Original Research Article

Utility of video capsule endoscopy in clinical practice, experience at King Faisal Specialist Hospital and Research Center, Riyadh

Feras A. Aljemeli1*, Ahmed A. Alzead2, Saad Al Shareef3, Aymen Almuhaidh2, Mohammed Q. Khan2, Abdullah AlQaraawi2, Hamad I. Al-Ashgar2, Khalid Al-Kahtani2, Mohammed Al Quazz2, Fahad Alsohaibani2, Abdulrahman Alfaad2, Adnan Almahrouq2, Ayman A. Alharbi4, Abdullah AlQaraawi2

INTRODUCTION

Video capsule endoscopy (VCE) is a valuable diagnostic tool especially for evaluating the small intestine. Evidence shows that it is effective in the diagnosis gastrointestinal (GI) mucosal lesions that could be challenging to diagnose by imaging. VCE offers a noninvasive diagnostic option alternative to imaging for the evaluation of small intestine.
which used to be out of reach by endoscopists until recent years. Evidence shows that it is effective in the diagnosis of occult bleeding and superficial lesions that are not radiographically observed.\(^1,2\) Furthermore, passive movement of the capsule through gastrointestinal tract offers functional assessment capabilities.\(^3\)

Proximal and distal GI tract mucosa was accessed by endoscopists during early endoscopic evolution.\(^1\) Introduction of enteroscopy offered the ability to evaluate the proximal small intestine and more recently almost all the intestine.\(^5\) Recent literature proposed that VCE is more accurate than radiographic studies in the diagnosis of mucosal pathologies such as angiodysplasia.\(^3\) Furthermore, VCE have shown to be effective in the diagnoses of a broad list of indications.\(^4\)

VCE have been used initially in the diagnosis of obscure GI bleeding, more recent evidence has shown that its useful in the evaluation of inflammatory bowel disease, celiac disease and small bowel neoplasia as well.\(^5\) Obscure GI bleeding is defined as gastrointestinal bleeding after nonrevealing upper and lower endoscopies. Etiology of Obscure GI bleeding is likely related to pathology in small intestine, an area traditionally believed to be difficult to evaluate adequately.\(^6\) Prior to the introduction of VCE the standard procedure included endoscopic evaluation with upper and lower endoscopy with push enteroscopy, enterolysis, tagged red blood cell scan, angiography, and small bowel follow through studies.

VCE offers the ability to examine the entire mucosa of the small bowel by noninvasive means through high resolution images which makes it more effective for the evaluation of superficial lesions than imaging. It has been shown that VCE is safe and effective with relatively high diagnostic yield especially if the study is performed within one month of bleeding.\(^7,8\)

Differentiating between crohn’s disease and ulcerative colitis can be made by the exclusion of proximal GI involvement thus potentially improving treatment decisions.\(^9\)

In most patients suffering from crohn’s disease the small intestine is affected.\(^10\) VCE enables clinicians to adequately assess small intestine without procedure or sedation related risks that accompany endoscopy or radiation risks that accompany computed tomography.\(^2,4\) Furthermore, it has the ability to define the extent of the disease activity as well.\(^11,14\)

Small intestine neoplasia occurs in the majority of patients with familial adenomatous polyposis (FAP) and Peutz-Jeghers syndrome (PJS).\(^12\) In patients with FAP, no consensus have been made for the management of jejunal and ileal polyps likely related to the low incidence of adenocarcinoma in such locations, while in cases of PJS, management is more clearly defined as the risk is more evident and thus preemptive evaluation may deter emergency surgery or cancer. VCE have shown to be more effective than barium study for the evaluation of small intestine polyps in patients known to have hereditary polyposis syndromes.\(^13\) It can also localize large polyps thus making polypectomy by means of endoscopy more feasible.\(^14\)

Small intestine neoplasia has been traditionally known to be challenging to diagnose, more recent evidence has shown VCE to be helpful in the diagnosis of such lesions. In a retrospective chart review of 562 patients undergoing VCE for different indications, 8.9% were diagnosed with small-bowel tumor from which 48% were malignant.\(^15\) The option of noninvasive diagnostic test with high diagnostic yield will help in the early diagnosis of small bowel neoplasia and thus may affect clinical outcomes.

**METHODS**

This is a retrospective chart review, which was designed to evaluate the efficacy and safety of the capsule endoscopy in the diagnosis and management of the common gastrointestinal disorders. The database was formed after gathering the appropriate information from eligible patients, in whom Video Capsule Endoscopy (VCE) was performed at King Faisal Specialist Hospital and Research Center. This proposed study was conducted at King Faisal Specialist Hospital and Research Center (KFSH & RC) for a proposed period from November 2014 to December 2018. Capsule endoscopy videos were analyzed by the investigators including revisions of opinions from the treating physicians. Aljemeeli, Feras Abdulrahman, Ahmed A. Alzead were responsible for study planning, contributing in data collection, and providing communication and the logistical support needed for the study as well as data analysis at the end of the study. Adnan Almahrourq is the endoscopy unit coordinator at KFSH and RC, who formulated our study database and assisted in the data collection process. Al Shareef, Almuaidh, Khan, AIQaraawi, Al-Ashgar, Al-Kahtani, Al Quaiz, Alsohaibani, Alfadda, Alharbi, and AlKhdairi assisted in interpretation of VCE studies and contributed in the data collection process and data entry to electronic data collection sheet. Data analysis is performed using Statistical package for social sciences (SPSS) 26™.

Approval for the study was granted from Research Ethical Committee in KFSH&RC. All patients who underwent Video Capsule Endoscopy in KFSH&RC were included in our study. Exclusion criteria were as follows; Patients aged below 14 years, poor bowel preparation during procedure, technical defects in VCE recording, lack of distal small bowel recordings due to long gastric transient time, prolonged small bowel transient time causing lack of distal small intestine recordings. Endoscopy indications were divided into eight main categories as following; overt gastrointestinal (GI) bleeding, obscure gastrointestinal (GI) bleeding, occult GI bleeding, undiagnosed chronic abdominal pain, iron deficiency anemia of unknown
etiology, weight loss, diarrhea of unknown origin, and abdominal mass detected in CT abdomen.

The demographic characteristics (i.e., age, sex, height, weight, body mass index etc.), presentation, comorbidities, medication history, complications, capsule endoscopy findings and interventions following the diagnosis by the CE were evaluated. The VCE findings were classified into erosions, angiodysplasia, polyps, bleeding or non-bleeding ulcers, gastritis and/or duodenitis, scalloping of the mucosa, aphous ulcers, adenocarcinoma, carcinoid tumor, gastrointestinal stromal tumor, lymphomas, lymphangioma, lymphangiectasia, hemangioma, hamartoma, tubular adenomas. Following interventions include discontinuation of medications, surgery, further diagnostic studies, increasing dose or adding medications. We are presenting summary statistics for continuous data as mean ± SD (standard deviation) and for categorical data as percentages. We constructed 95 % confidence interval to summarize the uncertainties. In case we needed sub-graph analyses arises, a T-test, chi-square test. In all analyses we shall set the type I error rate at 5%, with an adjustment for multiplicity if needed. Subjects involved in our proposed study already did Video Capsule Endoscopy as part of their routine evaluation and were not contacted for follow up data related to the study. Data was collected from the study subject’s files, electronic charts as well as endoscopy software. Study subjects were identified serial numbers in this proposed study. All data already existed in medical records as a result of routine clinical practice and the included subjects were not contacted for any further investigation or follow up data related to this study.

RESULTS

A total of 326 candidates met the inclusion criteria and entered the study. These included 178 males and 139 females: mean age 54 (range 13-90 years).

Table 1: Demographic characteristics.

| Variable    | Category      | N   | Percentage | Mean |
|-------------|---------------|-----|------------|------|
| Age         | Less than 40 years | 89  | 27.3       |      |
|             | 40-less than 60 years | 80  | 24.5       | 54 years |
|             | 60-less than 70 years | 74  | 22.7       |      |
|             | 70 years or above | 81  | 24.8       |      |
|             | Total          | 324 | 99.4       |      |
| Height (cm) | Less than 150 cm | 29  | 8.9        | 162.45 cm |
|             | 150-less than 160 cm | 91  | 27.9       |      |
|             | 160-less than 170 cm | 102 | 31.3       |      |
|             | 170 cm or above | 87  | 26.7       |      |
|             | Total          | 309 | 94.8       |      |
| Weight (kg) | Less than 60 kg | 76  | 23.3       | 70.7 kg |
|             | 60-less than 70 kg | 79  | 24.2       |      |
|             | 70-less than 85 kg | 80  | 24.5       |      |
|             | 85 kg or above | 75  | 23.0       |      |
|             | Total          | 310 | 95.1       |      |
| Gender      | Meal           | 178 | 54.6       |      |
|             | Female         | 139 | 42.6       |      |
|             | Total          | 317 | 97.2       |      |

Table 2: Indications.

| History                                      | Category      | N   | Observed Prop. (%) |
|----------------------------------------------|---------------|-----|---------------------|
| Mass in computed tomography for abdomen      | No            | 318 | 97.8                |
|                                              | Yes           | 7   | 2.2                 |
| Occult gastrointestinal bleeding             | No            | 213 | 65.3                |
|                                              | Yes           | 113 | 34.6                |
| Weight loss                                  | No            | 304 | 93.8                |
|                                              | Yes           | 20  | 6.2                 |
| Obscure gastrointestinal bleeding            | No            | 219 | 67.4                |
|                                              | Yes           | 106 | 32.6                |
| Abdominal pain of uncertain origin           | No            | 270 | 83.1                |
|                                              | Yes           | 55  | 16.9                |
| Diarrhea of Unknown origin                   | No            | 301 | 92.6                |
|                                              | Yes           | 24  | 7.4                 |
The main indication for VCE was occult gastrointestinal bleeding with 113 cases (34.6% of total cases). Video capsule endoscopy was performed for small bowel gastrointestinal bleeding with 106 cases (32.6% of total cases).

Table 3: Bowel preparation

| Bowel preparation | N  | Percentage |
|-------------------|----|------------|
| Good              | 180| 57.3       |
| Fair              | 79 | 25.2       |
| Satisfactory      | 35 | 11.1       |
| Poor              | 20 | 6.4        |
| Total             | 314| 100.0      |

Bowel preparation was good in 180 cases (57.3%), fair in 79 cases (25.2%), satisfactory in 35 cases (11.1%) and poor in 20 cases (6.4%). The study was deemed as technically difficult in 30 cases (9.3%). Overall diagnostic yield was 36%, diagnostic yield was 64% and 41% for overt and occult gastrointestinal bleeding respectively. Capsule retention rate was observed in 11 cases (3.4%). Capsule retention was observed in 4 out of 18 (22.2%) patients diagnosed with crohn’s disease. (Table 3, 4)

The most common reported finding was angiodysplasia in 65 cases (19.9%), followed by ulcers in 45 cases (13.8%), followed by polyps in 27 cases (8.3%), followed by erosions in 26 cases (8%), followed by unidentifed bleeding site in 22 cases (6.7%), followed by unspecified erythema in 16 cases (4.9%), followed by gastritis and/or duodenitis in 12 cases (3.7%), followed by diverticulae in 8 cases (2.5%), followed by aphthous ulcers in 10 cases (3.1%), followed by scalloping of the mucosa in 4 cases (1.2%).

Table 5: Findings.

| Findings                  | Category | N    | Observed Prop. (%) | Exact Sig. (2-tailed) |
|---------------------------|----------|------|---------------------|-----------------------|
| No abnormality            | No       | 208  | 63.8                | <0.05                 |
|                           | Yes      | 118  | 36.2                | <0.05                 |
| Erosions                  | No       | 300  | 92.0                | <0.05                 |
|                           | Yes      | 26   | 8.0                 | <0.05                 |
| Angiodysplasia            | No       | 261  | 80.1                | <0.05                 |
|                           | Yes      | 65   | 19.9                | <0.05                 |
| Polyps                    | No       | 299  | 91.7                | <0.05                 |
|                           | Yes      | 27   | 8.3                 | <0.05                 |
| Non-Bleeding Ulcer        | No       | 292  | 89.6                | <0.05                 |
|                           | Yes      | 34   | 10.4                | <0.05                 |
| Bleeding Ulcer            | No       | 315  | 96.6                | <0.05                 |
|                           | Yes      | 11   | 3.4                 | <0.05                 |
| Gastritis/ duodenitis     | No       | 314  | 96.3                | <0.05                 |
|                           | Yes      | 12   | 3.7                 | <0.05                 |
| Scalloping of the mucosa  | No       | 322  | 98.8                | <0.05                 |
|                           | Yes      | 4    | 1.2                 | <0.05                 |
| Aphth Ulcers              | No       | 316  | 96.9                | <0.05                 |
|                           | Yes      | 10   | 3.1                 | <0.05                 |
| Adeno Ca                  | No       | 326  | 100.0               | <0.05                 |
|                           | Yes      | 0    | 0.0                 | <0.05                 |
| Carcinoid                 | No       | 324  | 99.4                | <0.05                 |
|                           | Yes      | 2    | 0.6                 | <0.05                 |
| GI stomal tumors          | No       | 323  | 99.1                | <0.05                 |
|                           | Yes      | 3    | 0.9                 | <0.05                 |
| Lymphoma                  | No       | 326  | 100.0               | <0.05                 |
|                           | Yes      | 0    | 0.0                 | <0.05                 |

Continued.
Similar incidence was documented with lymphangiectasia in 4 cases (1.2%). Short transient time of capsule passage was documented in 2 cases (0.6%). Carcinoid tumor was documented in 2 cases (0.8%). Only a single case (0.3%) was documented for hemangioma (Table 5, Figure 2).

In patients referred with gastrointestinal bleeding, the most common finding was angiodysplasia in 33 cases (22%), followed by ulcers with 22 cases (14%), followed by unidentified bleeding site with 17 cases (11%), followed by polyps with 13 cases (9%), and erosions with 13 cases (9%), followed by gastritis and/or duodenitis with 6 cases...
(4%), followed by unspecified erythema with 5 cases (3%), and Diverticulae 3 cases (2%). When subcategorized for patients younger than 30 years-old, the most common finding was erosions 14% followed by ulcers 12% followed by gastritis and or duodenitis in 8%. Ulcers was the most common finding in patients aged between 30-50 years-old 20.1%, followed by erosions and angiodysplasia with both having 10% frequency. The most common finding in patients aged more than 50 years was angiodysplasia in 29.1, followed by ulcers in 11.8%, followed by polyps in 9.7% (Table 6).

Figure 1: Indications for video capsule endoscopy.
DISCUSSION

VCE proved to be an essential diagnostic tool especially in the evaluation of GI bleeding. It offers less labor, higher resolution, safety, and noninvasiveness. On the other hand, it did not offer intervention capabilities as in double balloon enteroscopy and sometimes its interpretation was difficult and time consuming. A meta-analysis comparing the two modalities has shown that the diagnostic yields were similar.\textsuperscript{5,16} Moreover, it has been estimated that for every seventeen VCE, there is one double balloon enteroscopy referral.\textsuperscript{17}

Diagnostic yield in cases referred with gastrointestinal bleeding was 53\% including occult gastrointestinal bleeding and 56\% excluding occult gastrointestinal bleeding.
bleeding. Lepileur et al performed a similar retrospective chart review on 911 patients with negative upper and lower endoscopy from 2004 to 2010 and found that the diagnostic yield of VCE was 56%. Systemic review by Liao et al found that success rate of VCE was 60% with angiodysplasia being the most common finding. Findings indicate that VCE is effective in the diagnosis of GI bleeding.

Bowel preparation was good in 180 cases (57.3%), fair in 79 cases (25.2%), satisfactory in 35 cases (11.1%) and poor in 20 cases (6.4%). The study was deemed as technically difficult in 30 cases (9.3%). Two recent meta-analyses showed an improved diagnostic yield after a purgative preparation. However, more recent meta-analysis found that the use of bowel preparation improves mucosal visualization but it did not affect the diagnostic yield or completion of the study.

Often VCE was reported to be negative in our study. Our study was limited by its design to assess the negative predictive value of VCE. Based on previous literature, normal results on capsule endoscopy were reassuring. Based on two studies, 95.5% of patients with negative study results have no pathology on follow-up evaluation. However, Curdia did a study on 68 patients and found rebleeding was documented in 16 (23.5%) patients. The most common reported positive finding was Angiodysplasia in 65 cases (19.9%), followed by non-bleeding ulcers in 34 cases (10.4%), erosions in 26 cases (8%) and polyps in 27 cases (8.3%), followed by unidentified bleeding site in 22 cases (6.7%). These findings go with concordance with other similar studies. Otherwise, there were no major differences noticed among referrals with different indications.

The study design was appropriate in evaluating indications, diagnostic yield and complications of VCE. Limitations of our study included potential selection bias as a result of the study being conducted in single referral center. Our study will likely assist in recommendations related the VCE in our region.

CONCLUSION

Video capsule endoscopy proved to be an essential diagnostic tool in gastrointestinal bleeding. It gained a lot of popularity among gastroenterologist because of its less labor, higher resolution, relative safety, and noninvasiveness. On the other hand, it does not offer intervention capabilities when compared with enteroscopy and its interpretation was often difficult and time consuming. Risk of capsule retention remains significant especially in patients suffering from crohn’s disease.

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