Clinical Indications of Colonic Capsule Endoscopy

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Introduction

The PillCam Colon 2® capsule (Given Imaging Covidien GI Solutions) has been developed for the examination of the colonic mucosa, with a similar technology as that of endoscopic capsules used for the examination of the small bowel. The second version of this colonic capsule endoscopy (CCE) has been improved with various technical advances: a wider angle of view of 172° instead of 156°, which allows a better examination of the colonic mucosa, and a variable frame rate frequency that can vary between 4 and 35 frames per second, providing a better visualization of colonic segment where the capsule progresses rapidly, in particular in the transverse colon. In parallel with these technical advances in the capsule, the reading software provided by Given Imaging (Rapid Access 8®) has also been improved and includes a function to facilitate the estimation of polyp size as well as the possibility of FICE-type electronic coloration (Fujifilm Inc. Omiya, Japan), which highlights polyp structure and changes in vasculature, as in conventional colonoscopy.

Several clinical studies have been performed since 2009, collecting data mainly on the ability of the CCE to detect colonic polyps. The results of these studies indicate possible clinical indications of CCE, all of them remaining currently under evaluation.

1. Colo-rectal cancer screening

1) Comparative studies of CCE versus colonoscopy for the detection of colonic polyps

Comparative studies of CCE® are summarized in the Table 1. In average, the sensitivity and specificity of CCE were 87% and 79% for polyps ≥ 6mm and 89% and 92% for polyps ≥ 10mm respectively (1-4). In the North American study (3), sensitivity of PillCam Colon2® was 88% for adenomas ≥ 6 mm and 92% for adenomas ≥ 10 mm, with specificities of 82% and 95%, respectively. When the analysis was based on all polyps, including hyperplastic polyps and serrated polyps, the sensitivity was 81% for polyps ≥ 6 mm and 80% for polyps ≥ 10 mm, with specificities of 93% and 97%, respectively. This observation may reflect the difficulty for the capsule to identify flat lesions such as serrated adenomas. Moreover, in some of these studies, discrepancies between standard colonoscopy and CCE were largely attributed to difficulty to estimate the size of the polyps on CCE recordings. This could be overcome with an algorithm included in the reading software in the future but it still deserves accurate validation studies.
Table 1.

<table>
<thead>
<tr>
<th>Study</th>
<th>Polyps ≥ 6 mm</th>
<th>Polyps ≥ 10 mm</th>
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<tbody>
<tr>
<td></td>
<td>Sensitivity</td>
<td>Specificity</td>
</tr>
<tr>
<td>Eliakim et al. Endoscopy 2009</td>
<td>89%</td>
<td>76%</td>
</tr>
<tr>
<td>Spada et al. Gastrointest. Endosc. 2011</td>
<td>84%</td>
<td>64%</td>
</tr>
<tr>
<td>Rondonotti et al. Clin. Gastroenterol. Hepatol 2014</td>
<td>88%</td>
<td>84%</td>
</tr>
<tr>
<td>Rex et al. Gastrointest. Endosc. 2013</td>
<td>88%</td>
<td>93%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>87%</td>
<td>79%</td>
</tr>
</tbody>
</table>

The results of studies comparing standard colonoscopy and CCE show a good sensitivity and specificity of CCE to detect polyps of any size. However, most of these studies were not undertaken in screening populations only. In some studies, the discordant cases were between capsule endoscopy and colonoscopy were reassessed retrospectively by a panel of experts. This may have contributed to the improvement in results and on the other hand, the specificity reported by some studies with PillCam Colon2, the most recent generation of CCE reported a large number of CCE false positive cases for polyps ≥ 6mm that were not identified during colonoscopy.

2) CCE as filter of indications of colonoscopy

In daily practice, a large number of colonoscopies show negative results, including during screening for colo-rectal cancer (5). On the other hand, some subjects might be reluctant to perform a colonoscopy for screening purpose and miss the opportunity of the screening. CCE could then be an alternative to colonoscopy. A first study tested this hypothesis (6). The positive predictive value of CCE to indicate a colonoscopy was 88% and the negative predictive value 76%, the latter being reduced by 8 false negatives with the CCE. Moreover, patient recruitment was not strictly that of a screening in the general population, as many patients with digestive symptoms or a high risk of polyps were included. In a recent study, 62 patients with a positive immunoassay for detection of blood in the stool were examined by CCE and colonoscopy in the next day (7). The positive predictive value of CCE was 79%, and the negative predictive value, 90%. These two studies suggest that CCE could be used as a filter of colonoscopy indications, reducing the number of negative colonoscopies. The influence on healthcare costs must be evaluated by medico-economic studies.

2. CCE in patients with previously failed of incomplete colonoscopy

The rate of caecal intubation during routine and screening colonoscopies is expected to be as high as 90% but in daily life, the actual caecal intubation rate is often suboptimal (8,9). On the other hand, caecal intubation is associated with an increased detection rate of advanced neoplasia, as 33-50% of advanced neoplasia are located in the proximal colon (10). After an incomplete optical colonoscopy, patients are required to undergo another test in order to exclude clinically relevant lesions and to reduce the risk of proximal cancer. Several studies have shown that CCE is able to visualize the colonic segments non investigated during a previously incomplete colonoscopy and the additional diagnostic yield of significant lesions ranged between 23 and 44% (11-15). One study (14) compared CCE with computed colonography and concluded to a comparable efficacy of the two techniques to evaluate the previously non-investigated colonic segments but the diagnostic yield of CCE was
superior to that of computed colonography, especially for flat and small lesions. Data available in the literature suggest that CCE is an effective examination for patients with previously incomplete colonoscopy and that it should be considered as a first-choice technique in such setting.

3. CCE for surveillance of patients with ulcerative colitis

A few recent studies have evaluated the feasibility of examining the colon by CCE in patients with ulcerative colitis (16-19). Compared with colonoscopy CCE had a good sensitivity and positive predictive value to detect the presence of inflammatory lesions of the colonic mucosa. In other studies, the concordance was evaluated to determine the endoscopic level of severity and the assessment of the extent of lesions. However, these studies included a limited number of patients and mainly evaluated inflammatory changes of the colonic mucosa. In clinical practice, CCE could find indications in patients with ulcerative colitis mainly during surveillance and in this setting, the screening for dysplastic lesions is of utmost importance. The capability of CCE to detect such lesions will need accurate and cautious studies but CCE could be regarded as a less invasive modality in these patients.

Conclusion

Clinical studies evaluating CCE have shown that it is effective to detect polyps and other significant lesions in the colon. The well validated indication of CCE is currently the investigation of patients with a previously failed or incomplete colonoscopy. This indication has recently been validated by the FDA in the USA. In the future, CCE could become a useful tool for screening of colorectal cancer, as an alternative to standard colonoscopy. The efficacy of CCE in this setting must further be evaluated in actual screening programmes and the influence on healthcare costs has to be determined.

References