World Journal of Gastroenterology

Online Submissions: http://www.wjgnet.com/esps/
bpgoffice@wjgnet.com
doi:10.3748/wjg.v20.i17.5045

World J Gastroenterol 2014 May 7; 20(17): 5045-5050
ISSN 1007-9327 (print) ISSN 2219-2840 (online)

BRIEF ARTICLE

Evaluation of preferable insertion routes for esophagogastroduodenoscopy using ultrathin endoscopes

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Supported by Grant-in-Aid for Young Scientists (B) from the Ministry of Education, Culture, Sports, Science and Technology (MEXT)
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Received: September 20, 2013 Revised: December 13, 2013
Accepted: January 19, 2014
Published online: May 7, 2014

Abstract

AIM: To evaluate the discomfort associated with esophagogastroduodenoscopy (EGD) using an ultrathin endoscope through different insertion routes.

METHODS: This study (January 2012-March 2013) included 1971 consecutive patients [male/female (M/F), 1158/813, 57.5 ± 11.9 years] who visited a single institute for annual health checkups. Transnasal EGD was performed in 1394 patients and transoral EGD in 577. EGD-associated discomfort was assessed using a visual analog scale score (VAS score: 0-10).

RESULTS: Multivariate analysis revealed gender (M *vs* F: 4.02 ± 2.15 *vs* 5.06 ± 2.43) as the only independent predictor of the VAS score in 180 patients who underwent EGD for the first time; whereas it revealed gender (M *vs* F 3.60 ± 2.20 *vs* 4.84 ± 2.37), operator, age group (A: < 39 years; B: 40-49 years; C: 50-59 years; D: 60-69 years; E: > 70 years; A/B/C/D/E: 4.99 ± 2.32/4.34 ± 2.49/4.19 ± 2.31/3.99 ± 2.27/3.63 ± 2.31), and type of insertion as independent predictors in the remaining patients. Subanalysis for gender, age group, and insertion route revealed that the VAS score decreased with age regardless of gender and insertion route, was high in female patients regardless of age and insertion route, and was low in males aged over 60 years who underwent transoral insertion.

CONCLUSION: Although comprehensive analysis revealed that the insertion route may not be an independent predictor of the VAS score, transoral insertion may reduce EGD-associated discomfort in elderly patients.

Key words: Esophagogastroduodenoscopy; Ultrathin endoscope; Visual analog scale

Core tip: To evaluate the effects of insertion route for unsedated surveillance esophagogastroduodenoscopy (EGD), this retrospective study included 1971 consecutive patients who visited a single institute for annual health checkups. EGD-associated discomfort was as-

sessed using a visual analog scale (VAS). Statistical analysis using VAS revealed that the VAS score decreased with age regardless of gender and insertion route, was high in females regardless of age and insertion route, and was low in males aged over 60 years who underwent transoral insertion.

Ono S, Niimi K, Fujishiro M, Takahashi Y, Sakaguchi Y, Nakayama C, Minatsuki C, Matsuda R, Hirayama-Asada I, Tsuji Y, Mochizuki S, Kodashima S, Yamamichi N, Ozeki A, Matsumoto L, Ohike Y, Yamazaki T, Koike K. Evaluation of preferable insertion routes for esophagogastroduodenoscopy using ultrathin endoscopes. *World J Gastroenterol* 2014; 20(17): 5045-5050 Available from: URL: http://www.wjgnet.com/1007-9327/full/v20/i17/5045.htm DOI: http://dx.doi.org/10.3748/wjg.v20.i17.5045

INTRODUCTION

Recently, because of the development of endoscopic treatment, the importance of early detection of gastrointestinal neoplasms has become extremely important[1-5]. In addition, gastrointestinal endoscopic technology has advanced considerably with improved resolution and image enhancement[6-10]. Inevitably, the importance of surveillance esophagogastroduodenoscopy (EGD) in detecting upper gastrointestinal neoplasms has become noticeable, particularly for superficial squamous cell carcinomas and early gastric cancers.

On the other hand, remarkable breakthrough in technology has led to the development of endoscopes of smaller diameter with high-resolution pictures. Ultrathin endoscopes have enabled us to perform surveillance EGD through transnasal insertion, and their role in minimally invasive EGD has been reported from various institutes[11-19]. Therefore, transnasal EGD has been accepted as a preferable choice for surveillance EGD, particularly among younger patients.

However, transnasal insertion sometimes cannot be performed because of various reasons such as pain or nasal hemorrhage, resulting in a switch to transoral insertion using the same ultrathin endoscope in daily clinical practice. Our previous study revealed that elderly patients prefer transoral EGD to transnasal EGD[20]. Although patients are reluctant to undergo EGD because of uncomfortable insertion, even if an annual check-up is recommended, a preferable choice of ultrathin endoscope insertion route in patients with different profiles has not been evaluated.

Therefore, this study aimed to evaluate preferable insertion routes during unsedated EGD using an ultrathin endoscope in patients with different profiles.

MATERIALS AND METHODS

This study was conducted at the Center for Epidemiology and Preventive Medicine in the University of Tokyo Hospital from January 2012 to March 2013. After excluding patients with invalid data, the study included patients who had an endoscopic procedure including biopsy, patients with a past history of upper gastrointestinal tract surgery, or patients with a change of insertion route because of nasal hemorrhage or intolerable pain; 1971 consecutive patients who underwent EGD with the use of ultrathin endoscopes during a medical checkup were enrolled. The profiles of these patients are shown in Table 1.

Table 1 Profiles of all patients

	Patients who underwent 1st EGD	Patients who underwent 2nd or subsequent EGD	*P* value
Gender			NS
Male	98	1060	
Female	82	731	
Operator			NS
a	128	1144	
b	49	599	
c	0	28	
d	2	16	
e	1	4	
Age group (yr)	49.3 ± 13.2 54	58.3 ± 11.5	< 0.05
< 39	39	115	
40-49	45	320	
50-59	29	464	
60-69	13	588	
> 70		304	
Insertion route			< 0.05
Transnasal	139	1255	
Transoral	41	536	
VAS score	4.50 ± 2.33	4.11 ± 2.35	< 0.05
Examination time (s)			NS
	306.0 ± 60.0	302.1 ± 61.8	
Type of scope			NS
a	78	690	
b	66	739	
c	19	162	
d	8	69	
e	4	36	
f	3	67	
g	2	28	

EGD: Esophagogastroduodenoscopy; VAS: Visual analog scale score; NS: Not significant.

Each patient was allowed to choose their insertion route. Pre-EGD preparation for both insertion routes included an oral administration of dimethicone (Gascon drop; Kissei Pharmaceutical Co., LTD.; Nagano, Japan) and pronase (PronaseMS; Kaken Pharmaceutical Co., LTD.; Tokyo, Japan). For local anesthesia, oral administration of a viscous gel of 2% lidocaine hydrochloride and modified spray method was provided for both transoral and transnasal insertion routes. The modified spray method involved spraying 0.05% naphazoline nitrate into each nostril, followed by an injection with a viscous gel of 2% lidocaine hydrochloride. Conscious sedation was not performed in any patient. For transoral insertion, a thin-type mouthpiece and tongue depressor (Endo-leader; Top Corp.; Tokyo, Japan) was used[21].

All EGDs were performed by well-trained endos-

Table 2 Univariate and multivariate analyses against the visual analog scale scores in patients who underwent 1st esophagogastroduodenoscopy

Patients who underwent 1st EGD	VAS score	Univariate	Multivariate
Gender		$P < 0.05$	$P < 0.05$
Male	4.02 ± 2.15		
Female	5.06 ± 2.42		
Operator		NS	NS
a	4.47 ± 2.30		
b	4.51 ± 2.49		
c	-		
d	6		
e	4		
Age group		NS	NS
< 39	4.93 ± 2.12		
40-49	4.44 ± 2.54		
50-59	4.11 ± 2.33		
60-69	4.34 ± 2.18		
> 70	4.54 ± 2.93		
Insertion route		NS	NS
Transnasal	4.50 ± 2.26		
Transoral	4.46 ± 2.59		
Examination time (s)		$P < 0.05$	NS
	$r^2 = 0.0336$		
Type of scope		NS	NS
a	4.60 ± 2.36		
b	4.76 ± 2.33		
c	3.95 ± 2.41		
d	3.13 ± 1.64		
e	5.25 ± 2.75		
f	2.33 ± 1.53		
g	4		

EGD: Esophagogastroduodenoscopy; VAS: Visual analog scale score; NS: Not significant.

Table 3 Univariate and multivariate analyses against the visual analog scale scores in patients who underwent 2nd or subsequent esophagogastroduodenoscopy

Patients who underwent 2nd or subsequent EGD	VAS score	Univariate	Multivariate
Gender		$P < 0.05$	$P < 0.05$
Male	3.60 ± 2.20		
Female	4.84 ± 2.37		
Operator		$P < 0.05$	$P < 0.05$
a	3.95 ± 2.36		
b	4.43 ± 2.34		
c	3.57 ± 2.04		
d	4.69 ± 2.06		
e	2.50 ± 1.00		
Age-group		$P < 0.05$	$P < 0.05$
< 39	4.99 ± 2.32		
40-49	4.34 ± 2.49		
50-59	4.19 ± 2.31		
60-69	3.99 ± 2.27		
> 70	3.63 ± 2.31		
Insertion route		$P < 0.05$	NS
Transnasal	4.19 ± 2.27		
Transoral	3.93 ± 2.53		
Examination time (s)		NS	NS
	$r^2 = 0.000843$		
Type of scope		NS	NS
a	4.22 ± 2.35		
b	4.11 ± 2.36		
c	3.93 ± 2.29		
d	3.98 ± 2.48		
e	4.64 ± 2.11		
f	3.25 ± 2.24		
g	3.82 ± 2.57		

EGD: Esophagogastroduodenoscopy; VAS: Visual analog scale score; NS: Not significant.

Table 4 Jonckheere-Terpstra test of the visual analog scale score and age group in addition to gender and insertion route

Jonckheere-Terpstra test	*P* value		
Male-transnasal insertion	NS	NS	$P < 0.05$
Female-transnasal insertion	NS		
Male-transoral insertion	NS ($P = 0.0833$)	$P < 0.05$	
Female-transorai insertion	$P < 0.05$		

NS: Not significant.

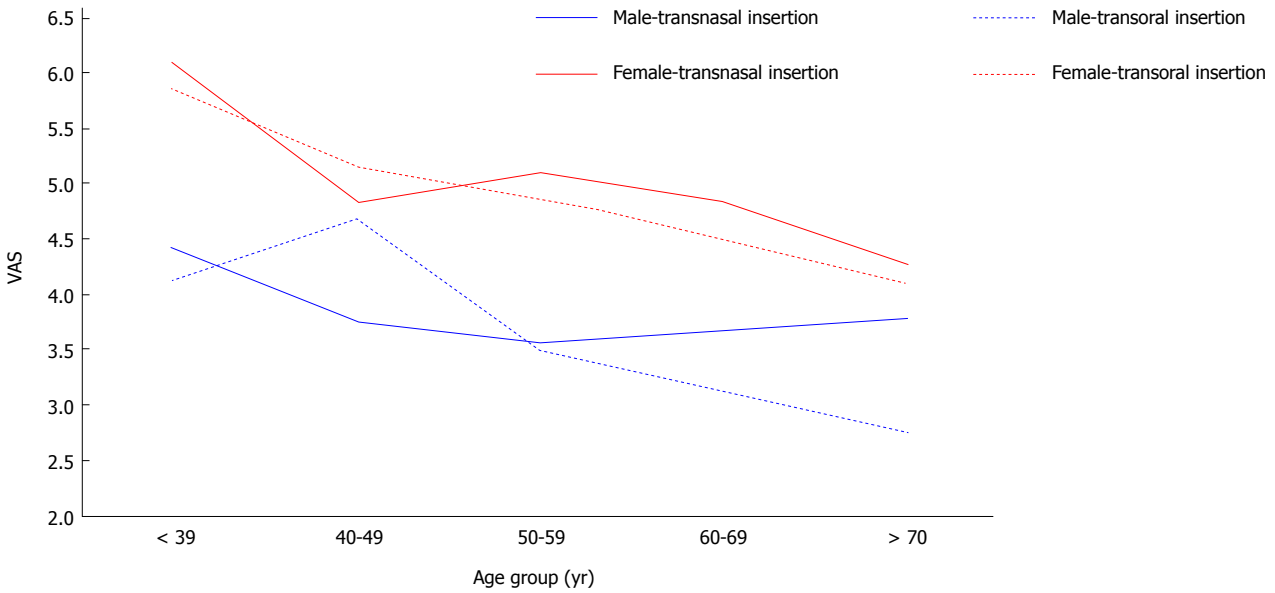
copists who has performed more than 1000 EGDs respectively and were certified by the Japanese Gastroenterological Endoscopy Society. Seven types of ultrathin endoscopes were used in this study: GIF-XP260N and GIF-XP260NS (Olympus Corp, Tokyo, Japan), EG-580NW, EG-530NW, and EG-530N (Fujifilm Holdings Corp, Tokyo, Japan), and EG16-K10 and prototype EG17-K10 (Hoya Corp, Tokyo, Japan). The Prototype EG17-K10 was used as a part of collaborative effort by the University of Tokyo Hospital and Hoya Corporation. These endoscopes are indicated as a, b, c, d, e, f, and g, respectively, in the tables.

Each patient rated EGD-associated discomfort on a visual analog scale (VAS) score of 0-10, with ten being rated as maximum discomfort[22-24]. These questions were part of examination routines and the feedback was used to improve our clinical practice. This study was conducted as a retrospective chart review of consecutive patients and was approved by the Ethics committee.

The parameters, such as gender, age group, previous experience with EGD, insertion route, operator, examination time, and the VAS score, were evaluated. Age groups were defined as A, B, C, D, and E in patients aged below 40 years, 40-49 years, 50-59 years, 60-69 years, and over 70 years, respectively. Statistical analyses were performed using the student's t-test for numerical variables, the Chi-square test for categorical variables, and the Jonckheere-Terpstra test for trend analysis. Multivariate analyses were performed using a stepwise regression analysis. All analyses except for the Jonckheel-Terpstra test were performed using a JMP software (SAS Institute Inc., Cary, NC, United States). A P value < 0.05 was considered significant.

RESULTS

Of 1971 patients (male/female: 1158/813, mean age, 57.5 ± 11.9 years, range, 25-89 years), 180 and 1791 patients underwent a 1st EGD and a 2nd or subsequent EGD, respectively. Patients who underwent 1st EGD were significantly younger than other patients. Furthermore, the number of patients receiving transnasal EGD and the



Age group	< 39		40-49		50-59		60-69		> 70	
Male-transnasal insertion (n = 769)	4.41 ± 2.00 (n = 58)	4.37 ± 2.24 (n = 71)	3.75 ± 2.19 (n = 154)	3.91 ± 2.30 (n = 185)	3.56 ± 2.20 (n = 207)	3.54 ± 2.17 (n = 261)	3.65 ± 2.04 (n = 255)	3.51 ± 2.15 (n = 357)	3.77 ± 2.09 (n = 95)	3.27 ± 2.18 (n = 186)
Male-transoral insertion (n = 291)	4.15 ± 3.21 (n = 58)		4.68 ± 2.68 (n = 31)		3.38 ± 2.04 (n = 54)		3.15 ± 2.36 (n = 102)		2.76 ± 2.16 (n = 91)	
			[a]		[a]		[a]		[a]	[a]
Female-transnasal insertion (n = 486)	6.06 ± 2.09 (n = 31)	6.00 ± 2.09 (n = 44)	4.84 ± 2.58 (n = 94)	4.93 ± 2.64 (n = 135)	5.10 ± 2.12 (n = 139)	5.03 ± 2.23 (n = 203)	4.84 ± 2.21 (n = 161)	4.74 ± 2.27 (n = 231)	4.28 ± 2.35 (n = 61)	4.20 ± 2.41 (n = 118)
Female-transoral insertion (n = 245)	5.85 ± 1.91 (n = 13)		5.15 ± 2.79 (n = 41)		4.86 ± 2.45 (n = 64)		4.50 ± 2.41 (n = 70)		4.12 ± 2.49 (n = 57)	

([a]P < 0.05)

Figure 1 Visual analog scale score score and age groups in addition to gender and insertion route. [a]P < 0.05 between male and female groups.

VAS score were significantly higher in those who underwent their 1st EGD than in other patients.

Although univariate analysis revealed a significantly higher VAS score in females than in males and a positive correlation with examination time, multivariate analysis revealed gender as the only independent predictor of the VAS score (Table 2).

For patients who underwent their 2nd or subsequent EGD, multivariate analysis revealed gender, operator, and age group as independent predictors of the VAS score. Although the VAS score for transnasal insertion was significantly higher than that for transoral insertion, multivariate analysis indicated that the insertion route may not be an independent predictor of the VAS score (Table 3).

For further evaluation, subanalysis performed by combining gender, age group, and insertion route (Figure 1) revealed that the VAS scores were significantly higher in females than in males, regardless of age group and insertion route. With regard to the insertion route, among the male patients aged over 60 years old, the VAS scores were significantly lower in patients receiving transoral insertion than in those receiving transnasal insertion. The Jonckheere-Terpstra test revealed that the VAS scores decreased with age (Table 4). In particular, these scores markedly decreased with age in patients who underwent transoral insertion.

DISCUSSION

This study revealed the relationship between the profiles of patients and EGD-associated discomfort using an ultrathin endoscope. To minimize the discomfort during a surveillance EGD, it may be better to recommend transnasal insertion for younger patients and transoral insertion for elderly patients, particularly in males aged over 60 years.

Although the reason why gender difference affected the VAS score in this study is not clear, higher VAS scores in females have previously been reported with regard to postoperative pain[25]. Aubrun *et al*[25] evaluated postoperative pain using VAS scores and morphine dos-

age and reported a significantly higher VAS score and dosage in females. The authors speculated that women had a lower pain threshold and less tolerance to experimental pain compared with men. Our study also supports their speculation.

With regard to the decreasing trend in the VAS score with age, we speculated that it may be due to weakening of the gag reflex. On the other hand, any discomfort associated with transnasal insertion to the hypopharynx primarily includes nasal pain rather than weakening of the gag reflex. We speculated that age is more strongly associated with weakening of the gag reflex than with nasal pain. In addition, male gender has been reported to be a risk factor for aspiration pneumonia in a systematic review[26]. This report indicates that age-related weakening of the gag reflex is greater in males than in females. Nasal pain does not seem to be related to age, which results in lower VAS scores for transoral insertion in elderly individuals, particularly males.

The main limitation of this study is a lack of objectivity when assessing discomfort using the VAS score. EGD-associated discomfort also includes anxiety, abdominal fullness due to insufflation, and various other factors in addition to nasal pain and weakening of the gag reflex. However, it may be difficult to objectively evaluate each factor. In addition, the difference in discomfort associated with transnasal and transoral insertions may be limited to discomfort associated with insertion to the hypopharynx. With regard to this short route, the difference in discomfort associated with both insertion routes is primarily attributed to nasal pain and weakening of the gag reflex. Therefore, we used the VAS score as a relatively reliable and simple objective assessment method to compare these two insertion routes.

In conclusion, this study demonstrated age-related and gender-related discomfort associated with transoral and transnasal EGD using ultrathin endoscopes. Although further data collection is necessary, the appropriate choice of insertion route may easily convince patients who are reluctant to undergo surveillance EGD.

ACKNOWLEDGMENTS

We are grateful to Mr. Takeshi Shimamoto for his valuable comments and suggestions on statistical analysis. We would also like to thank Dr. Taku Mayahara and Dr. Takeshi Ono and the staff of Center for Epidemiology and Preventive Medicine of the University of Tokyo Hospital for their valuable opinions and information, which have helped us considerably throughout the study.

COMMENTS

Background

The importance of surveillance esophagogastroduodenoscopy (EGD) in detecting upper gastrointestinal neoplasms has become very evident in the context of clinical daily practice where the importance of detection of early stage gastrointestinal neoplasms has received more emphasis.

Research frontiers

Although the ultrathin endoscopes for transoral or transnasal insertion during medical checkups has been accepted as a less invasive technique, because of the discomfort due to an uncomfortable insertion route, patients may become reluctant to undergo EGDs during annual health checkups.

Innovations and breakthroughs

The authors' study investigating discomfort that accompanies unsedated EGD using ultrathin endoscopes demonstrated a correlation between discomfort and insertion route with regard to gender and age group.

Applications

To decrease unsedated EGD-associated discomfort while using ultrathin endoscopes, transnasal insertion should be chosen except for elderly males. For elderly males aged over 60 years, transoral insertion may be preferred rather than transnasal insertion.

Terminology

An ultrathin endoscope is an endoscope with a tip diameter of approximately 6 mm. It enables transnasal insertion and is widely used for a medical checkup using EGD in Japan.

Peer review

This study demonstrated age-related and gender-related discomfort associated with transoral and transnasal EGD using ultrathin endoscopes. It's a good study with important clinical applications.

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P- Reviewer: Sivandzadeh GR
S- Editor: Zhai HH **L- Editor**: A **E- Editor**: Liu XM

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Flat C, 23/F., Lucky Plaza,
315-321 Lockhart Road, Wan Chai, Hong Kong, China
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Telephone: +852-31779906
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ISSN 1007-9327
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