

Unsedated small caliber esophagogastroduodenoscopy: Can we trust this technique?

Yücel ÜSTÜNDAĞ¹, Ülkü SARITAŞ², Thierry PONCHON³

Department of ¹Gastroenterology, Zonguldak Karaelmas University, School of Medicine, Zonguldak

Department of ²Gastroenterology, Medikal Park Hospital, Ankara

Department of ³Gastroenterology, Endoscopy Unit, Hôpital Edouard Herriot, Lyon, France

Small caliber endoscopes are one of the best examples of fantastic technological advancements in gastrointestinal endoscopy. First designed for pediatric patients in the 1970s, current small caliber videoendoscopes were used for unsedated transnasal gastrointestinal endoscopy after 1994. Nowadays, unsedated endoscopy can be successfully done using small caliber endoscopes via transoral or transnasal route in nearly 90% of cases. Several large studies have shown that small caliber endoscopy is feasible, safe and well-tolerated. These devices can decrease the potential risks of upper gastrointestinal endoscopy by eliminating the need for sedation since these ultrathin endoscopes induce much less gag reflex or choking sensation in patients. Moreover, gastrointestinal endoscopy with small caliber endoscopes results in less sympathetic system activation as well as less oxygen desaturation compared to standard endoscopy, especially in aged, severely ill, bedridden patients. Nevertheless, there is no overall consensus on its cost effectiveness. Though indications are similar with standard endoscopy, small caliber endoscopy can be preferred in patients with gastrointestinal stenosis. Less common indications include transnasal endoscopic retrograde cholangiography and postpyloric feeding tube insertion. The esophagogastroduodenoscopy procedure with small caliber endoscopes is easy to perform, and there is generally no need for further training for this technique. However, the additional cost of equipment and some medicolegal and technical issues have resulted in the unpopularity of small caliber endoscopy in most countries other than France and Japan. However, sharing information about this technique and stressing its potential advantages can help in its widespread use in various countries including Turkey. We believe that routine use of small caliber endoscopes during daily gastrointestinal endoscopy practice is not far away in many countries.

Key words: Unsedated, small caliber endoscopy, esophagogastroduodenoscopy

Sedasyonsuz küçük çaplı özofagogastroduodenoskopi: Bu tekniğe güvenebilir miyiz?

Küçük çaplı endoskoplar gastrointestinal endoskopinin müthiş teknolojik gelişiminin en iyi örneklerinden biridir. İlk olarak pediatrik yaş grubu için 1970'li yıllarda tasarlanmışken, günümüzdeki küçük çaplı videoendoskoplar, sedasyonsuz transnazal gastrointestinal endoskopi için 1994'den sonra kullanılmışlardır. Günümüzde, sedasyonsuz endoskopi bu cihazları kullanarak transoral veya transnazal olarak, olguların %90'ında başarıyla uygulanabilmektedir. Büyük serili çalışmalar, küçük çaplı endoskopinin uygulanması mümkün, güvenli ve iyi tolere edilen bir işlem olduğunu göstermiştir. Küçük çaplı endoskoplar, daha az öğürme refleksi veya boğulma hissi uyandırdıkları için, sedasyon ihtiyacını ortadan kaldırarak, gastrointestinal endoskopinin potansiyel risklerini azaltmaktadırlar. Ayrıca, küçük çaplı endoskopi ile gastrointestinal endoskopi, özellikle yaşlı, yatağa bağımlı bireylerde, standart konvansiyonel endoskoplara göre daha az sempatetik sistem aktivasyonu ve daha az oksijen desatürasyonuna neden olmaktadır. Bununla beraber, küçük çaplı endoskopinin maliyet etkinliği analizinde bir görüş birliği olamamıştır. Standart endoskopi ile aynı endikasyonları olmasına rağmen, küçük çaplı endoskopi gastrointestinal darlığı olan olgularda tercih edilmektedirler. Daha az sıklıkla olan endikasyonlar, transnazal endoskopik retrograd kolanjiografi ve postpylorik beslenme tüpü yerleştirilmesidir. Küçük çaplı endoskopi ile özofagogastroduodenoskopi işlem uygulaması kolaydır ve genel olarak bu işlem için daha fazla eğitime gerek olmamaktadır. Bununla beraber, cihazların ek maliyeti, bazı medikolegal ve teknik durumlar, bu işlemin Japonya ve Fransa hariç olmak üzere bir çok ülkede popüler olamamasına neden olmuştur. Ancak, bu teknik hakkında bilgi paylaşımı ve bu cihazların potansiyel faydalarının vurgulanması, Türkiye dahil olmak üzere bir çok ülkede daha yaygın kullanımına yardımcı olabilecektir. İnanıyoruz ki, gastrointestinal endoskopi için küçük çaplı endoskopların günlük gastrointestinal endoskopi pratiğinde rutin kullanılması, bir çok ülke için çok uzak gözükmemektedir.

Anahtar kelimeler: Sedasyonsuz, küçük çaplı endoskopi, özofagogastroduodenoskopi

Address for correspondence: Yücel ÜSTÜNDAĞ
Zonguldak Karaelmas University School of Medicine,
Department of Gastroenterology, Zonguldak, Turkey
E-mail: yucel_u@yahoo.com

Manuscript received: 09.08.2010 **Accepted:** 28.01.2011

Turk J Gastroenterol 2011; 22 (3): 237-242
doi: 10.4318/tjg.2011.0207

Most GI endoscopists perform upper GI endoscopy via the transoral route using conventional EGD devices. This practice requires the use of various sedatives in most patients to reduce the disturbing effects of the procedure. There are some precise data that sedation can be responsible for most of the morbidity and mortality associated with endoscopy. This also induces extensive prolongation of the time period engaged with the patient and also adds to the overall cost of the procedure. Moreover, the transoral route may not be applicable in some patients with anatomical or mechanical obstacles in the oral cavity. Fortunately, technical developments in the field of endoscopy have enriched us with new ultrathin scopes that have minimized the need for sedation by improving comfort during the procedure. Although there is a continuing discussion on the safety and cost issues, some authors have already indicated that ultrathin scopes have augmented the safety and reduced the cost of endoscopic examinations in the upper GI tract (1-3).

When compared with transoral conventional EGD, transnasal small caliber EGD has fewer adverse effects on cardiopulmonary function and the autonomic nervous system since it requires minimal or no sedation (4,5). Nevertheless, small caliber EGD has not gained much popularity in many countries other than France and possibly Japan, despite its good safety profile. Aside from the lack of physician incentives, cost of the equipment and medicolegal issues, we believe that doubts about the adequacy of these scopes or questions regarding their advantages over conventional endoscopes are the most important factors underlying this unpopularity. Nevertheless, stressing this idea, one survey assessed the adoption of this technique during an endoscopic workshop, and indicated that live case demonstration can decrease barriers to the adoption of this technique (6). Although small caliber scopes are useful tools in endoscopy units, the inability to deliver endotherapy due to the small diameter of the working channel in these scopes is a true limitation. However, we can exclude the factor of lack of training since there is no need for special training for an endoscopist competent in conventional endoscopy to perform a small caliber EGD (7). The aim of this review is to inform physicians about the feasibility, tolerability, adequacy, and safety of unsedated small caliber endoscopy.

TECHNICAL ASPECTS, FEASIBILITY AND ADEQUACY

Unsedated small caliber EGD can be done via eit-

her transoral or transnasal routes. Transnasal endoscopy is surely feasible with endoscopes that are <6 mm in outside diameter (5.1-6 mm in range), approximately half the diameter of conventional endoscopes. These scopes have bidirectional (left-right and up-down) angulations and working lengths of 1030-1330 mm. Esophagoscopes have an outside diameter of <4 mm with a working length of 600 mm. Uncooperative patients or patients with high preprocedure anxiety are not suitable candidates. After appropriate explanation of the procedure, topical anesthesia with lidocaine jelly is administered to the patient's patent nostril and pharyngeal anesthesia is also recommended. The standard left lateral decubitus position is generally preferred, but the upright position can also be attempted. There is one recently published randomized prospective study comparing unsedated endoscopy via the transoral and transnasal routes using 5.5 mm videoendoscopy. In that study, transoral EGD was found to be superior to transnasal EGD with regard to the patient's discomfort, examination duration, pharyngeal pain, and rate of other adverse events (8). In one of the earliest studies, the failure rate of the unsedated transnasal route was also reported to be higher than that of the unsedated transoral route with small caliber endoscopes (12% vs 1%) (9). Pediatric biopsy forceps can be used through the accessory channel if the outside diameter of the endoscope is >5.1 mm. A recent study showed that 1,335 biopsy specimens obtained with small caliber endoscopes had comparable diagnostic performances with those obtained with conventional endoscopes (10). However, another report indicated limited success with the two-directional small caliber EGD to obtain a biopsy from gastric lesions located at the posterior aspect of the cardia (11). Another limitation of small caliber endoscopes can be the poor lens-cleansing function of the scope due to the small caliber water-jet nozzle. However, this problem can easily be solved with cleansing solutions. One report indicated the good lens-cleansing ability of an oolong tea solution to resolve this minor problem (12).

The technical feasibility of small caliber EGD has been addressed in several studies, one of which indicated an 88% success rate in completing the procedure by using small caliber EGD through the transnasal route in 33 volunteers (13). Another study showed that unsedated small caliber endoscopy through the transnasal route with a 6 mm

endoscope was completed in 98% of patients compared to 91% undergoing unsedated EGD with a 9.8 mm gastroscope (14). There are other studies that have presented good feasibility data on transoral and transnasal unsedated EGD. However, most of these studies are not prospective randomized controlled trials and generally enrolled a small number of patients. Thus, we may consider unsedated small caliber EGD to be a technically satisfying method in motivated hands although we do not yet have absolute conclusive data.

The small diameter of the channels could also impair suctioning ability, especially to aspirate blood and thick debris. This may cast doubt on the accuracy of the small caliber EGD by causing inadequate visualization and failure to complete the procedure. These issues have been addressed by several previous studies. One of the earliest reports indicated a 92% diagnostic accuracy of unsedated EGD using a 6 mm ultrathin videoscope, and the optical quality of the images was rated as good in 84%, 65% and 78% of the cases when examining the esophagus, stomach and duodenum, respectively. In that study, 60 patients out of 105 agreed to undergo unsedated EGD. Peroral unsedated EGD was possible in 34 of 35 (97%) of the cases, while the unsedated transnasal route was successful in 25 of 29 (86%) patients (15). Another study clearly indicated that compared with sedated conventional EGD, sedated and unsedated small caliber EGD were 96% and 97% accurate, respectively (16). Another randomized prospective trial compared unsedated esophagoscopy via the transnasal and transoral routes using a 4 mm videoendoscope with conventional endoscopy with sedation. The authors found that unsedated esophagoscopy had a similar level of diagnostic accuracy to that of conventional endoscopy (17).

TOLERABILITY

This is a very important issue since it directly determines the acceptance, adequacy and feasibility of the procedure on the part of the patients and physicians. Indeed, patients undergoing EGD examination for the first time in their life seem to feel more comfortable with sedation. However, there are some reports indicating that more than two-thirds of the patients who agreed to undergo unsedated small caliber EGD were willing to have an unsedated small caliber EGD in the future (15,18). The explanation for this may be the fact that unsedated transnasal EGD is more acceptable and

less stressful to patients than conventional EGD (19-23). This is due to the nausea and choking sensation, which are the main limitations of transoral EGD. The number of gagging episodes was reported to be much lower in the transnasal small caliber EGD as compared with transoral small caliber or conventional EGD (20,23). This is because it is less stimulative to the uvula, palatine arches and the base of the tongue. Thus, the nasal route increases patient tolerance during an EGD examination (1,9,19,20,23). However, small caliber transnasal EGD may induce more pain on insertion than does the transoral EGD, especially in younger patients. The acceptability of unsedated transnasal endoscopy in younger versus older patients was also found to be invariable in a recent study (21).

Transnasal small caliber EGD induces a low degree of choking sensation, mild nasal discomfort, mild sore throat, and abdominal discomfort. The only complications reported by the patients are epistaxis, sinusitis, transient light-headedness, and mucous discharge. Thus, the lack of serious patient discomfort and the high level of patient satisfaction via the transnasal route may be explanations for why the majority of patients who are experienced in both unsedated transoral conventional EGD and unsedated transnasal small caliber EGD prefer the transnasal route (24).

Unsedated transnasal small caliber EGD has also been reported to be safe and tolerable in the diagnosis of hypopharyngeal cancer and in the screening of esophageal lesions (25). In a series of patients with dysphagia following treatment for previous primary head and neck cancer, no significant complications were reported to have occurred during or after unsedated transnasal EGD (26). In that report, all of the patients were noted to have tolerated the procedure well.

SAFETY

Unsedated small caliber EGD represents a valid alternative to sedated conventional EGD in many respects, including tolerability, technical feasibility and adequacy. Safety is another important issue to consider when applying small caliber EGD to our patients. Naturally, the major morbidity and mortality associated with conventional EGD is associated with sedation. The overall complication rate associated with sedated EGD is reported to be around 9 in 100,000 cases (27). An American Society for Gastrointestinal Endoscopy/Food and

Drug Administration (ASGE/FDA) collaborative study indicated the incidence of serious cardiovascular complications as 5.4 per 1000 cases and the incidence of death as 0.3 per 1000 cases (28).

However, cardiovascular impacts of transnasal versus transoral EGD in aged patients with or without hypertension revealed that cardiovascular complications of transoral EGD should not be neglected. In most comparative studies, transnasal EGD was found to have smaller cardiovascular impacts than transoral conventional EGD, and transnasal EGD was found to be safer than conventional EGD for most patients (20,21,29). Transnasal small caliber EGD was reported to be a safer method than transoral conventional EGD in aged hypertensive patients or critically ill, bedridden patients who are undergoing percutaneous endoscopic gastrostomy (PEG) feeding (30,31). The explanation behind these results can be attributed to less sympathetic stimulation induced by transnasal small caliber EGD leading to lesser elevation of blood pressure and pulse (5). Unsedated transnasal EGD has also been reported to have less decrease in oxygen saturation than observed with the transoral conventional EGD method (4,19). It is known that the transoral conventional endoscope may stimulate salivary secretion and further increase the risk of aspiration. In one study, unsedated transnasal small caliber EGD in elderly and bedridden patients was found to be much safer than its transoral counterpart with conventional endoscopes with regard to the risk of aspiration pneumonia (31). Application of this technique was also reported to be a safe and tolerable technique in the diagnosis of hypopharyngeal cancer and screening of simultaneous esophageal cancer (26). The safety issue has also been addressed in the outpatient gastroenterology practice in a randomized trial (22). The authors concluded that transnasal EGD with a small caliber endoscope should be proposed to all patients undergoing diagnostic EGD.

COST EFFECTIVENESS

Elimination of the need for sedation surely decreases the total expense of an EGD procedure by eliminating various sedation-related complications, the incidence of sedation-related work loss and post-procedural monitoring. However, adequacy and the physician's satisfaction with the procedure are other determinants of the cost since a repeat examination under sedation can increase the

expenditure related to the procedure. There are several studies that have investigated the impact of unsedated endoscopy on the cost of EGD. One of these reports proved the cost-saving with unsedated small caliber EGD. The mean procedure time, mean recovery room time and mean cost of unsedated small caliber EGD were found to be statistically lower than those of sedated conventional EGD (32). The other two reports comparing unsedated small caliber EGD with sedated conventional EGD also reached similar results favoring unsedated small caliber EGD (33,34). However, it is not clear that unsedated endoscopy results in cost-saving without compromising the patient's and/or the endoscopist's satisfaction with the procedure. Furthermore, large randomized controlled studies and cost-effectiveness analyses are not present to date, and such studies are needed to obtain conclusive results on several issues, including cost-effectiveness.

OTHER APPLICATIONS OF SMALL CALIBER EGD

The use of small caliber esophagoscopy makes possible simultaneous manometry and endoscopic observation of the esophagus. This combination proves useful in the evaluation of esophageal peristaltic function, such as in the diagnosis of gastroesophageal reflux disease (35). The small caliber transnasal endoscope was also reported to be valuable in the management of foreign bodies in the pharynx and esophagus (36). Small caliber endoscopy with narrow band imaging and Lugol staining to screen patients with head and neck cancer are important in such cases with some limitations for oral intubation with conventional endoscopes. The use of small caliber endoscopy was found to be feasible in patients with head and neck cancer to detect synchronous neoplasms (37). Furthermore, unsedated transnasal endoscopy was reported to be successful in the accurate detection and surveillance of Barrett's metaplasia and dysplasia (38). Technical difficulties related to the insertion of a long intestinal tube can also be easily overcome by small caliber transnasal EGD. Transnasal EGD decreases the mean procedure time and mean radiation exposure time significantly during feeding tube insertion (39). Inconvenience and complications of the transnasal feeding tube can be avoided by transnasal PEG tube placement. This technique can be especially safe and effective for patients with partial luminal obstruction due to head and neck cancer and/or GI cancer. It can be done on unsedated pati-

ents with small caliber endoscopes, and has been reported to be minimally invasive, feasible in selected patients and rarely associated with complications (40,41). Endoscopic position control of nasointestinal feeding tubes by transnasal re-endoscopy in intensive care patients was also reported to be a feasible and very accurate method (42).

Interestingly, small caliber endoscopes have found a potential place in the field of ERCP. A study comparing conventional oral ERCP and transnasal ERCP in 50 patients revealed that transnasal ERCP was a well-tolerated method with less cardiovascular stress than oral ERCP. The lack of necessity of mouth-to-nose transfer of the nasobiliary drainage tube during transnasal ERCP seemed to be another advantage of this technique (43). In a small series of patients with previous biliary sphincterotomy, unsedated transnasal small caliber endoscopes were suggested to be useful in draining the biliary system in patients with cholangitis (44,45).

CONCLUSION

Small caliber videoendoscopy is obviously a milestone in the evolving field of GI endoscopy. Such an evolution surely required developments in technology, and image quality can be the main limitation of small caliber endoscopes. Improvements in the resolution problem with these scopes can solve this problem in the future. Self-training seems to be possible with this technology since experienced

endoscopists can easily perform this procedure. The feasibility and tolerability of unsedated GI endoscopy with small caliber videoscopes support its worth over transoral conventional EGD in both young and elderly patients. Though it rarely carries risks to life-threatening dimensions, transoral conventional EGD increases the cardiopulmonary work load especially for elderly and/or critically ill patients. The current literature has provided sufficient data to suggest that small caliber unsedated EGD seems to be safer than its transoral alternative with conventional videoscopes in this group of subjects. Administration of GI feeding or decompression tubes including PEG catheters in cases with head and neck cancer or conditions leading to GI luminal obstruction and insertion of nasobiliary drainage catheters in patients with previous sphincterotomy can be done successfully with small caliber videoscopes. The current literature supports unsedated small caliber EGD as a safe and less costly alternative to conventional transoral EGD. However, the question of whether the unsedated small caliber technique compromises patient and/or physician comfort has to be addressed to determine the utility of this approach in our daily practice. We already need guidelines on how to select a suitable patient population definitely. The question of whether we can trust this technique and administer it at every available opportunity remains to be answered. Perhaps we can approach each patient individually and hopefully wait for healthy guidelines in the near future.

REFERENCES

1. Dumortier J, Ponchon T, Scoazec JY, et al. Prospective evaluation of transnasal esophagogastroduodenoscopy: feasibility and study on performance and tolerance. *Gastrointest Endosc* 1999; 49: 285-91.
2. Garcia RT, Cello JP, Nguyen MH, et al. Unsedated ultrathin EGD is well accepted when compared with conventional sedated EGD: a multicenter randomized trial. *Gastroenterology* 2003; 125: 1606-12.
3. Dumortier J, Napoleon B, Hedelius F, et al. Unsedated transnasal EGD in daily practice: results with 1100 consecutive patients. *Gastrointest Endosc* 2003; 57: 198-204.
4. Kawai T, Miyazaki I, Yagi K, et al. Comparison of the effects on cardiopulmonary function of ultrathin transnasal versus normal diameter transoral esophagogastroduodenoscopy in Japan. *Hepatogastroenterology* 2007; 54: 770-4.
5. Mori A, Ohashi N, Tatebe H, et al. Autonomic nervous function in upper gastrointestinal endoscopy: a prospective randomized comparison between transnasal and oral procedures. *J Gastroenterol* 2008; 43: 38-44.
6. Dumonceau JM, Dumortier J, Daviere J, et al. Transnasal OGD: practice survey and impact of a live video retransmission. *Dig Liver Dis* 2008; 40: 776-83.
7. Maffei M, Dumortier J, Dumonceau JM. Self training in unsedated transnasal EGD by endoscopists competent in standard peroral EGD: prospective assessment of the learning curve. *Gastrointestinal Endosc* 2008; 67: 410-8.
8. Watanabe H, Watanabe N, Ogura R, et al. A randomized prospective trial comparing unsedated endoscopy via transnasal and transoral routes using 5.5-mm video endoscopy. *Dig Dis Sci* 2009; 54: 2155-60.
9. 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: 292-6.
10. Walter T, Chesnay AL, Dumortier J, et al. Biopsy specimens obtained with small-caliber endoscopes have comparable diagnostic performances than those obtained with conventional endoscopes: a prospective study on 1335 specimens. *J Clin Gastroenterol* 2010; 44: 12-7.
11. Rhee KH, Han HS, Lee SY, et al. Does a small biopsied gastric specimen limit the usage of two directional transnasal esophagogastroduodenoscopy? *J Gastroenterol Hepatol* 2010; 25: 270-6.

12. Komazawa Y, Amano Y, Yuki M, et al. Oolong tea is useful for lens cleansing in transnasal small-caliber esophagogastroduodenoscopy. *Endoscopy* 2010; 42: 104-8.
13. Wilkins T, Browster A, Lammers J. Comparison of thin versus standard esophagogastroduodenoscopy. *J Fam Pract* 2002; 51: 625-8.
14. Mulcahy HE, Riches A, Kiely M, et al. A prospective randomized controlled trial of an ultrathin versus a conventional endoscope in unsedated upper gastrointestinal endoscopy. *Endoscopy* 2001; 33: 311-6.
15. Zaman A, Hapke R, Sahagun G, Katon RM. Unsedated peroral endoscopy with a video ultrathin endoscope: patient acceptance, tolerance, and diagnostic accuracy. *Am J Gastroenterol* 1998; 93: 1260-3.
16. Sorbi D, Gostout CJ, Henry J, Lindor KD. Unsedated small-caliber esophagogastroduodenoscopy (EGD) versus conventional EGD: a comparative study. *Gastroenterology* 1999; 117: 1301-7.
17. Thota PN, Zuccaro G Jr, Vargo JJ, et al. 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: 559-65.
18. Solomon SA, Kajla VK, Banerjee AK. Can the elderly tolerate endoscopy without sedation? *J R Coll Physicians Lond* 1994; 28: 407-10.
19. Dean R, Dua K, Massey B, et al. A comparative study of unsedated transnasal esophagogastroduodenoscopy and conventional EGD. *Gastrointest Endosc* 1996; 44: 422-4.
20. Yagi J, Adachi K, Arima N, et al. A prospective randomized comparative study on the safety and tolerability of transnasal esophagogastroduodenoscopy. *Endoscopy* 2005; 37: 1226-31.
21. Stroppa I, Grasso E, E, Paoluzi OA, et al. Unsedated transnasal versus transoral sedated upper gastrointestinal endoscopy: a one series prospective study on safety and patient acceptability. *Dig Liver Dis* 2008; 40: 767-75.
22. Trevisani L, Cifala V, Sartori S, et al. Unsedated ultrathin upper endoscopy is better than conventional endoscopy in routine outpatient gastroenterology practices: a randomized trial. *World J Gastroenterol* 2007; 13: 906-11.
23. Preiss C, Charton JP, Schumacher B, Neuhaus H. A randomized trial of unsedated transnasal small caliber esophagogastroduodenoscopy versus peroral small-caliber EGD versus conventional EGD. *Endoscopy* 2003; 35: 641-6.
24. Krakamp B, Parusel M, Saers T. Prospective study comparing conventional and transnasal esophagogastroduodenoscopy for routine diagnosis. *Deutsch Med Wochenschr* 2004; 129: 82-6.
25. Wang CP, Lee YC, Yang TL, et al. Application of unsedated transnasal esophagogastroduodenoscopy in the diagnosis of hypopharyngeal cancer. *Head Neck* 2009; 31: 153-7.
26. Wang CP, Lee YC, Lou PJ, et al. Unsedated transnasal esophagogastroduodenoscopy for the evaluation of dysphagia following treatment for previous primary head neck cancer. *Oral Oncol* 2009; 45: 615-20.
27. Arrowsmith JB, Gerstman BB, Fleischer DE, Benjamin SB. Results from the American Society for Gastrointestinal Endoscopy/U.S. Food and Drug Administration collaborative study on complication rates and drug use during gastrointestinal endoscopy. *Gastrointest Endosc* 1991; 37: 421-7.
28. Sieg A, Hachmoeller-Eisenbach U, Heisenbach T. How safe is premedication in ambulatory endoscopy in Germany? A prospective study in gastroenterology specialty practices. *Dtsch Med Wochenschr* 2000; 125: 1288-93.
29. Luman W. Patient's perception of transnasal gastroscopy. *Singapore Med J* 2008; 49: 339-41.
30. Gu Q, Wu C, Gu L, et al. Comparison of the cardiovascular impacts of transnasal versus transoral gastroscopy in the aged patients with or without hypertension. *Hepatogastroenterology* 2009; 56: 1562-5.
31. Yuki M, Amano Y, Komazawa Y, et al. Unsedated transnasal small caliber esophagogastroduodenoscopy in elderly and bedridden patients. *World J Gastroenterol* 2009; 15: 5586-91.
32. Gorelick AB, Inadomi JM, Barnett JL. Unsedated small caliber esophagogastroduodenoscopy: less expensive and less time-consuming than conventional EGD. *J Clin Gastroenterol* 2001; 33: 210-4.
33. Wilkins T, Brewster A, Lammers J. Comparison of thin versus standard esophagogastroduodenoscopy. *J Fam Pract* 2002; 51: 625-9.
34. Bampton PA, Reid DP, Johnson RD, et al. A comparison of transnasal and transoral oesophagogastroduodenoscopy. *J Gastroenterol Hepatol* 1998; 13: 579-84.
35. Kawai T, Yamagishi T, Yagi K, et al. Impact of transnasal ultrathin esophagogastroduodenoscopy in the evaluation of esophageal peristaltic function. *J Gastroenterol Hepatol* 2008; 23 (Suppl 2): s181-5.
36. Bennett AM, Sharma A, Price T, Montgomery PQ. The management of foreign bodies in the pharynx and esophagus using transnasal flexible laryngoesophagoscopy. *Ann R Coll Surg Engl* 2008; 90: 13-6.
37. Lee YC, Wang CP, Chen CC, et al. Transnasal endoscopy with narrow-band imaging and Lugol staining to screen patients with head and neck cancer whose condition limits oral intubation with standard endoscope. *Gastrointest Endosc* 2009; 69: 408-17.
38. Parham K. Detection of Barrett's esophagus using transnasal esophagoscopy with narrow-band imaging. *Laryngoscope* 2007; 117: 953-4.
39. Sato R, Watari J, Tanabe H, et al. Transnasal ultrathin endoscopy for placement of a long intestinal tube in patients with intestinal obstruction. *Gastrointest Endosc* 2008; 67: 953-7.
40. Dumortier J, Lapalus MG, Pereira A, et al. Unsedated transnasal PEG placement. *Gastrointest Endosc* 2004; 59: 54-7.
41. Taller A, Horvarth E, Ilias L, et al. Technical modifications for improving the success rate of PEG tube placement in patients with head and neck cancer. *Gastrointest Endosc* 2001; 54: 633-6.
42. Wiegand N, Bauerfeind P, Delco F, et al. Endoscopic position control of nasoenteral feeding tubes by transnasal re-endoscopy: a prospective study in intensive care patients. *Am J Gastroenterol* 2009; 104: 1271-6.
43. Mori A, Ohashi N, Maruyama T, et al. Transnasal endoscopic retrograde cholangiopancreatography using an ultrathin endoscope: a prospective comparison with a routine oral procedure. *World J Gastroenterol* 2008; 14: 1514-20.
44. Itoi T, Kawai T, Itokawa F, et al. Initial experience of transnasal endoscopic biliary drainage without conscious sedation for the treatment of acute cholangitis. *Gastrointest Endosc* 2008; 67: 328-32.
45. Itoi T, Kawai T, Sofuni A, et al. Efficacy and safety of 1-step transnasal endoscopic nasobiliary drainage for the treatment of acute cholangitis in patients with previous endoscopic sphincterotomy. *Gastrointest Endosc* 2008; 68: 84-90.