COMPARISON OF THE DIAGNOSTIC VALUE OF CAPSULE ENDOSCOPY IN TWO POSITIONS FOR ESOPHAGEAL LESIONS IN THE ELDERLY

YU YAJING[1], ZHANG SHIZHEN[1], XIANG XUELIAN[2], TU LING[1], XIE XIAOPING[2*], CHENG JINGPING[3*]
[1]School of Medicine, Wuhan University of Science and Technology - [2]Department of Gastroenterology, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology - [3]Department of Geriatrics,Huarun WISCO General Hospital Affiliated to Wuhan University of Science and Technology

ABSTRACT

Objective: *To investigate the diagnostic value of capsule endoscopy in recumbent position and upright position for esophageal lesions in the elderly.*

Methods: *Clinical data of 180 elderly patients undergoing magnetic control capsule endoscopy (MCCE) in the digestive endoscopy center of our hospital were retrospectively analyzed. Statistical analysis was made on time for MCCE to pass through esophagus, dentate line visibility, esophageal lesion detection rate and safety under capsule endoscopy in recumbent position and upright position. Comparison was made on the diagnostic value and safety of capsule endoscopy in the two positions for esophageal lesions.*

Results: *The time for MCCE to pass through the esophagus was significantly higher in the recumbent position group than in the upright position group (87.1±6.62 seconds vs. 16.15±4.66, P<0.005). The dentate line detection rate was significantly higher in the recumbent position group than in the upright position group (62.2% vs 33.3%, P<0.001). The positive lesion detection rate was superior in the recumbent position group compared with the upright position group (37% vs 12%, P = 0.001). All examinees had no capsule retention.*

Conclusion: *The recumbent position group has higher detection rate of esophageal lesions than the upright position group. The result can be extended to capsule endoscopy of general population, which is beneficial to improve the detection rate of esophageal lesions.*

Keywords: *Position, capsule endoscopy, elderly, esophageal disease, diagnosis.*

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Introduction

Since 2001, capsule endoscopy has been extensively applied in the diagnosis of gastrointestinal diseases[1-7], and its non-invasive examination method features advantages of easy subject tolerance, safety and efficiency, which is favored by more and more physical examination people, people intolerant of traditional gastroscopy or with severe cardiopulmonary dysfunction. Capsule endoscopic esophageal visual examination, i.e. Esophageal capsule endoscopy (ECE), was approved by the FDA for clinical use in 2004[8]. Although esophageal capsule endoscopy has been proven as a viable and safe alternative diagnosis of esophageal disease, due to passive movement of ECE through the esophagus and rapid passage, it is difficult to observe the important anatomical region of the esophagogastric junction[9]. Accordingly, it has relatively low diagnostic accuracy and is thus restricted to the first-line diagnosis tool for esophageal diseases. Recent years witness the birth of a new technology, the Magnetic Control Capsule Endoscopy (MCE). Studies by Lien GS[10] and Parker CE[11] confirmed the safety and feasibility of MCE examination for the upper digestive tract including the esophagus, stomach and duodenum. Liao Zhuan[12] and Wang Ao[13] found that separate magnetic control capsule endoscopy (DS-MCE) also has certain ability to screen and diagnose esophageal diseases.

Capsule endoscopy gradually evolves from the initial detection of portal hypertensive enteropathy to the field of full digestive tract including esophagus. Therefore, the diagnostic ability of capsule en-

doscopy for esophageal diseases is gaining more and more attention in the hope that development is possible from procedures and preparation techniques[11]. At the same time, in clinical practice, the swallowing position in capsule endoscopy has not been clearly defined[14], the observation effect of esophagus, the detection rate of esophageal lesions and the safety of crowd inspection in the elderly are unclear for the two swallowing positions: recumbent and upright position. Therefore, we retrospectively analyzed the clinical data of the elderly population undergoing endoscopic examination in endoscopic center of our hospital, with a view to investigating the appropriate position with higher detection rate of esophageal lesions during capsule endoscopy.

Materials and methods

General data

Elderly patients undergoing capsule endoscopy at the Digestive Endoscopy Center of Wuhan Union Hospital from January 2017 to May 2019 were enrolled in this study.

Inclusion criteria:

• Those with symptoms of digestive tract discomfort and those requiring capsule endoscopy.

Exclusion criteria:

• Those equipped with cardiac pacemakers or those prone to the risk of magnetic resonance imaging (MRI);

• Those with known or suspected gastrointestinal obstruction, stenosis and fistula;

• Those with dysphagia;

• Those with mental illness;

• Those with uncontrollable high blood pressure;

• Those with severe heart, lung, liver and kidney dysfunction.

A total of 180 elderly patients aged 60-80 years were enrolled, including 93 males and 87 females with an average age of 69.5±2.59 years. The examinees had symptoms such as abdominal pain, abdominal distension, acid reflux, heartburn, nausea, vomiting and blood in the stool. The patients were divided into recumbent position group (90 cases) and upright position group (90 cases) by random number table method. The detection rate and safety of esophageal lesions were compared between the two positions for capsule swallowing. This study has been approved by the ethics committee of our hospital. The subjects have been fully informed and signed informed consent before gastroscopy.

Pre-examination preparation and examination protocol

Before the examination, the doctor instructed the patient to make gastric preparation: one day before the examination, quit alcohol and tobacco, avoid spicy and non-digestible foods, eat fruits and vegetables after peeling, take light white rice porridge and noodles. Keep fasting after 8:00 one day before examination, avoid drinking any colored liquid, such as tea, cola, milk, soup, yogurt, coffee, etc., drink 500ml after an hour of dinner, drink 500-800ml after getting up. On the day of the examination, take oral simethicone 1 hour before the examination to remove mucus and air bubbles in the esophagus, drink 800-1000 ml of water to fill the stomach cavity 30 minutes before the examination. The capsule endoscopy system adopted by the center was magnetic control capsule endoscope system (MCE) developed and produced by Shanghai Anhan Medical Technology Co., Ltd. and Anhan Optoelectronic Technology (Wuhan) Co., Ltd. Subjects received 3-5 times of water swallowing training according to position, swallowing 10 ml water each time. Formal examination should be performed after confirming mastery of swallowing act with no discomfort. The endoscope camera end was placed in the patient's mouth toward the pharynx. The capsule endoscope was swallowed with the aid of 15 ml water. The position at capsule swallowing was always maintained during the patient examination, and the magnetic control system was not used during the examination. Whether the subject was uncomfortable was recorded amid examination. Capsule discharge was probed via reading film analysis, telephone follow-up or face-to-face follow-up after the examination was over. MCE operations were performed by the same physician.

Observation indicators

• Dentate line observation effect: the visibility of the dentate line and the discovery rate in 50% visible range of the dentate line

• The time for capsule endoscope to pass through the esophagus: defined as the time difference between the first-frame esophageal image and the first-frame stomach image.

• Detection of esophageal lesions: including esophageal erosion, esophageal ulcer, esophageal flat bulge, esophageal and gastric mucosa ectopia, esophageal polyps and other lesions detected.

• Examination tolerance and safety analysis: adverse events during the examination and capsule discharge rate.

Statistical methods

The data was analyzed using SPSS 21.0 statistical software. The measurement data in normal distribution is expressed as x±s, and t test is used for comparison; the count data is expressed in numbers and percentages, and the χ^2 test is used for comparison. P<0.05 indicates statistical significance.

Results

Baseline data comparison:

A total of 180 patients were included in the study, 90 patients in each group. The indications included 68 cases of acid reflux and heartburn, 30 cases of nausea and vomiting, 22 cases of gastrointestinal bleeding, 29 cases of abdominal pain, 19 cases of abdominal distension, and 14 cases of feeding obstruction. There was no statistically significant difference in gender composition, age and capsule endoscopy indications between the two groups (Table 1).

Item	Recumbent position group (n=90)	Upright position group (n=90)	P value
Male (%)	47 (52.2%)	46 (51.1%)	0.69
Female (%)	43 (47.8)	44 (48.9%)	
Age (years)	69.9±2.58	69.2±2.59	0.84
Indications for the examination			
Feeding obstruction (%)	37(41.1%)	31 (34.4%)	
Acid reflux and heartburn (%)	15 (16.7%)	15 (16.7%)	
Nausea and vomiting (%)	10 (11.1%)	10 (11.1%)	0.99
Unexplained Gastrointestinal bleeding (%)	13 (14.4%)	16 (17.8%)	
Abdominal pain (%)	9 (10%)	10 (11.1%)	
Abdominal distention (%)	6 (6.7%)	8 (8.9%)	

Table. 1: Comparison of baseline data of 180 elderly patients.

Dentate line observation effect:

The recumbent position group had higher visibility than upright position group (62.2% vs. 33.3%), with statistically significant difference (P< 0.001). The recumbent position group has higher discovery rate in 50% visual range of dentate line compared with the upright position group (44.4% vs 21.1%), with statistically significant difference (P=0.001).

Time for capsule endoscope to pass through the esophagus:

The recumbent position group required (87.1±6.62) seconds for capsule endoscope to pass through the esophagus, which was longer than that of (16.15±4.66) seconds in the upright position group. The difference was statistically significant (P= 0.004).

Detection of esophageal lesions:

The recumbent position group had higher detection rate of esophageal lesions than the upright position group in overall (37% vs 12%, P=0.001). A total of 33 lesions were found in 90 subjects in the recumbent position group, including esophageal erosion (n=16), flat bulge (n=9), ectopic gastric mucosa in lower esophagus (n=4), esophageal ulcer (n= 4).

A total of 11 lesions were found in 90 subjects in the upright position group, including esophageal erosion (n=5), flat bulge (n=3), ectopic gastric mucosa in lower esophagus (n=1), esophageal ulcer (n= 2). The recumbent position group had higher detection rates of esophageal lesions than the upright position group, which was 17.8% vs 5.6%, 10% vs 3.5%, 4.4%vs 1.1%, and 4.4% vs 2.2%. For the detection rate of esophageal erosion, difference was statistically significant (P = 0.011).

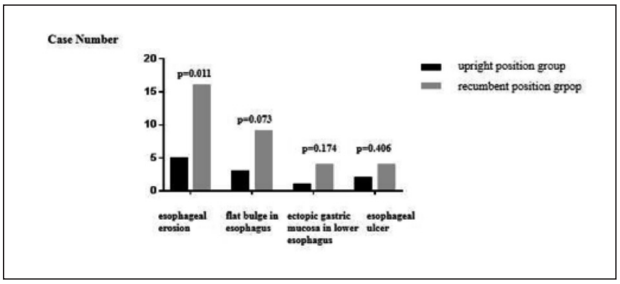

Figure 1: Detection of esophageal lesions.

A typical image of specific esophageal lesion is shown in Figure 2.

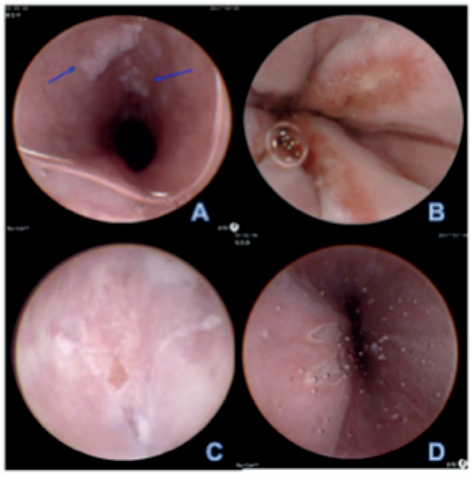

Figure 2: Typical picture of esophageal lesions.
Note: A white flat bulge in esophagus. B esophageal erosion. C ectopic gastric mucosa in lower esophagus D esophageal ulcer.

Examination tolerance and safety analysis:

• All patients completed the MCCE examination.

• There was no statistically significant difference in the adverse reaction events between the recumbent position group and the upright position group during the examination (P=0.225). See Table 2 for details.

• All subjects successfully discharged the capsule within two weeks without capsule retention.

Adverse events	Recumbent position group	Upright position group	P value
Nausea and vomiting	5	3	
Chocking	3	3	0.225
Swallowing discomfort	3	1	

Table. 2: Number of adverse events in different position groups for swallowing of capsule endoscope.

Discussion

In this study, the elderly undergoing MCE examination were randomly divided according to different swallowing ways: recumbent position and upright position. It was found that the recumbent position group required (87.1±6.62) seconds for capsule endoscope to pass through the esophagus, which was longer than that of (16.15±4.66) seconds in the upright position group. The difference was statistically significant (P= 0.004). The result was consistent with Cao Weipeng [15]: the time for capsule endoscope to pass through the esophagus was longer in the recumbent position group than in the upright position group.

In this study, the recumbent position group had higher discovery rate in 50% visual range of dentate line compared with the upright position group (44.4% vs 21.1%), with statistically significant difference (P=0.001). The 62.2% visibility of dentate line in the recumbent position group was consistent with 67% visibility of the dentate line in the recumbent position in the Fernandez's study[16]. However, the 33.3% visibility of dentate line in the upright position group was higher than 15.8% visibility of dentate line in the upright position group in Fernandez's study[16]. The difference was not statistically significant (P>0.05), which may be related to the difference in the number of enrolled cases. In this study, the visibility of dentate line in the recumbent position group was 62.2% (56/90), which was higher than (33.3%, 30/90) of upright position group. The difference was statistically significant (P <0.001).

In this study, the index of discovery rate in 50% visual range of dentate line was selected because larger visual range of the dentate line is more favorable for discovery of lesion. The reason for different visibility of the dentate line under different postures may be that the capsule endoscope passes through the esophagus under the action of gravity and esophageal creeping force in the case of upright position, while the capsule endoscope passes through the distal end of esophagus under the action of merely esophageal creeping force in the case of upright position. As a result, in recumbent position, capsule moves slower, capsule endoscope requires longer time to pass through the esophagus, the esophageal mucosa exposure time is extended, more images in higher quality can be collected, leading to higher discovery rate of dentate line. Therefore, in summary, the recumbent position group can prolong the time for capsule endoscope to pass through the esophagus, and the dentate line has higher visibility.

In this study, the overall detection rate of MCE for esophageal lesions was 24.4%, which was higher than 13.1% in Wang Ao's study [13], and similar to 24.6% overall detection rate in Gao Yulan's study[17]. For specific lesions, the overall detection rate of esophageal erosion and esophageal ulcer in this study was 15.0%, which was similar to 18.9% detection rate of esophagitis in Gao Yulan's study[17], and 12.2% detection rate of esophagitis in Wang Haihong's study[18]. Both suggest that capsule endoscopy has certain ability to screen and diagnose esophageal diseases. As to detection rate of specific lesions under different swallowing positions, the detection rate of esophageal erosion was higher in this study with recumbent position than in Wang Ao's study (17.8% vs. 7%), with statistically significant difference (P = 0.011). The difference may be related to the different inclusion criteria and the swallowing position. Wang Ao's study[13] included asymptomatic examination group, while this study included patients with upper gastrointestinal symptoms who took recumbent position in swallowing. Therefore, in clinical practice, recumbent position in capsule endoscopy is more conducive to improving the discovery rate of esophageal lesions.

During the examination, MCCE was performed in the two groups with different positions. There was no capsule retention, and the difference in adverse event incidence rate was not statistically significant, suggesting that both body positions for swallowing capsule endoscope are safe. At the same time, this study excluded confounding factors in abnor-

mal incidence of esophageal lesions in different age groups, and safety test was performed on the elderly population relatively prone to swallowing-related adverse events. The study can be extended to general examination population. It is thus clinically recommended that, when performing capsule endoscopy, recumbent position should be preferred for capsule endoscopy, and the patient should be instructed to perform position placement and drinking exercises. Formal examination may be started after the patient is confirmed to have mastered swallowing method in recumbent position. If there is adverse reaction such as severe chocking of patient in the recumbent position, let the patient rest and then try to drink in the recumbent position again. If there is still severe choking and other adverse reactions, capsule endoscopy in recumbent position should be given up and changed to upright position.

This study has certain limitations. First, due to the limitations of capsule endoscopy techniques, biopsy cannot be performed, and pathological tissue findings are lacked for abnormal esophageal lesions. Secondly, diagnosis and treatment scheme is not followed up for abnormal examination results. The relationship between the detection rate of esophageal lesions and the actual incidence of lesions cannot be further elaborated. In the future, the difference in detection rates of MCCE and common electronic endoscopy can be compared.

The results of this study showed that recumbent position can improve the detection rate of MCCE for esophageal lesions. Although the equipment used in this study was magnetic control capsule endoscopy, magnetic control technique was not used when capsule endoscope passed through the esophageal cavity. Therefore, swallowing method in recumbent position can be extended to all examination of esophageal diseases by capsule endoscopy, which can improve the detection rate for esophageal lesions as a suitable and safe position for endoscopic screening of esophageal lesions.

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Corresponding Author:
Xie Xiaoping
Department of Gastroenterology, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology
Email: xiexiaoping63@126.com
(China)
Cheng Jingping
Geriatrics Department of Huarun WISCO General Hospital
Email: 404178516@qq.com
(China)