

Characteristics of Patients with a Retained Wireless Capsule Endoscope (WCE) Necessitating Laparotomy for Removal of the Capsule

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Abstract. *Aim: A capsule endoscope is a wireless miniature camera used to take images of the small bowel mucosa. Retention of the wireless capsule endoscope (WCE), defined as at least two weeks' retention or an obstruction demanding removal by laparotomy, is the main and practically only complication of the procedure. The aim of this study was to evaluate the characteristics of patients with a retained WCE necessitating laparotomy for removal of the capsule or capsule fragments. Patients and Methods: The medical records of 555 patients who had undergone the WCE procedure over a 7-year period (2002-2008) were reviewed. The indications for the WCE procedure were, obscure gastrointestinal bleeding, Crohn's disease, abdominal pain and suspicion of malignancy. Results: A retained WCE requiring operative treatment was found in 10 cases (in nine patients, twice in one patient). The WCE retention frequency of 1.8% (10/555) equalled that in the literature. Conclusion: The retention rate of WCE capsules is low and routine examination of the small bowel with MRI or CT is not necessary before WCE. These examinations were able to predict WCE retention according to our results.*

As an addition to traditional flexible and rigid endoscopes, the concept of wireless capsule endoscopy (WCE) was first introduced in 1999 by Iddan *et al.* (1) and WCE has become accepted as the standard in patients with obscure gastrointestinal (GI) bleeding after negative endoscopies.

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WCE represents fundamental progress in non-invasive imaging of the GI tract, particularly the small intestine, associated with efficacy, the obviation of need for open surgery and favourable diagnostic accuracy (2, 3, 4). Most WCE examinations are carried out for obscure GI bleeding after negative endoscopies and to diagnose suspected Crohn's disease and its response to modern medical treatment.

The WCE retention defined as at least two weeks' retention or an obstruction demanding an operation in the small bowel is the most frequent complication of capsule endoscopic procedure. Aspiration of the capsule with accompanying dyspnoea and hypoxia is another reported complication, which necessitates retrieval by way of bronchoscopy. In everyday practice, the overall incidence of WCE retention is estimated to be rather low (1-2%), but the real frequency remains poorly defined (4, 5). The present retrospective study was undertaken to evaluate the characteristics of the patients with a retained WCE necessitating laparotomy for removal.

Patients and Methods

The medical records of all WCE (Given, Given Imaging Ltd, Yotneam, Israel) procedures between January 2002 and December 2008 in Kuopio University Hospital were reviewed. All the WCE procedures were carried out in Kuopio University hospital, which is a referral centre for four Central Hospitals (Joensuu, Jyväskylä, Mikkeli and Savonlinna) and two District Hospitals (Iisalmi and Varkaus).

In preparation for WCE, a 12-hour fast was required, after which a single smooth plastic capsule was swallowed with water. Bowel preparations and prokinetic drug usage to improve the visualization and rate of capsule passage are currently under discussion, and were inconsistently applied. The patients were allowed to ingest clear liquids two hours after intake of the capsule and were allowed to eat a very light meal after four hours. As the capsule travels from the mouth to the anus by peristalsis, the patient was free to conduct his or her daily activities.

Table I. Characteristics of patients with WCE retention necessitating laparotomy for removal of the capsule.

No. of patient	Age	Gender	Indication for WCE	Cause of WCE	Site of retention	Previous surgery	Previous radio therapy	Previous enterography
1* A	74	F	Anemia,	Crohn	?	-	-	-
1 B			activity of Crohn	Crohn	?	1	-	-
2	69	F	Anemia	NSAID - enteropathy	Jejunioleal	-	-	Normal
3	76	F	Obstructive symptoms	Radiation induced stricture	Ileum	1	Yes	Normal
4	65	F	Anemia	Metastatic tumors	Ileum	1	-	-
5	62	F	Anemia	Tumor carcinoides	Ileum	-	-	Distal ileitis
6	45	F	Activity of Crohn	Crohn		-	-	Normal
7	60	M	Anemia	Crohn	Jejunum	4	-	-
8	39	M	Activity of Crohn	Crohn	Ileocolic anastomosis	3	-	-
9	31	M	Crohn suspicion	Crohn	Jejunioleal	-	-	Crohn suspicion

WCE: Wireless capsule endoscope; *WCE retention twice in same patient.

Results

The capsule retention rate was 1.8% (10/555). Three patients with capsule retention were male and six female, and retention occurred twice in one patient (Table I). The mean age (SD, range) was 57.9 years (19.9 years, 31-76 years). Five out of the ten capsule endoscopies were conducted for anaemia and 4/10 for Crohn's disease. Out of the total of 555 patients, anaemia (47.2%) and Crohn's disease or its suspicion (45.0%) were the main indications. When Crohn's disease activity was to be clarified, capsule retention occurred in 3 out of 41 examinations (7.3%).

Stricture localization if mentioned (8/10) was in the distal ileum. Twice a neoplasia and once a strictured ileocolic anastomosis were involved. Three out of the nine patients had strictures in the jejunal section. Five patients had undergone abdominal operations in the past, one patient had undergone three and another patient four operations altogether. Only one patient had a radiation-induced stricture. One patient had both pyloric stenosis and 16 strictures in the jejunioleal region suggesting nonsteroidal anti-inflammatory drug (NSAID) – enteropathy (Table I).

Previous computed tomography (CT)-enterography had been carried out in four cases and one magnetic resonance impedance (MRI)-enterography. They were considered normal in three patients.

Crohn's disease caused the retention in six out of the ten incidents. Two new cases of Crohn's disease and two

malignancies were found among these nine operated patients. To date, no endocapsules have been extracted with an endoscope in our hospital.

Discussion

WCE imaging was approved in 2001 by the FDA for the evaluation of occult GI bleeding and chronic unexplained GI blood loss. Since then, the use of WCE has been extended to the evaluation of Crohn's disease and its response to medical treatment, suspicion of malignancy or tumour recurrence, surveillance of inherited polyposis syndromes, celiac disease, NSAID-enteropathy, anaemia and unexplained chronic abdominal pain.

In agreement with previous reports, the present study revealed a low WCE retention rate, and in the literature, the WCE retention rates are 0% for healthy volunteers (6), 0-6.2% for obscure GI bleeding (4, 7), 4-8% in patients with diagnosed Crohn's disease (4, 8), 0-5% in patients with suspected Crohn's disease (4, 9), and 2.5-5% in patients with hereditary familial polyposis syndromes (4, 10); from all indications, incidence ranged from 0% to 10% depending on the patient selection and the design of the study performed (4, 7, 10, 11). WCE retention has also been reported rarely in both Meckel's diverticulum (12) and Zenker's diverticulum (13). A total of 11 reports (14, 16-25) of 74 capsule retentions necessitating laparotomy for removal were found in the literature (Table II).

Table II. Previous reports of WCE retention necessitating laparotomy for removal of the capsule or capsule fragments.

Author (ref)	Perioperative status					
	Malignancy	Crohn	NSAID-enteropathy	Postradiation/postoperative stenosis	Tuberculosis	Ischaemia
Enns <i>et al</i> . 2004 (17)	NA	NA	NA	NA	NA	NA
Fry <i>et al</i> . 2005 (18)	-	-	1	-	-	-
Rondonotti <i>et al</i> . 2005 (19)	3	5	2	3	-	1
Baichi <i>et al</i> . 2006 (20)	1	2	?	1	-	-
Cheifetz and Lewis 2006 (21)	1	7	1	1	-	-
Magdeburg <i>et al</i> . 2006 (22)	-	1	-	-	-	-
Agaba <i>et al</i> . 2007 (23)	2	?	?	1	-	-
Bai <i>et al</i> . 2007 (24)	-	1	-	-	-	-
Cheon <i>et al</i> . 2007 (14)	4	16	1	2	3	-
Li <i>et al</i> . 2008 (16)	2	-	11	-	-	-
Kelley and Lohr 2009 (25)	-	-	-	1	-	-
Total 74 (%)	13 (18%)	32 (44.5%)	16 (20.5%)	9 (12%)	3 (3.6%)	1 (1.2%)

NA: Not available.

Once a wireless capsule is retained, conservative, endoscopic or surgical intervention resolves the complication. In the majority of cases, WCE retention runs asymptotically and a symptomless WCE retention may be followed by plain x-ray radiography when waiting for a spontaneous passage. A 'wait and see strategy' is often followed, especially in cases where WCE retention occurs in the distal small bowel or non endoscopically-accessible area. In some such cases, the use of a double-balloon enteroscope has proved valuable (4, 15). Where inflammation was the cause of obstruction, as in inflammatory bowel disease, steroid therapy resulted in spontaneous capsule passage in about half of these cases (11).

Patients with obstructive symptoms need more strict follow-up and when the WCE retention causes pain, surgical intervention should be prompt. When surgical intervention is unavoidable, a previous history of radiation therapy or abdominal operation suggests a benign stricture. The possibility of a malignancy should be considered, while in Western countries, intestinal tuberculosis, accounting for 9.4% in Korean material (14), can usually be excluded.

NSAID enteropathy, also known as diaphragm disease, although found in 11 out of 14 American patients, is seldom reported and is difficult to find in enterography because these diaphragmatic strictures are usually thin and resemble exaggerated *plicae circularis*. Diagnosis is best achieved by comparison of the microscopical findings of nonspecific inflammatory changes with anamnesis of NSAID usage.

In conclusion, the WCE retention rate is low and the routine examination of the small bowel with MRI or CT is not necessary before WCE. These examinations were unable to predict a WCE retention according to our results.

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