RESEARCH

Paradigm shift: should the elderly undergo propofol sedation for DBE? A prospective cohort study

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ABSTRACT

Objective Evaluate the safety of propofol-assisted double balloon enteroscopy (DBE) in elderly patients against a younger cohort.

Design Prospective cohort study

Setting All patients undergoing DBE over a 30-month period were recruited at our tertiary centre.

Patients 215 procedures in 161 patients were performed. An age cut-off of 65 years and above was used to define those who were elderly.

Interventions Patients were subcategorised into four groups: elderly or young undergoing DBE with propofol or conventional sedation (with midazolam±fentanyl).

Main outcome measures Patient demographics, comorbidities, procedural data, complications, diagnostic and therapeutic yield were compared.

Results Cardiovascular disease and a higher American Society of Anaesthesiologists (ASA) status were more prevalent in elderly patients undergoing DBE with propofol ($p<0.05$). Common indications for DBE were occult and overt obscure gastrointestinal bleeding and suspected Crohn's disease (elderly vs young: 50.7% vs 42.3%, 17.8% vs 12% and 19.2% vs 26.1%, respectively). Diagnostic yield was higher in elderly compared with young patients (75.3% vs 58.5%, $p=0.016$). The most common findings in elderly and young patients were angioectasia (30.1% and 18.3%, respectively) and ulcers (17.8% and 9.2%, respectively), while therapeutic intervention rates were comparable (42.5% vs 32.4%, $p=0.18$). ASA status did not affect propofol dose ($p=0.55$) or procedure duration ($p=0.31$). Tolerance scores were favourable in those receiving propofol compared with conventional sedation ($p<0.05$). There was no difference in complications between the four groups ($p=0.17$).

Conclusion Compared with young patients, propofol-assisted DBE in the elderly is safe and has a high diagnostic yield.

INTRODUCTION

The double balloon enteroscopy (DBE) system was first introduced in 2001. It has since revolutionised the way the small bowel is now investigated and treated. DBE allows deep examination of the small bowel far exceeding the length that can be achieved by push enteroscopy.^{1–3} In addition, biopsies of ulcers and or suspicious lesions, placement of tattoos and treatment of bleeding lesions is possible with DBE.

When compared with video capsule endoscopy (VCE), the diagnostic yield of DBE remains comparable,^{4,5} but DBE also has concomitant therapeutic capabilities.⁶ Obscure gastrointestinal bleeding (OGIB) is the most common indication for DBE.^{7,8} Utilisation of DBE also includes secondary assessment of pathology identified by other modalities including VCE and radiology. Other common indications for DBE include suspected small bowel Crohn's disease,⁹ small bowel tumours,¹⁰ familial adenomatous polyposis and Peutz-Jeghers syndrome (PJS).¹¹

The procedural duration of DBE remains laborious, with mean antero-grade and retrograde DBE times of 70 and 85 min, respectively.¹² Major complications occur in 0.72% of diagnostic procedures; the most common of these being perforation, pancreatitis and bleeding.¹³ When therapeutic intervention is involved, the complication rates are higher, up to 4.3%.¹⁴ Moreover, longer procedural times are associated with more frequent complications.¹⁵ Advanced age presents a risk for most interventional and lengthy procedures including DBE. Many centres in the UK provide a standard sedation-based service for DBE, while propofol and the use of a general anaesthetic is more prevalent in

other centres in Europe.¹⁶ The lowest cumulative dose of sedation is used in the elderly to minimise complications as a result of reduced renal and hepatic clearance of drugs.¹⁷ More recently, bispectral index (BIS) monitoring has also provided a means of delivering adequate deep sedation while avoiding unnecessary propofol doses. BIS monitoring has been shown to be effective in guiding sedation for endoscopy,¹⁸ including in DBE.¹⁹ The aim of this study was to compare the safety of propofol-assisted DBE with conventional midazolam-based sedation in the elderly and the young.

MATERIALS AND METHODS

Patient population

Between March 2013 and December 2015, all patients undergoing DBE were prospectively recruited at the Royal Hallamshire Hospital, Sheffield, UK. The study was registered and approved as service evaluation with the Clinical Effectiveness Unit, Sheffield Teaching Hospitals NHS Foundation Trust (registration number 7073). A total of 215 procedures in 161 patients were performed. As per the WHO definition, an age cut-off of 65 years and above was used to define those who were elderly. Patients were subcategorised into four groups: those who were elderly (≥ 65 years) and underwent DBE under propofol (group 1, 37 procedures) or conventional sedation with midazolam $\pm$ fentanyl (group 2, 36 procedures), and those who were young (< 65 years) and underwent DBE under propofol (group 3, 77 procedures) or conventional sedation (group 4, 65 procedures). Patient demographics, comorbidities, American Society of Anaesthesiologists (ASA) physical status, sedation dose, complications, diagnostic and therapeutic yield were compared. Complications were defined as acute episodes of cardiovascular, respiratory or systemic compromise requiring significant active treatment and/or premature termination of the procedure. The Hospital Anxiety and Depression Scale has been used in multiple clinical settings to explore the baseline state of anxiety and depression in patients²⁰ and was compared among the four groups. This was to ensure that the patient experience of DBE was not confounded by pre-existing high anxiety or depression states. Propofol offers deeper sedation when compared with midazolam (with or without opioid) sedation. The former class of drug permits a reduced level of consciousness, hence improved tolerance during endoscopy.²¹ This is appropriate for a lengthy procedure such as DBE but requires the assistance of the anaesthetic team in the UK. However, the effectiveness of propofol cannot be assumed a priori. There is limited data comparing the tolerance of DBE under conscious sedation against deep sedation.²² Moreover, data on the elderly population specifically are lacking. Thus, addition preprocedural and postprocedural pain, discomfort and distress scores were compared among the four groups using previously tested visual analogue scales.^{23 24} Patients were asked to rank their

experience by scoring themselves between the range of 0 (no pain/discomfort/distress) to 10 (extreme pain/discomfort/distress) (see online supplementary appendix 1).

Procedure-related information

All DBEs were performed by two experienced endoscopists (RS and DSS) using the Fujinon double balloon therapeutic endoscope system (Fujinon inc Saitama, Japan). All patients were fasted and received polyethylene glycol solution (Klean Prep; Norgine Pharmaceuticals, Middlesex, UK) as bowel preparation prior to the procedure. VCE or radiological imaging preceded all DBE in order to determine the optimal route of access (oral vs anal). All patients had baseline blood tests and ECG prior to DBE and were assessed for suitability by both consultant gastroenterologist and anaesthetist.

Procedures were performed under conventional conscious sedation using midazolam and fentanyl, or deep sedation with propofol. Conventional sedation was administered by the endoscopist and titrated according to tolerability. Propofol was administered by an anaesthetist in a dedicated endoscopy suite, outside of theatre but with appropriate anaesthetic equipment. The dose of propofol was guided by BIS monitoring with a target BIS score of 45 to 60. Propofol was delivered using the Marsh model for target-controlled infusion (TCI).²⁵ The TCI was increased in 1 mcg/mL increments, starting at 1 mcg/mL, until the target sedation level was reached. Once established, TCI target changes were increased or decreased by 0.5 mcg/mL according to the BIS score. Sedation choice was historically guided by the expected length or complexity of the procedure but as of 2013, all DBEs were performed under propofol sedation. DBE was performed to the maximum point of insertion where the suspected pathology was reached or surpassed. The most distal point reached was then tattooed with Spot Ink (GI Supply, Camp Hill, Pennsylvania, USA).

Statistical analysis

Statistical analysis was performed using SPSS V.22.0 (IBM). Continuous data were expressed as mean $\pm$ SD or as a range. Student's t-test or one-way analysis of variance was used to compare continuous variables. Categorical variables were expressed as absolute numbers $\pm$ percentages. The χ^2 test or Fisher's exact probability test were used to compare differences in categorical variables. $p < 0.05$ (two-sided) was considered statistically significant.

RESULTS

Patient characteristics

Table 1 illustrates the demographic data of all groups. Baseline characteristics including sex distribution ($p = 0.434$), body mass index ($p = 0.526$) and previous abdominal surgery ($p = 0.483$) were comparable across

Table 1 Patient demographics

	Group 1: elderly+propofol	Group 2: elderly+conventional	Group 3: young+propofol	Group 4: young+conventional
Mean age, years (SD)	72 (5.5)	74 (5.8)	50 (9.8)	50 (11)
Number of procedures	37	36	77	65
Male (%)	16/31 (52)	18/34 (53)	23/54 (43)	23/52 (44)
Female (%)	15/31 (48)	16/34 (47)	31/54 (57)	29/52 (56)
Oral/antegrade route	27/37	30/36	65/77	53/65
Anal/retrograde route	10/37	6/36	12/77	12/65
Mean BMI, kg/m ² (SD)	27.5 (5.7)	26.6 (4.3)	27.4 (5.3)	25.8 (4.8)
ASA (SD)*	2.3 (0.9)	1.8 (0.8)	1.6 (0.6)	1.4 (0.8)
Cardiovascular disease (%)*	18 (49)	3 (8)	14 (18)	5 (8)
Previous abdominal surgery	15 (41)	14 (39)	39 (52)	33 (51)
Median HADS: Anxiety	6.8/21	4.8/21	5.8/21	6.5/21
Median HADS: Depression	5/21	4.6/21	4.1/21	4.3/21
Mean baseline discomfort (SD)	0.8 (2.0)	1.5 (2.6)	1.2 (2.0)	1.7 (2.6)
Mean baseline pain (SD)	0.2 (2.1)	1.2 (2.7)	1.1 (2.2)	1.5 (2.5)
Mean expected discomfort (SD)*	2.8 (3.2)	3.8 (2.8)	3.8 (3.2)	5.5 (2.5)
Mean expected pain (SD)*	2.0 (3.0)	3.3 (2.8)	3.5 (3.3)	5.4 (2.6)

*p <0.05

ASA, American Society of Anaesthesiologists classification; BMI, body mass index; HADS, Hospital Anxiety and Depression Scale.

all groups. ASA status was higher in elderly patients undergoing DBE with propofol-sedation (group 1) compared with the other groups. Cardiovascular disease (defined by the presence of ischaemic heart disease, cardiac valve replacement, atrial fibrillation and congestive cardiac failure) was more common in this cohort (p=0.0002). Respiratory, hepatic, renal comorbidity and diabetes in group 1 was seen in 21.6%, 8.1%, 21.6% and 27%, respectively. Hospital Anxiety and Depression Scale for anxiety (p=0.247) and for depression (p=0.753) were comparable across all groups. Baseline discomfort and pain were also similar (p=0.31 and 0.77, respectively).

Indications for DBE

Indications for DBE in the elderly (groups 1+2) and the young (groups 3+4) are illustrated in [table 2](#). DBE

was performed more commonly in elderly patients for suspected complications of coeliac disease (elderly vs young, 8.2% vs 0.7%, respectively, p=0.006) and in young patients for PJS (young vs elderly, 14.1% vs 0%, respectively, p=0.0003). There were no differences in the frequency of the other indications between the two subgroups otherwise.

Procedural data

[Table 3](#) summarises procedural data. The diagnostic and therapeutic yields were comparable among all four groups (p=0.056 and p=0.128, respectively). The mean sedation dose required, irrespective of propofol or midazolam/fentanyl, was significantly less in elderly compared with young patients; mean propofol use in elderly versus young, 12.4±4.1 mg/min versus 14.7±5.8 mg/min, respectively, p=0.041 ([table 4](#)). [Table 5](#) illustrates data from elderly patients of high and low ASA status. ASA status did not affect the rate of propofol in elderly patients (high ASA (class III/IV) vs low ASA (class I/II), 14±4.1 mg/min vs 14±5.9 mg/min, respectively, p=0.95). ASA status also had no influence on procedure duration (high ASA vs low ASA, 68±20 mins vs 74±25 mins, respectively, p=0.12).

DBE findings

All groups had comparable diagnostic yield. Analysis was also performed comparing all elderly (groups 1+2) versus all young (groups 3+4) patients ([table 6](#)). The diagnostic yield was significantly higher in the elderly compared with the young (75.3% vs 58.5%, respectively, p=0.0164). Therapeutic interventions were comparable among elderly and young patients

Table 2 Indications for DBE in the elderly (groups 1+2) versus young (groups 3+4)

Indication	Elderly	Young
Occult OGIB (%)	37 (50.7)	60 (42.3)
Overt OGIB (%)	13 (17.8)	17 (12.0)
Suspected Crohn's disease (%)	14 (19.2)	37 (26.1)
Indication abnormal radiology (%)	3 (4.1)	6 (4.2)
Suspected small bowel tumour without IDA (%)	1 (1.4)	6 (4.2)
PJS (%)*	0 (0)	20 (14.1)
Suspected coeliac disease complication (%)*	6 (8.2)	1 (0.7)

*p <0.05

IDA, iron deficiency anaemia; OGIB, obscure gastrointestinal bleeding;

PJS, Peutz-Jeghers syndrome.

Table 3 Procedural data

	Group 1: elderly+propofol	Group 2: elderly+conventional	Group 3: young+propofol	Group 4: young+conventional
Procedural time, mins (SD)*	73.3 (21.7)	64.4 (19.1)	77.6 (25.2)	70.7 (25.3)
Depth of insertion, cm (SD)	145.2 (50.2)	149.7 (54.6)	153.0 (57.3)	146.3 (61.1)
Diagnostic yield (%)	30 (81.1)	25 (69.4)	44 (57.1)	38 (58.5)
Therapeutic yield (%)	17 (45.9)	14 (38.9)	30 (39.0)	16 (24.6)
Complications (%)	0 (0)	1 (2.8)	0 (0)	0 (0)
Mean pain score (SD)*	0 (0)	3.0 (3.0)	0.2 (0.6)	4.3 (3.4)
Mean discomfort score (SD)*	0 (0)	2.7 (2.7)	0.2 (0.8)	4.7 (3.4)
Mean distress score (SD)*	0.1 (0.5)	2.3 (2.9)	0.1 (0.6)	3.4 (3.3)

*p < 0.05

(42.5% vs 32.4%, $p=0.18$). Argon plasma coagulation (APC) for angiodysplasia in the elderly was more common compared with the young (32.9% vs 18.3%, respectively, $p=0.026$). No statistically significant difference was seen in polypectomy rates (6.8% vs 13.4%, $p=0.176$). Balloon dilatation of a stricture was performed in one elderly patient. Hemoclip was deployed to control a bleeding ulcer in a young patient.

Tolerance

Pain, discomfort and distress scores (table 3) were less in those groups receiving propofol (groups 1 and 3) compared with those receiving conventional sedation (groups 2 and 4) ($p<0.05$ for all parameters). Patients' expectations of discomfort and pain from DBE were also significantly less in those receiving propofol sedation (both $p<0.05$).

Safety

Overall, one significant complication and 10 minor adverse reactions were seen. There were no significant complications in elderly patients receiving propofol. One elderly patient receiving standard sedation sustained a myocardial infarction postprocedure. This patient who had been referred from a different region, had critical triple vessel disease which was previously unknown and required an inpatient coronary artery bypass graft. Despite this, a statistically significant difference in complications between the four groups was not seen ($p=0.17$). Adverse reactions that required simple conservative measures were seen in the other groups. In elderly patients receiving propofol, there were two cases of transient hypoxaemia requiring an

increase in supplemental oxygen. Three cases of transient bradycardia were also seen. One patient, with a background of lymphoma, received glycopyrrolate for an episode of bradycardia while the rest did not require treatment. Young patients receiving propofol reported four cases of transient hypoxaemia with one of these cases also developing bronchospasm with an underlying diagnosis of chronic obstructive pulmonary disease (COPD). All cases responded appropriately to uptitrating oxygen supplementation. The patient with COPD received nebulisers and hydrocortisone. One young patient receiving standard sedation experienced transient hypotension that spontaneously resolved without intervention. None of these adverse reactions required any additional significant management or premature termination of DBE.

DISCUSSION

There is growing interest in propofol-assisted endoscopy. Advanced endoscopic procedures are highly effective under propofol sedation, with completion rates very nearly reaching 100%.^{26 27} Moreover, the use of propofol in endoscopy has been reported as safe in a recent meta-analysis of over 2500 patients.²⁸ Similar rates of cardiopulmonary adverse events were reported in those receiving propofol when compared with traditional sedation. During complex endoscopy, the frequency of hypoxaemia, hypotension and arrhythmias were still similar in both groups. With DBE, studies have assessed the safety of performing procedures under traditional sedation (with midazolam with/without fentanyl or pethidine)^{29 30} as

Table 4 Comparison of sedation between elderly and young patients

	Elderly patients	Young patients
Mean propofol rate, mg/min (SD)*	12.4 (4.1)	14.7 (5.8)
Mean midazolam dose, mg (SD)*	4.5 (2.1)	6.6 (2.3)
Mean fentanyl dose, mcg (SD)*	84.7 (46.5)	124.7 (48.7)

*p < 0.05

Table 5 Propofol use and procedure duration in elderly patients according to ASA

	Elderly patients with high ASA (class III/IV)	Elderly patients with low ASA (class I/II)
Mean propofol rate, mg/min (SD)	14 (4.1)	14 (5.9)
Procedural time, mins (SD)	68 (20)	74 (25)

ASA, American Society of Anaesthesiologists classification.

Table 6 Findings at DBE for the elderly (groups 1+2) versus young (groups 3+4)

Findings	Elderly	Young
Normal examination (%)*	18 (24.7)	59 (41.5)
Abnormal examination (%)*	55 (75.3)	83 (58.5)
Small bowel tumour (%)	4 (5.5)	6 (4.2)
Angioectasia (%)	23 (31.5)	26 (18.3)
Ulcers (%)	13 (17.8)	14 (9.9)
Stricture (%)	5 (6.8)	7 (4.9)
Fresh blood with no other abnormality found (%)	1 (1.4)	1 (0.7)
Changes of coeliac disease	5 (6.8)	1 (0.7)
PJS polyp (%)*	0 (0)	17 (12.0)

*p < 0.05

PJS, Peutz-Jeghers syndrome.

well as with propofol.³¹ In many European countries, complex gastrointestinal endoscopy is routinely performed under propofol sedation, with or without the assistance of an anaesthetist. Recent meta-analyses support this tactic,^{32 33} including in advanced procedures such as endoscopic retrograde cholangiopancreatography (ERCP), endoscopic ultrasound and DBE. In fact in ERCP, propofol-sedation has been demonstrated to be comparably safe to midazolam-sedation³⁴ with a shorter recovery time.³⁵ Yet specific literature on propofol-assisted DBE safety in the elderly population remains sparse.

In a small study that incorporated adult patients of all ages, propofol-assisted DBE was safe when compared with standard sedation. However, the safety in elderly patients specifically was not evaluated.²² Byeon *et al* have demonstrated that propofol-assisted DBE can be safe in the elderly in a large single-centre study, but no comparison with conventional sedation was made in this retrospective analysis.³¹ Thus, existing isolated papers appraising the safety of DBE in the elderly have either not analysed data regarding sedation type^{36 37} or focused on just one sedation approach such as propofol without comparison to controls.³¹

Here, we present for the first time data that support the safety of propofol-assisted DBE in the elderly when compared with those receiving midazolam and also compared with the young. There was no statistically significant difference in complications. The only significant complication seen in this study was in an elderly patient receiving midazolam who developed an acute myocardial event. The remaining minor adverse reactions observed were successfully managed conservatively. Thus, our data suggest that propofol-assisted DBE in elderly patients is as safe as that for young patients. This is despite this cohort being burdened with a higher prevalence of cardiovascular disease and higher ASA grade. This is akin to the general literature in endoscopy: propofol sedation is safe.^{28 32}

DBE in the elderly further demonstrates several advantages. First, the diagnostic yield is higher in elderly patients compared with the young, 75.3% vs 58.5% (p=0.016). This is similar to data presented by Hegde *et al*³⁶ as well as from this institute,²⁹ although a statistically significant difference was not previously demonstrated. The high diagnostic yield in the elderly is also in keeping with previously quoted figures. These preceding studies involved elderly patients of a similar age and demonstrated diagnostic yields ranging from 55.7% to 78.6%.^{10 31 36–38} Furthermore, as previously recognised,^{31 36–38} angioectasia was the most common pathology identified in the elderly in our series.

The therapeutic yield overall in the elderly was comparable to younger patients. Of note, APC for angioectasia was performed more in elderly than young patients; thus positively affecting management more in the former. One limitation of the study is the lack of long term follow-up of patients to assess the true impact of DBE and APC on their transfusion requirement. Studies involving patients of all ages suggest that there is some long-term benefit in reducing rebleeding rates.^{39 40} Byeon *et al* suggested the benefit of DBE in avoiding invasive surgery in the elderly.³¹ The higher risk of surgical intervention in patients with an advanced ASA status is well described.^{41 42} This is particularly relevant to our study where ASA status was higher in elderly patients undergoing propofol-assisted procedures.

Propofol rates were less in the elderly compared with the young, but ASA status did not affect the dose of propofol in our study. Bispectral index monitoring may play a role in accurately measuring sedation depth during endoscopy. A recent meta-analysis has suggested that BIS may appropriately avoid unnecessary usage of excess propofol in endoscopy¹⁸ which may be useful in patients with a higher ASA status. The tolerance for DBE is also worthy of mention. Previous studies on DBE in elderly patients focus on procedural effectiveness and safety as their main outcomes. Yet insight into patient tolerance is lacking. In our study, patients undergoing propofol-assisted procedures both expected and experienced less pain, discomfort and distress compared with those undergoing conventional sedation. This resonates with data published on the use of propofol during other forms of complex gastrointestinal endoscopy.^{21 43} Our data encourage propofol sedation in the future, as patients (both elderly and young) may find the procedure more acceptable. In the current climate where patient-centred care and experience shapes the way we structure services, this is particularly relevant.⁴⁴

There are limitations to our study. This was a cohort study whereby sedation method was initially decided by the expected duration or complexity of the procedure. In 2013, a departmental decision was made to perform all DBEs under propofol sedation. The two modes of sedation (conscious vs deep) were then

compared, providing an advantage over preceding studies that only examined one sedation method.^{31 36} Nevertheless, a randomised control study would carry more weight and should be undertaken in the future. This would avoid the selection bias associated with choice of sedation, often seen in clinical endoscopic practice.

An inherent drawback to the study also lies in the variability between two types of sedation provided by two forms of expert (anaesthetic and gastroenterology) and interoperator differences in DBE technique; this may influence outcomes. The former issue, in fact, reflects current practice in the UK. However, there is interest in non-anaesthetist-administered propofol-sedation (NAAP). Future studies comparing NAAP with conventional sedation (delivered by the endoscopist) will avoid the difference in the approach to sedation by anaesthetists and gastroenterologists. Interoperator variability in DBE technique was not analysed. DBE technique and experience can influence outcomes.^{45 46} However, it is reassuring to see that no statistically significant difference was seen in the hard end points (diagnostic and therapeutic yield and complications)

between the four groups. Future studies may benefit from a subgroup analysis of operators.

There are advantages to our study. First, it was a prospective study. A novel comparison between elderly and young patients as well as sedation type was made in tandem. Thus, statements claiming safety of propofol-assisted DBE in the elderly are made in the presence of comparative analysis with younger cohorts. Higher ASA status in elderly patients did not translate into more frequent complications in keeping with the findings of Byeon *et al*³¹

Finally, we demonstrate the feasibility of providing an anaesthetic-led propofol-based DBE service outside the theatre environment. In the UK, propofol can only be delivered by a trained anaesthetist. In other centres in Europe and the USA, however, this practice differs with the ability of endoscopists to administer propofol. In fact, there is growing interest in NAAP,⁴⁷ which has been shown to be safe in colonoscopy in the endoscopy suite.⁴⁸ The feasibility and safety of nurse-led deep sedation for endoscopy have also been demonstrated.^{26 49} NAAP in advanced endoscopy appears to be safe.^{26 50} However, propofol-assisted advanced endoscopic procedures are largely performed in the theatre and may impose unnecessary strain on theatre services as well as adding to the cost of the procedure. Our study is novel in demonstrating the feasibility of delivering propofol-assisted DBE outside of the theatre, in a dedicated endoscopy suite.

Key messages

What is already known on this topic?

- ▶ The published literature on the safety of double balloon enteroscopy (DBE) in elderly patients is sparse.
- ▶ Isolated studies have either omitted details on intraprocedural sedation type or focused on just one, such as propofol, without comparison to control.
- ▶ Thus, whether elderly patients are subject to greater risk from propofol-assisted DBE remains unclear.

What this study adds?

- ▶ We conducted a large prospective study involving 215 procedures, comparing the elderly and young with different sedation types.
- ▶ Our results provide novel evidence that elderly patients can safely undergo propofol-assisted DBE with higher diagnostic yield compared with young patients.
- ▶ High American Society of Anaesthesiologists class (III/IV) in the elderly should not automatically deter attempts at DBE under propofol sedation.

How might it impact on clinical practice in the foreseeable future?

- ▶ DBE in elderly patients should be performed under propofol-sedation. It is well tolerated and the risk of the procedure is no more than seen with conventional sedation.
- ▶ The UK should embrace a propofol-based approach to DBE, already adopted by neighbouring European and worldwide countries.

CONCLUSION

Endoscopic procedures in the elderly are increasingly common.⁵¹ Our study suggests that propofol-assisted DBE in the elderly has higher diagnostic efficacy and comparable therapeutic yield against young patients. It is also better tolerated than conscious sedation. The presence of higher ASA grade should not deter consideration for DBE as we have shown that it can be safe. Clinical judgement towards overall performance status remains significant. However, advanced age should not be used as a reference point to deprive elderly patients of the benefits of DBE under deep sedation.

Contributors RS designed the study, assisted with interpretation of results and critically appraised the manuscript. H-LC performed data collection, led the analysis of data and drafted the manuscript. FB, DSS and DT performed data collection and critically appraised the manuscript. All authors approved the final manuscript. H-LC is guarantor.

Competing interests None declared.

Ethics approval The study was registered and approved as service evaluation with the Clinical Effectiveness Unit, Sheffield Teaching Hospitals NHS Foundation Trust (registration number 7073).

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