80 years old). Indications for EGD were as follows in 65–79-year-old group (one indication per patient): prior VCE with delayed gastric passage, large hiatus hernia, stricture of the hypopharynx after radiation therapy, previous pancreaticoduodenectomy, and previous gastric banding procedure. The indication for EGD of the ≥ 80 -year-old patient was not recorded.

The quality of preparation was satisfactory (good or mildly impaired) in more than 85% in both groups of patients (65–79 years old 86.6% vs. ≥ 80 years old 86.8%, $p = 0.949$) (Figure 3).

VCE findings

The prevalence of positive VCE studies (any findings) was higher among the ≥ 80 -year-old group compared to the 65–79-year-old group (67.0% vs. 51.5%, respectively, $p = 0.007$). Importantly, this was also the case for clinically significant findings (52.7% vs. 40.0%, $p = 0.025$). Bleeding or non-bleeding angioectasias were the most prevalent finding in both groups, but were more prevalent among ≥ 80 -year-old patients (36.0% vs. 23.4%, $p = 0.014$). Active bleeding on VCE was also observed more frequently in ≥ 80 -year-old patients compared to 65–79 years old (12.5% vs. 6.5%, $p = 0.053$). Of the 28 VCE studies demonstrating active bleeding in 65–79-year-old patients, four were related to ulcers/

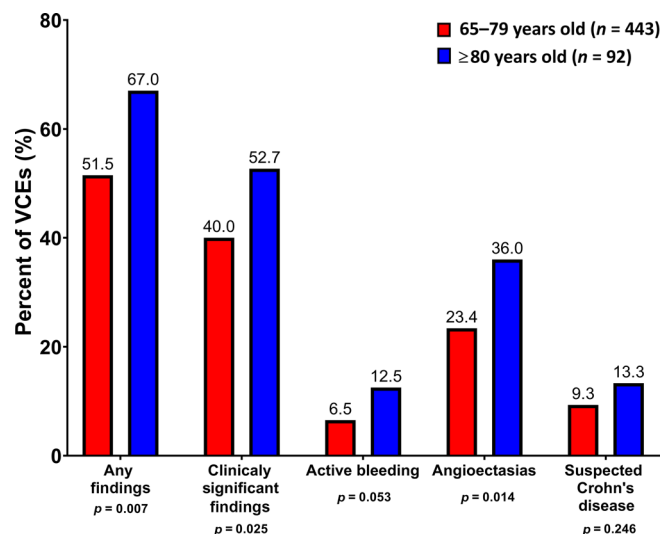


FIGURE 4 Video capsule endoscopy (VCE) findings in older adult patients

inflammation, one was attributed to parasitic infection and 23 were of unknown origin. In the ≥ 80 -year-old patients' group, one of 11 VCE studies with active bleeding was related to established Crohn's disease and 10 were obscure. In one obscure bleeding study performed in 81-year-old patient, fresh blood was observed in the colon, although colonoscopy performed 4 months earlier revealed only 2 tubular adenomas that were resected. Colonoscopy was repeated 1 month after VCE, and revealed a circular mass that was surgically resected and found to be a necrotizing adenocarcinoma. This patient has just celebrated his 90th birthday. Further details regarding the patients diagnosed with active bleeding (location, cause, outcome, etc.) can be found in Supplementary Table S1.

The prevalence of findings compatible with Crohn's disease (edema, erythema, typical ulcers, and strictures in the SB) was similar between groups (65–79 years old 9.3% vs. ≥ 80 years old 13.3%, $p = 0.246$) (Figure 4). Furthermore, findings suggestive of new onset older adults' Crohn's disease were documented in 45/535 patients (8.4%) and the prevalence was comparable between the older adults' subgroups [65–79 years old 34/443 (7.7%) vs. ≥ 80 years old 11/92 (12.0%), ($p = 0.213$)]. Extensive SB involvement (≥ 2 SB segments) was recorded in 62.2% of newly diagnosed patients, while 40% presented with medium to large diameter ulcers, suggestive of moderate to severe disease activity. Of the 45 newly diagnosed patients, follow-up records were available for 27 patients (60%). Half of these records disclosed new diagnoses of Crohn's disease (ICD-10-CM Diagnosis Code K50) and changes in treatment paradigm as a result of the VCE report.

Although VCE is designed to detect pathologies primarily in the SB, 8 (1.5%) older adult patients, all referred to VCE due to obscure GI bleeding, had a significant pathologic finding in the colon or the stomach. Three VCEs showed a suspicious colonic mass with active bleeding (all in 65–79-year-old patients). Three patients had fresh colonic bleeding of unknown origin, with normal or near normal SB study (two patients 65–79 years old and one patient ≥ 80 years old). One patient had colonic angiodysplasia and one had a suspected gastric mass, only one of the eight patients had a synchronous SB finding on VCE—a non-bleeding angioectasia. Endoscopic follow-up of these eight patients revealed a malignant mass of the right colon in four patients (one 75 years patient had two synchronous adenocarcinomas in the cecum and the ascending colon). The gastric mass was a large eroded hyperplastic polyp which was removed endoscopically. One patient had a normal ileocolonoscopy after suspected colonic bleeding, and two patients did not continue investigation.

DISCUSSION

VCE is performed for suspected SB pathology usually after negative upper and lower endoscopy.¹⁴ VCE is simple to perform and has a good safety profile and a high diagnostic yield. These parameters are especially important in the older adult population that often suffers from substantial comorbidities. Prior studies have demonstrated a higher yield of VCE in patients aged 75 years or more, compared to the younger population (40–74 years), especially for obscure GI bleeding.¹⁵ The diagnostic yield in even-younger patients (< 50) with iron deficiency anemia and negative bidirectional endoscopy was lower (32.3%).¹⁶

To our knowledge, this study is the first to characterize VCE performance in subgroups of older adult patients. Specifically, we compared octa-nonagenarians to younger older-adult populations to assess indications, quality of preparation, safety, and the diagnostic yield. Importantly, findings compatible with obscure overt GI bleeding (non-bleeding angioectasia and overt bleeding on VCE) were much more common in the ≥ 80 -year-old group suggesting a higher yield for VCE in investigating obscure GI bleeding in this population.

Indications for VCE in older adults differ from VCE indications among younger patients. A study from Greece showed that young patients (< 40 years) were mostly referred for evaluation of chronic diarrhea and suspected Crohn's disease (56.3%) while older adult patients (≥ 65 years) were referred mostly for evaluation of obscure GI bleeding (88.5%).¹⁷ This difference was

evident even within our cohort of older adult patient subgroups: obscure overt GI bleeding was 2.5 times more common among octa-nonagenarians than among younger older-adult patients ($p < 0.001$).

We did not find any difference in transit times between the 65–79-year-old patients and ≥ 80 -year-old patients, and no correlation was observed between age and transit times. Although the propagation velocity of phase 3 of the migrating motor complex (MMC3) is slower in older adults¹⁸ the patterns of motility and the transit times appear to be maintained in the SB with aging^{19,20} in keeping with our findings. The safety of the procedure was highly satisfactory, with only one of the 535 procedures performed (0.2%) resulting in true capsule retention in the stomach that was accessible for removal by EGD without any further adverse events. Only six patients required capsule insertion through EGD, mostly in the 65–79-year-old group and for abnormal anatomy and all EGDs were uneventful. According a 10-years study in a tertiary UK referral center, 50% of angioectasias were identified within the first 10% of SB transit time.²¹ In our cohort, although EGD and colonoscopy are mandatory prior to VCE, most lesions were proximal as well (see supplementary file). Nevertheless, the vast majority of procedures following the VCE were either push enteroscopy (performed with a colonoscope) or balloon-assisted enteroscopy. Thus, EGD alone prior to the VCE study would not be enough. However, perhaps more effort should be done made in the acute setting to reach a deeper endpoint, or VCE can be considered as first line in selected cases of occult bleeding in order to increase the pre-test probability of the upper endoscopy.

Crohn's disease's prevalence is rising in the older adult population, due to increase in incidence and in overall life expectancy.^{22,23} Yet, accumulating comorbidities such as diverticular disease, bowel ischemia, use of non-steroidal anti-inflammatory drugs (NSAID's), infectious and microscopic colitis, and other conditions that mimic inflammatory bowel disease, create a diagnostic challenge and might delay Crohn's disease diagnosis in older adult patients.²⁴ Chao et al. described newly diagnosed Crohn's disease by VCE in 8/197 (4.1%) older adult patients (age > 70 years) evaluated for any indication.²⁵ Looking at our entire cohort, 8.4% of VCE studies had SB findings compatible with newly diagnosed Crohn's disease. The prevalence of newly diagnosed Crohn's disease among ≥ 80 -year-old group was even higher, accounting for 12% of this age subgroup. This difference can be partially explained by the indications for VCE. Approximately 94.7% of VCEs were performed for obscure GI bleeding and 5.3% for abdominal symptoms in Chao's cohort, as opposed to 72.9% and 19.0% respectively in ours. We acknowledge the fact that the diagnosis of

Crohn's disease was based on video findings and not on histology and that there is a substantial differential diagnosis. However, more than half of the follow-up records we recovered demonstrated an adoption of the Crohn's disease diagnosis and initiation of appropriate treatment as a result of the VCE study findings. This finding stresses the importance of SB investigation for abdominal symptoms in older adults.

Guidelines for investigation of obscure GI bleeding state that VCE should follow negative upper and lower endoscopies.¹⁴ The new AGA guidelines¹³ emphasize that uncomplicated asymptomatic patients can be treated with iron supplementation over routine use of VCE; however, this is irrelevant to our older adults' cohort. Moreover, when discussing the necessity of a diagnostic procedure among older adults, the question of futility is pertinent. The most commonly cited definition for medical futility was published by Schneiderman et al.: "Physicians should distinguish between an effect which is limited to some part of the patient's body, and benefit which the patient has the capacity to appreciate and which improves the patient as a whole."²⁶ Moreover, the utility of a test or a study should not be assessed by health professionals alone but also by the patients and their families according to their preferences and priorities differing from one to another in terms of personal, cultural, and religious values. Thus, futility of VCE studies which are simple to perform and bear a highly safety profile should not be determined by the rate of ensuing treatments but on the diagnostic yield. It is also important to keep in mind that among the older adult population a negative study is as important and useful as a positive study. In a meta-analysis by Yung et al. the pooled rate of rebleeding after negative VCE was substantially lower than after positive VCE. Hence, negative VCE studies resulted in low risk of rebleeding and could be managed with close monitoring alone.²⁷

Another valuable outcome was the non-SB clinically significant findings. Surprisingly, we found that within 1–25 months from non-diagnostic colonoscopy, four patients were diagnosed with adenocarcinoma of the ascending colon and one had a bleeding hyperplastic polyp in the stomach. A previous study demonstrated significant colonic finding in 2.4% of SB-VCEs, of which 25% were the sole finding on VCE, with active bleeding and polyps constituting 46%.²⁸ Another study demonstrated significant gastric lesions in 19% of VCEs, mostly erosions and gastritis (58%) but also polyps and tumors in 9%.²⁹ A study in inpatients with melena or severe iron deficiency found that even after negative bidirectional endoscopy, VCE found significant gastric findings among 16.8% of patients and significant colonic findings among 12.6% of patients.³⁰ These studies along with our findings

emphasize the importance of reviewing the entire recording track of VCE to avoid missing significant lesions. In our cohort the gastric and colonic findings were the sole finding on VCE in 7/8 (88%) of these patients.

Our study has several limitations. We could not retrospectively assess the frailty score of our patients. There is no gold standard for diagnosing frailty and numerous frailty screening tools and scores were found valid^{31–33} mostly requiring clinical- and/or physical performance assessment. Our VCE service is a tertiary referral center, and the studies are performed by ambulatory patients who sign an obligatory informed consent form prior to the study. The entire cohort was capable of arriving at the clinic after appropriate preparation, to sign an informed consent form and to perform simple instructions at home for the rest of the day. All of this support the notion our cohort was rather fit and healthy as far as frailty assessment is concerned. Moreover, we could not recover sufficient data regarding previous endoscopies, yet, in patients too frail to undergo endoscopy for investigating and treating obscure GI bleeding, completion of a VCE study would be futile. Another limitation of a tertiary referral center is that most patients are referred through the "open access" approach. Therefore, data regarding further management of VCE findings might be incomplete or missing. However, the merit of VCE studies cannot be narrowed to ensuing invasive treatments alone but also to the reassurance of patients and physicians through negative studies, insignificant findings or non-accessible significant findings. Therefore, further treatments were not defined as a secondary outcome in the study. As for patient characteristics, it is possible that the ≥ 80 -year-old group have more comorbidities and/or medications taken on a regular base compared to the 65–79-year-old group and this could be one reason for the increased prevalence of significant findings. However, the purpose of the study was to evaluate the safety and efficacy of the VCE in this age group and not to investigate the etiology of the findings.

In conclusion, VCE is a safe and simple procedure with a high diagnostic yield, not limited by altered motility in older adult patients. The yield of VCE rises with age with no additional safety concerns. Moreover, due to the significant findings in the colon and stomach, we would suggest assuring high quality negative upper and lower endoscopy before VCE, but also reading the entire recording including the stomach and colon for unsuspected severe pathologies even though the algorithm of SB-VCE is designed for investigating only the SB.

AUTHOR CONTRIBUTIONS

Tamar Thurm: analysis and interpretation of the data; drafting of the article, final version improvement.

Nathan Gluck: critical revision of the article for important intellectual content, final version approval.

Orly Barak: critical revision of the article for important intellectual content, final version approval.

Liat Deutsch: conception and design; analysis and interpretation of the data; drafting of the article; critical revision of the article for important intellectual content; final version approval.

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The authors declare no funding was received for this study.

CONFLICT OF INTEREST

The corresponding author, Liat Deutsch, is consultant for “Given Imaging,” yet the company was not involved in the study in any way.

Authors Orly Barak, Nathan Gluck, and Tamar Thurm declare no Conflict of Interests for this article.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Supplementary Table S1 Characteristics of patients diagnosed with active bleeding in video capsule endoscopy (VCE) study and following outcomes

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