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RAPID COMMUNICATION

Unsedated ultrathin upper endoscopy is better than conventional endoscopy in routine outpatient gastroenterology practice: A randomized trial

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Abstract

AIM: to compare the feasibility and patients' tolerance of esophagogastroduodenoscopy (EGD) using a thin endoscope with those of conventional oral EGD and to determine the optimal route of introduction of small-caliber endoscopes.

METHODS: One hundred and sixty outpatients referred for diagnostic EGD were randomly allocated to 3 groups: conventional (C)-EGD (9.8 mm in diameter), transnasal (TN)-EGD and transoral (TO)-EGD (5.9 mm in diameter). Pre-EGD anxiety was measured using a 100-mm visual analogue scale (VAS). After EGD, patients and endoscopists completed a questionnaire on the pain, nausea, choking, overall discomfort, and quality of the examination either using VAS or answering some questions. The duration of EGD was timed. Blood oxygen saturation (SaO_2) and heart rate (HR) were monitored during EGD.

RESULTS: Twenty-one patients refused to participate in the study. The 3 groups were well-matched for age, gender, experience with EGD, and anxiety. EGD was completed in 91.1% (41/45), 97.5% (40/41), and 96.2% (51/53) of cases in TN-EGD, TO-EGD, and C-EGD groups, respectively. TN-EGD lasted longer (3.11 ± 1.60 min) than TO-EGD (2.25 ± 1.45 min) and C-EGD (2.49 ± 1.64 min) ($P < 0.05$). The overall tolerance was higher ($P < 0.05$) and the overall discomfort was lower ($P < 0.05$) in TN-EGD group than in C-EGD group. EGD was tolerated "better than expected" in 73.2% of patients in TN-EGD group and 55% and 39.2% of patients in TO-EGD and C-EGD groups, respectively ($P < 0.05$). Endoscopy was tolerated "worst than expected" in 4.9% of patients in TN-EGD group and 17.5% and 23.5% of patients in TO-EGD and C-EGD groups, respectively ($P < 0.05$). TN-EGD caused mild epistaxis in one case. The ability to insufflate air, wash the lens, and suction of the thin endoscope were lower than those of conventional instrument ($P < 0.001$). All biopsies performed were adequate for histological assessment.

CONCLUSION: Diagnostic TN-EGD is better tolerated than C-EGD. Narrow-diameter endoscope has a level of diagnostic accuracy comparable to that of conventional gastroscope, even though some technical characteristics of these instruments should be improved. Transnasal EGD with narrow-diameter endoscope should be proposed to all patients undergoing diagnostic EGD.

Key words: Diagnotic esophagogastroduodenoscopy; Endoscopy; Gastroscopy

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INTRODUCTION

Esophagogastroduodenoscopy (EGD) is a safe and quick procedure, and can be carried out without sedation[1]. However, it can evoke anxiety, feelings of vulnerability, embarrassment, and discomfort[2]. The fears and concerns associated with the endoscopic procedure decrease patient's compliance, making EGD execution more difficult[2-4], and in many countries EGD is performed using conscious sedation[5]. Although usually safe, sedation is not free from adverse effects[6-8], and produces a 30%-50% increase of the EGD costs, either direct (medications, additional time required to sedate and recover the patients, additional personnel needed to monitor the patients) or indirect (time lost from work by both the patient and patient's escort)[9,10].

Narrow-diameter endoscopes (< 6 mm) were developed in the early 1990s with the aim of reducing patient discomfort and avoiding the cost and risks of conscious sedation. These endoscopes can also be

introduced through the nose, as reported by Shaker in 1994[11]. Either this study or a cancer screening program in Japan[12] showed that the transnasal unsedated procedure is safe and well tolerated, and allows adequate visualization of the upper gastrointestinal tract. However, the use of these endoscopes is still limited to a small subset of patients[10], even though they have been reported to be suitable not only for diagnostic purposes, but also for interventional procedures, such as PEG and placement of nasoenteric feeding tubes[13-16].

In this randomized trial, we compared the unsedated small-caliber endoscopy using the transnasal and transoral routes with unsedated conventional endoscopy. Our primary aims were to compare the patients' tolerance to small-caliber and conventional endoscopes, to determine the optimal route of introduction of small-caliber endoscopes, and to evaluate the differences in the general handling of small-caliber and conventional instruments. Secondary objectives were to evaluate duration and safety of the procedure.

MATERIALS AND METHODS

Study population

One hundred and sixty consecutive outpatients, undergoing elective diagnostic EGD and fulfilling the eligibility criteria, were randomly assigned to three groups by a computer-generated randomization list and asked to participate in the study. Inclusion criteria were age between 18 and 70 years, and capability (evaluated by the endoscopist) of fully understanding and filling up the questionnaire of the study. Exclusion criteria were history of gastrectomy, esophagectomy, or other upper-gastrointestinal (GI) tract surgery, history of sinus or nasal septum surgery, planned endoscopic therapy, coagulopathy or anticoagulant therapy, psychiatric diseases or long-term psychiatric drug addiction, presence of neoplastic or other serious concomitant diseases, pregnancy.

In the control group (C-EGD), unsedated EGD was performed with pharyngeal topical anesthesia, using a Fujinon EG-250WR5 videoendoscope (outer diameter of the insertion tube is 9.8 mm). In the transnasal-EGD (TN-EGD) and transoral-EGD (TO-EGD) groups, unsedated EGD was performed with pharyngeal or nasal topical anesthesia alone, using a Fujinon EG-270N5 videoendoscope (outer diameter of the insertion tube is 5.9 mm), which was introduced through the nose or the mouth. The patients underwent EGD in the left lateral position, and all procedures were carried out by three endoscopists well trained in unsedated narrow-diameter transnasal and transoral endoscopy.

The study protocol was approved by the Ethical Committee of our hospital, and all patients enrolled gave their written informed consent to participate in the study.

Outcome measurements

Pre-EGD assessment: Age, gender, prior experience of endoscopic examination, blood oxygen saturation (SaO_2), and heart rate (HR) were recorded. Since anxiety was hypothesized to be a potential factor of discomfort, all patients were asked to rate their pre-EGD anxiety level using a 100-mm visual analogue scale (VAS), with 100 being the highest level. The patients were asked also to specify what they dreaded more about endoscopic examination among the following six items: fear of pain, fear of vomiting, fear of stifling, fear of complications, fear of endoscopic findings, and others.

Monitored parameters: SaO_2 and HR were continuously monitored during EGD. An abnormal vital sign was defined as HR > 130 bpm or decrease in SaO_2 below 90% for over one minute. The duration of EGD was timed in all patients. A procedure was considered complete if gastric retroflexion was accomplished, the second portion of the duodenum was reached, and all indicated biopsies were obtained. If the transnasal route failed, a switch was made to the oral route using the same instrument, and EGD was considered unsuccessful according to the study design. The occurrence of complications was recorded after each procedure.

Post-EGD assessment: Data were collected from both the patient and the endoscopist. The sensation of pain and overall discomfort were quantified on a 100-mm VAS (0 = non existent, 100 = unbearable), and the overall tolerance to EGD was assessed as very poor, poor, fair, good, excellent. Patients scored their sensation of nausea and choking on a 100-mm VAS, and indicated also their tolerance by answering the questions of "how did you tolerate EGD, and what you were expecting?" and choosing one of the following 3 items: worse than expected, as expected, better than expected.

Endoscopists scored the level of difficulty in introduction of the gastroscope on a 100-mm VAS. Endoscopists' satisfaction was assessed with 100-mm VAS for the performances of the endoscopes, with regard to the adequacy of the view, the air insufflation/washing of the lens, and suction.

Statistical analysis

Statistical analysis was performed by using Statgraphics V4 (STSC Inc.; Rockville, MD, USA) and SPSS V8 (SPSS Inc.; Chicago, IL, USA) statistical software packages. Gender and previous experience of endoscopic examination were analyzed by the chi square test. Age and pre-endoscopic anxiety levels were analyzed using the Kruskal-Wallis non parametric test. Kruskal-Wallis test was also used to analyze the duration of EGD, difficulty in introduction of the gastroscope, nausea, choking, and performances of the endoscope. ANOVA-RM was used to compare physicians' and patients' opinions about intubation pain, overall discomfort, and overall tolerance.

The statistical power of the sample size was also evaluated, and levels over 90% were found in the most part of the tests applied. $P < 0.05$ was considered statistically significant.

RESULTS

Twenty-one out of 160 patients who were considered eligible and randomized into TN-EGD group ($n = 9$), TO-EGD group ($n = 11$), and C-EGD group ($n = 1$), refused

Table 1 Demographic and clinical data of the patients

	TN-EGD	TO-EGD	C-EGD	*P*
Patients (*n*)	45	41	53	
Gender (m/f)	22/23	15/26	24/29	NS
Age (yr; mean ± SD)	45.73 ± 12.59	43.92 ± 14.97	43.83 ± 13.68	NS
Patients with previous EGD, *n* (%)	17 (37.7)	17 (41.4)	19 (35.8)	NS
Baseline anxiety score in VAS (mean ± SD)	45.36 ± 27.71	44.34 ± 32.25	45.84 ± 30.35	NS
Baseline oxygen saturation (%; mean ± SD)	98.58 ± 1.41	98.48 ± 1.38	98.47 ± 1.54	NS
Baseline hart rate (bpm; mean ± SD)	84.92 ± 16.12	86.07 ± 15.80	86.32 ± 15.01	NS
Successful completion EGD, *n* (%)	41 (91.1)	40 (97.5)	51 (96.2)	NS
Duration of EGD (min; mean ± SD)	3.11 ± 1.60	2.25 ± 1.45	2.49 ± 1.64	< 0.05
Tachycardia, *n* (%)	1 (2.4)	1 (2.5)	3 (5.9)	NS
Blood oxygen desaturation, *n* (%)	0 (0)	0 (0)	2 (3.9)	NS
Biopsy during EGD, *n* (%)	19 (46.3)	16 (40.0)	24 (47.0)	NS
Complications, *n* (%)	1 (2.4)	0 (0)	0 (0)	NS

Table 2 Patients' and endoscopists' evaluations (mean ± SD)

	TN-EGD (*n* = 41)	TO-EGD (*n* = 40)	C-EGD (*n* = 51)	*P*	Statistical procedure
Patients' assessment					
Intubation (pain)	24.49 ± 21.70	20.08 ± 23.46	26.53 ± 31.18	NS	ANOVA-RM
Overall discomfort	22.49 ± 23.59	32.35 ± 28.65	34.02 ± 31.21	NS	ANOVA-RM
Choking	9.66 ± 13.44	19.72 ± 25.80	25.37 ± 33.77	NS	Kruskal-Wallis
Nausea/Vomiting	21.80 ± 26.89	39.57 ± 34.40	35.39 ± 34.27	NS	Kruskal-Wallis
Overall tolerance	3.95 ± 0.71	3.70 ± 0.72	3.29 ± 0.90	< 0.001	ANOVA-RM
Endoscopists' assessment					
Difficulty in intubation	10.97 ± 16.71	6.57 ± 10.37	9.61 ± 14.78	NS	Kruskal-Wallis
Intubation (pain)	16.34 ± 18.37	15.00 ± 17.48	20.10 ± 25.56	NS	ANOVA-RM
Overall discomfort	8.22 ± 9.76	14.85 ± 16.84	23.04 ± 27.31	NS	ANOVA-RM
Overall tolerance	4.56 ± 0.59	4.18 ± 0.93	3.63 ± 1.08	< 0.01	ANOVA-RM

to participate in the study. One hundred and thirty-nine patients (61 males and 78 females) entered the study. The three groups were well-matched for age, gender, previous experience of endoscopic examination, blood oxygen saturation, heart rate, and baseline anxiety score (Table 1). In all groups the most common cause of fear before EGD was fear of stifling (44 cases on the whole). Seven out of 139 patients (5.0%) did not complete EGD and were excluded from any subsequent analysis. EGD was successfully completed in 91.1% (41/45) of patients in TN-EGD group, 97.5% (40/41) in TO-EGD group, and 96.2% (51/53) in C-EGD group, respectively. TN-EGD failed in 4 cases (8.9%) due to difficult insertion of the endoscope through the nose or intolerance. These patients were excluded from any subsequent analysis.

The duration of the procedure was significantly longer in TN-EGD group than in TO-EGD and C-EGD groups (3.11 ± 1.6 min *vs* 2.25 ± 1.45 min and 2.49 ± 1.64 min, respectively; $P < 0.05$). Such a difference was not due to a higher frequency of biopsy sampling that was similar in the three groups (Table 1).

No complication occurred in C-EGD and TO-EGD groups. One patient (2.4%) in TN-EGD group had mild and self-limiting epistaxis. Occurrence of abnormal vital signs (blood oxygen desaturation and tachycardia) was less frequent in TN-EGD group than in the other two groups, but the difference was not statistically significant (Table 1).

Endoscopists' assessment showed no difference in the intubation difficulty among the three groups (Table 2). Likewise, on the basis of patients' evaluation, no difference was found in choking or nausea/vomiting among the three groups.

ANOVA-RM analysis of the factor "method" (TN-EGD *vs* TO-EGD *vs* C-EGD) independently of the observer (patient or endoscopist), showed that the overall tolerance was significantly higher in TN-EGD and TO-EGD groups than in C-EGD group ($P < 0.001$ and $P < 0.01$, respectively). TN-EGD and TO-EGD groups did not differ from each other. Conversely, no difference was observed in intubation pain and overall discomfort (Table 2). ANOVA-RM analysis of the factor "observer" (patient *vs* endoscopist) independently of the method, showed that endoscopist underestimated the levels of intubation pain ($P < 0.01$) and overall discomfort ($P < 0.001$), and overrated the overall tolerance ($P < 0.001$) in comparison with the patient. Contemporaneous analysis of both factors "observer" and "method", a significant difference was observed in overall discomfort and overall tolerance between TN-EGD and C-EGD ($P < 0.05$) (Figures 1A and B). All these results had a power greater than 90%, even though some differences were observed according to the factor considered (method, observer, and their combination).

Seventy-three point two percent of patients in TN-EGD group, 55% in TO-EGD group, and 39.2% in C-EGD group tolerated EGD better than expected (Table 3). EGD was tolerated worst than expected by 4.9%, 17.5%, and 23.5% of patients, respectively. Frequency

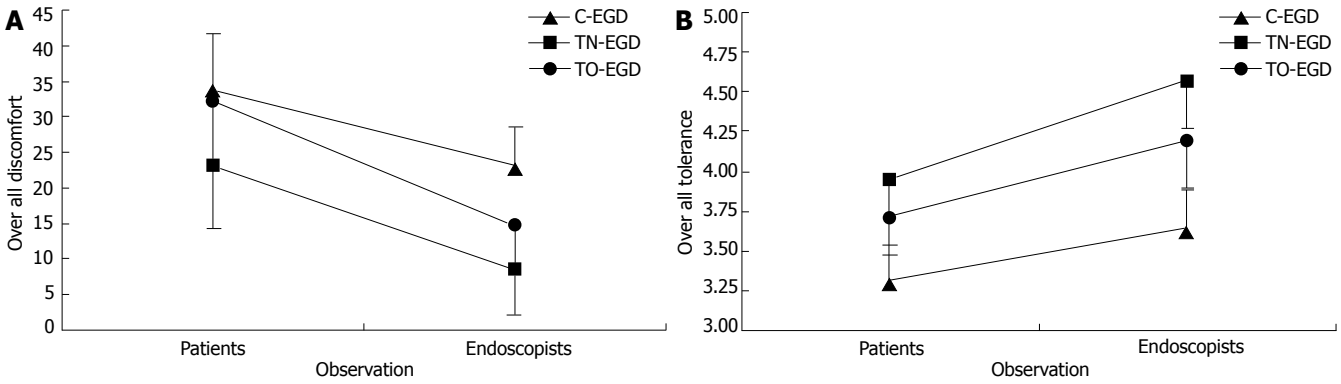

Figure 1 Overall discomfort (**A**) and overall tolerance (**B**) at EGD for patients and endoscopists in the three groups of patients. Statistical difference can be observed comparing TN-EGD *vs* C-EGD.

Table 3 Answers to the questions of "how did you tolerate EGD and what you were expecting of?"

	TN-EGD (n = 41)	TO-EGD (n = 40)	C-EGD (n = 51)
Worse than expected, n (%)	2 (4.9)	7 (17.5)	12 (23.5)
As expected, n (%)	9 (21.9)	11 (27.5)	19 (37.3)
Better than expected, n (%)	30 (73.2)	22 (55.0)	20 (39.2)

Table 4 Results of the endoscopists' evaluation of the performances of endoscopes

	TN-EGD (n = 41)	TO-EGD (n = 40)	C-EGD (n = 51)	P
Endoscopists' score (mean ± SD)				
Image quality	87.85 ± 14.34	89.57 ± 11.00	91.98 ± 11.85	NS
Suction	81.90 ± 9.98	84.82 ± 11.82	94.37 ± 7.49	< 0.001
Air insufflation/washing of the lens	83.90 ± 13.70	85.80 ± 13.34	94.76 ± 6.49	< 0.001
Reaching of the second portionof the duodenum, n (%)	41 (100)	40 (100)	51 (100)	NS
Adequate biopsy sampling, n (%)	19/19 (100)	16/16 (100)	24/24 (100)	NS

analysis showed a statistically significant trend ($P < 0.05$) due to the difference between TN-EGD and C-EGD ($P < 0.01$).

On the basis of the endoscopists' rating scores, the ability to insufflate air/wash the lens, and suction of ultrathin endoscope were lower than those of conventional endoscope ($P < 0.001$) (Table 4). No difference was observed in image quality, and the second portion of the duodenum was reached in all cases with both instruments. In no case the examination was not completed because of the higher flexibility of ultrathin endoscope.

Biopsies were taken at the operator's discretion in 59 cases (19 in TN-EGD group, 16 in TO-EGD group, and 24 in C-EGD group). All biopsies were adequate (Table 3), EGD needed to be repeated in no case because of inadequate histopathologic results.

DISCUSSION

Narrow-diameter endoscopes have been put on the market about ten years before, but their use in clinical practice is still limited to a small subset of patients, either in the United States[10] or in countries such as Italy, where EGD is performed without routine conscious sedation. It is still debated whether the best way of introduction of these instruments is the transnasal or the peroral route, as until now few comparisons have been published in literature. Some randomized trials suggested that the peroral route may be easier to perform and slightly preferred by both patients and endoscopists[17-20]. Conversely, in our series TN-EGD caused less discomfort and was better tolerated. Indeed, univariate analysis seemed to suggest that both TN-EGD and TO-EGD were better tolerated than C-EGD, but multivariate analysis revealed that only TN-EGD showed significantly lower discomfort and higher tolerance than C-EGD. Moreover, TN-EGD patients answered the questions of "how did you tolerate EGD and what you were expecting of?" more positively than the other patients. Our results partially agree with those of Preiss *et al*[21] who observed that patients' acceptance of the EGD is significantly better with the ultrathin endoscope introduced through the nose (but not through the mouth) than with the standard endoscope, as choking was lower. More recently, Thota *et al*[22] reported that the transnasal route is better tolerated than the transoral route, but a 4-mm videoendoscope was used in their study. Conversely, in a randomized trial comparing ultrathin endoscopy through both the transnasal and oral routes with standard EGD, Birkner *et al*[23] observed that patients' opinion about the overall assessment is significantly better in the standard oral EGD. However, this result may be biased by the presence of higher anxiety levels in ultrathin endoscope groups than in control group. Indeed, anxiety is well known to decrease patient compliance, making EGD execution more difficult[3,24]. Such a bias could also explain the surprising observation that patients who underwent peroral EGD with a 6-mm endoscope complained of greater gagging than those who underwent peroral EGD with a 9.8-mm endoscope. Indeed, a lot of trials reported that patient discomfort is lower when small-caliber endoscopes are used[17,25] or no difference is found in tolerance related to endoscope

size[26]. To our knowledge no other study has reported that increasing diameters of the instrument can improve the feasibility and tolerance of unsedated upper endoscopy. Unlike the trial of Birkner[23], our three groups were well-matched for parameters such as gender, age, previous experience of EGD, and anxiety, which can influence the tolerance to endoscopy[24,27]. In our study, transnasal EGD failed in only 4 out of 45 patients (8.9%) because of inability to insert the endoscope through the nose. Once the nasal tract was passed, it was possible to complete all the EGD procedures, including exploration of the second part of the duodenum. Our failure rate is similar to that reported by other authors who used endoscopes with outer diameter of 5.9 mm[21]. Today, endoscopes with a smaller diameter have become available, so it is likely that failure rate will decrease and patients' acceptance will improve in the near future, as the larger-endoscope diameter is considered a predictive factor for procedure failure[19,22].

All biopsy samples taken in our patients were of good quality, and EGD never needed to be repeated because of inadequate histopathologic results. This confirms that biopsy sampling can successfully be done using small diameter endoscopes[17,26,28].

According to other trials[21,29], in our study the percentage of abnormal vital signs was similar in the three groups of patients. However, it has recently been reported that TN-EGD is associated with fewer adverse effects on cardiopulmonary function than TO-EGD[30].

Our study confirmed that the performances of the narrow endoscope were acceptable. Unlike some prior reports[23,26], our experience indicates that image quality and handling of ultrathin and standard endoscopes are similar. Compared to the older color wheel technology, the new ultrathin technology using a color chip similar to that used in standard endoscopes is therefore not susceptible to image distortion. Conversely, the ability to insufflate air, wash the lens, and suction of ultrathin endoscope were lower than those of conventional endoscope. These limits do not compromise diagnostic EGD, but might hamper operative endoscopy, even though some studies suggested that ultrathin endoscopes can work well also in some interventional procedures[13-16].

The average duration of TN-EGD is significantly longer than that of TO-EGD, either in our study or in many other prior reports[17,23,31,32], probably because gastroenterologists are commonly not familiar with the introduction of endoscopes through the nose. Conversely, some authors have not found any difference in duration of EGD between oral and nasal route[21] and a prospective study reported that the duration of transnasal technique is even shorter than peroral technique[33]. However, in this latter study, the time spent to perform transoral EGD was unusually long (11 min).

In conclusion, small-caliber peroral or transnasal EGD has good technical performances, and is safe, generally well accepted and preferred by the patients to conventional EGD. In our opinion, unsedated EGD with narrow-diameter endoscopes should be proposed to all patients undergoing diagnostic EGD. As transnasal EGD seems better tolerated than peroral endoscopy, endoscopists should acquire more familiarity with this route of introduction. The growing skill of endoscopists, as well as further technical improvements in the ultrathin endoscopes, will probably lead to the increasing use of transnasal gastroscopy in the near future.

REFERENCES

1 **al-Atrakchi HA**. Upper gastrointestinal endoscopy without sedation: a prospective study of 2000 examinations. *Gastrointest Endosc* 1989; **35**: 79-81
2 **Brandt LJ**. Patients' attitudes and apprehensions about endoscopy: how to calm troubled waters. *Am J Gastroenterol* 2001; **96**: 280-284
3 **Campo R**, Brullet E, Montserrat A, Calvet X, Moix J, Rué M, Roqué M, Donoso L, Bordas JM. Identification of factors that influence tolerance of upper gastrointestinal endoscopy. *Eur J Gastroenterol Hepatol* 1999; **11**: 201-204
4 **Dominitz JA**, Provenzale D. Patient preferences and quality of life associated with colorectal cancer screening. *Am J Gastroenterol* 1997; **92**: 2171-2178
5 **Bell GD**. Premedication, preparation, and surveillance. *Endoscopy* 2002; **34**: 2-12
6 **Gattuso SM**, Litt MD, Fitzgerald TE. Coping with gastrointestinal endoscopy: self-efficacy enhancement and coping style. *J Consult Clin Psychol* 1992; **60**: 133-139
7 **Woloshynowych M**, Oakley DA, Saunders BP, Williams CB. Psychological aspects of gastrointestinal endoscopy: a review. *Endoscopy* 1996; **28**: 763-767
8 **Conlong P**, Rees W. The use of hypnosis in gastroscopy: a comparison with intravenous sedation. *Postgrad Med J* 1999; **75**: 223-225
9 **Mokhashi MS**, Hawes RH. Struggling toward easier endoscopy. *Gastrointest Endosc* 1998; **48**: 432-440
10 **Sorbi D**, Chak A. Unsedated EGD. *Gastrointest Endosc* 2003; **58**: 102-110
11 **Shaker R**. Unsedated trans-nasal pharyngoesophagogastrodu odenoscopy (T-EGD): technique. *Gastrointest Endosc* 1994; **40**: 346-348
12 **Nozaki R**, Fujiyoshi T, Tamura M, Tsuchiya A, Takagi K, Takano M. Evaluation of small calibre transnasal panendoscopes for upper GI screening examination. *Dig Endosc* 1995; **7**: 155-159
13 **Bajaj JS**, Shaker R. Another indication for transnasal, unsedated upper-GI endoscopy. *Gastrointest Endosc* 2005; **62**: 667-668
14 **Dumortier J**, Lapalus MG, Pereira A, Lagarrigue JP, Chavaillon A, Ponchon T. Unsedated transnasal PEG placement. *Gastrointest Endosc* 2004; **59**: 54-57
15 **Fang JC**, Hilden K, Holubkov R, DiSario JA. Transnasal endoscopy vs. fluoroscopy for the placement of nasoenteric feeding tubes in critically ill patients. *Gastrointest Endosc* 2005; **62**: 661-666
16 **Vitale MA**, Villotti G, D'Alba L, De Cesare MA, Frontespezi S, Iacopini G. Unsedated transnasal percutaneous endoscopic gastrostomy placement in selected patients. *Endoscopy* 2005; **37**: 48-51
17 **Craig A**, Hanlon J, Dent J, Schoeman M. A comparison of transnasal and transoral endoscopy with small-diameter endoscopes in unsedated patients. *Gastrointest Endosc* 1999; **49**: 292-296
18 **Dean R**, Dua K, Massey B, Berger W, Hogan WJ, Shaker R. A comparative study of unsedated transnasal esophagogastrod uodenoscopy and conventional EGD. *Gastrointest Endosc* 1996; **44**: 422-424
19 **Dumortier J**, Napoleon B, Hedelius F, Pellissier PE, Leprince E, Pujol B, Ponchon T. Unsedated transnasal EGD in daily practice: results with 1100 consecutive patients. *Gastrointest Endosc* 2003; **57**: 198-204
20 **Zaman A**, Hahn M, Hapke R, Knigge K, Fennerty MB, Katon RM. A randomized trial of peroral versus transnasal unsedated endoscopy using an ultrathin videoendoscope.

Gastrointest Endosc 1999; **49**: 279-284
21 **Preiss C**, Charton JP, Schumacher B, Neuhaus H. A randomized trial of unsedated transnasal small-caliber esoph agogastroduodenoscopy (EGD) versus peroral small-caliber EGD versus conventional EGD. *Endoscopy* 2003; **35**: 641-646
22 **Thota PN**, Zuccaro G, Vargo JJ, Conwell DL, Dumot JA, Xu M. A randomized prospective trial comparing unsedated esophagoscopy via transnasal and transoral routes using a 4-mm video endoscope with conventional endoscopy with sedation. *Endoscopy* 2005; **37**: 559-565
23 **Birkner B**, Fritz N, Schatke W, Hasford J. A prospective randomized comparison of unsedated ultrathin versus standard esophagogastroduodenoscopy in routine outpatient gastroenterology practice: does it work better through the nose? *Endoscopy* 2003; **35**: 647-651
24 **Trevisani L**, Sartori S, Gaudenzi P, Gilli G, Matarese G, Gullini S, Abbasciano V. Upper gastrointestinal endoscopy: are preparatory interventions or conscious sedation effective? A randomized trial. *World J Gastroenterol* 2004; **10**: 3313-3317
25 **Mulcahy HE**, Riches A, Kiely M, Farthing MJ, Fairclough PD. A prospective controlled trial of an ultrathin versus a conventional endoscope in unsedated upper gastrointestinal endoscopy. *Endoscopy* 2001; **33**: 311-316
26 **Dumortier J**, Ponchon T, Scoazec JY, Moulinier B, Zarka F, Paliard P, Lambert R. Prospective evaluation of transnasal esophagogastroduodenoscopy: feasibility and study on performance and tolerance. *Gastrointest Endosc* 1999; **49**: 285-291
27 **Abuksis G**, Mor M, Segal N, Shemesh I, Morad I, Plaut S, Weiss E, Sulkes J, Fraser G, Niv Y. A patient education program is cost-effective for preventing failure of endoscopic procedures in a gastroenterology department. *Am J Gastroenterol* 2001; **96**: 1786-1790
28 **Saeian K**, Townsend WF, Rochling FA, Bardan E, Dua K, Phadnis S, Dunn BE, Darnell K, Shaker R. Unsedated transnasal EGD: an alternative approach to conventional esophagogastroduodenoscopy for documenting Helicobacter pylori eradication. *Gastrointest Endosc* 1999; **49**: 297-301
29 **Garcia RT**, Cello JP, Nguyen MH, Rogers SJ, Rodas A, Trinh HN, Stollman NH, Schlueck G, McQuaid KR. Unsedated ultrathin EGD is well accepted when compared with conventional sedated EGD: a multicenter randomized trial. *Gastroenterology* 2003; **125**: 1606-1612
30 **Yagi J**, Adachi K, Arima N, Tanaka S, Ose T, Azumi T, Sasaki H, Sato M, Kinoshita Y. A prospective randomized comparative study on the safety and tolerability of transnasal esophagogast roduodenoscopy. *Endoscopy* 2005; **37**: 1226-1231
31 **Campo R**, Montserrat A, Brullet E. Transnasal gastroscopy compared to conventional gastroscopy: a randomized study of feasibility, safety, and tolerance. *Endoscopy* 1998; **30**: 448-452
32 **Shaker R**, Saeian K. Unsedated transnasal laryngo-esophagogastroduodenoscopy: an alternative to conventional endoscopy. *Am J Med* 2001; **111** Suppl 8A: 153S-156S
33 **Krakamp B**, Parusel M, Saers T. Prospective study comparing conventional and transnasal esophagogastroduodenoscopy for routine diagnosis. *Dtsch Med Wochenschr* 2004; **129**: 82-86

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