

Sedation for upper gastrointestinal endoscopy: results of a nationwide survey

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Abstract

A postal questionnaire inquiring about routine sedation and premedication practice for upper gastrointestinal endoscopy was sent to 1048 doctors. Of 665 appropriate returns, 81% were from consultant physicians and surgeons. Most endoscopists (90%) reported using an intravenous benzodiazepine for at least three quarters of endoscopies and 54% of physicians and 69% of surgeons always did so. Midazolam was the intravenous sedative used by a third of all respondents and 13% also used an additional intravenous agent, usually pethidine. Over the previous two years a total of 119 respiratory arrests, 37 cardiac arrests, and 52 deaths were identified. Adverse outcomes were reported more frequently by consultant physicians, by those who 'titrated' the intravenous sedative, and by those who used an additional intravenous agent, but were reported equally frequently by endoscopists using midazolam and endoscopists using diazepam. There is an urgent need for a prospective study to identify the circumstances and risk factors associated with adverse outcomes related to endoscopy.

Gastrointestinal endoscopy is now widely available in Britain and is generally safe. On the basis of figures from the Trent region we estimate that about 400 000 are performed yearly in Britain.¹ Endoscopy is increasingly carried out on the 'old' and the very sick. Most endoscopies are performed using intravenous sedation with a benzodiazepine which can occasionally produce severe hypoventilation and hypoxia.²⁻⁶ Adverse outcomes of endoscopy are uncommon but fatalities occur, as noted in several recent reports.⁷⁻¹⁰ In the United States 66 deaths after sedation with intravenous midazolam have been reported to the Federal Drug Administration and the Committee on Safety of Medicines has received similar reports.¹¹

The pattern of premedication and sedation currently in use in Britain is largely unknown. There is also little information about the frequency of adverse outcomes associated with endoscopy. The aim of this study was to establish the pattern of current practice and to make a preliminary estimate of the frequency of adverse outcomes and their possible association with the use of particular drugs.

Methods

We sent an anonymous questionnaire to 1048 doctors who were identified as endoscopists from the mailing list of one of the major suppliers of endoscopy equipment in the United Kingdom

(KeyMed Ltd). The questionnaire and covering letter were mailed by KeyMed in September 1988, and completed questionnaires were returned to the Department of Community Medicine and Epidemiology. If no reply had been received by November 1988 a second questionnaire was sent by KeyMed.

The questionnaire was contained on two sides of an A4 sheet and consisted of 10 questions (Table I). Although the questionnaires were designed to be self coding, all completed questionnaires were inspected for inconsistencies and coding errors before being included on the data file. Missing or unclear responses to questions were coded as missing. The data were checked by double entry key punching and by checking extreme values against the relevant returned questionnaires.

Results

By December 1988, 676 questionnaires had been returned. In 11 the respondents stated that they had either stopped performing endoscopy or performed all endoscopies under general anaesthesia. Thus 665 questionnaires were suitable for analysis. A further 20 questionnaires were returned too late to be included in the analysis.

GRADE AND SPECIALTY AND NUMBER OF ENDSOCOPIES PERFORMED

As Table II shows, 81% of respondents were consultants in surgery or general medicine, including gastroenterology. The number of respondents in junior hospital posts in medicine and surgery respectively was so small that they have been combined according to status or specialty. Consultant physicians reported doing more endoscopies than consultant surgeons, and this was mirrored by the junior doctors in medicine, of whom 69% reported performing more than 30 endoscopies in the previous month compared with 25% of junior surgeons.

PREMEDICATION AND SEDATION

Table I shows the overall pattern of routine practice reported; 63% of respondents used a local anaesthetic for the oropharynx for most endoscopies and 23% also used an anticholinergic agent routinely. There were small differences in practices reported by the various groups. Consultant and junior surgeons tended to use hyoscine butylbromide (Buscopan) (14%) rather than atropine (7%), whereas consultant and junior physicians showed no preference. More consultant and junior surgeons (69%) reported always using intravenous sedation than other groups (54%) ($\chi^2=13.2$, $p<0.001$) but

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TABLE I Survey of sedation and premedication practice for upper gastrointestinal endoscopy

The purpose of this short questionnaire is to determine what are the patterns of standard practice in the UK and assess the frequency of any adverse outcomes. If you have other staff doing endoscopy under your supervision and who have not received a questionnaire, please give them the spare copy or a photocopy to complete. All questionnaires are anonymous. Please would you fill in the boxes with the appropriate response

<i>Please fill in box with appropriate code</i>											
1. Your present grade/status is:											
1	Cons Phys/Gastroenterologist	42%	5	Reg/SHO in Medicine	2%						
2	Cons Surgeon	39%	6	Reg/SHO on Surgery	3%						
3	SR/Lecturer in Medicine/GE	4%	7	Clin Assistant/GP	3%						
4	SR/Lecturer in Surgery	3%	8	Other (state)	3%	<input type="checkbox"/>					
2. How many upper GI endoscopies (including oesophageal dilations but not intubation or ERCP) did you or other staff under your supervision do in the last month?											
1	Less than 5	8%	4	31-45	19%	7	76-100	5%	Yourself <input type="checkbox"/>		
2	6-15	23%	5	46-60	11%	8	more than 100	4%	Others <input type="checkbox"/>		
3	16-30	26%	6	61-75	4%						
<i>Subsequent questions relate to your own practice</i>											
3. Do you give a local anaesthetic for mouth and pharynx?											
1	Yes, always	49%	3	Yes, occasionally	16%						
2	Yes, usually	14%	4	Never	20%	<input type="checkbox"/>					
4. Do you use an anticholinergic agent routinely?											
1	Yes, atropine	9%	3	Yes, other	1%						
2	Yes, Buscopan (hyoscine butylbromide)	13%	4	No	77%	<input type="checkbox"/>					
5. Sedation											
(a) Do you use intravenous sedation for your upper endoscopies?											
1	Yes, always	62%	4	Yes, no more than 1/3	6%						
2	Yes, more than 3/4	28%	5	None	2%						
3	Yes, about a half	2%	<input type="checkbox"/>								
(b) If YES, is it											
1	Diazepam	5%	4	Droperidol	0%						
2	Diazemuls	59%	5	Other (please state)	1%	<input type="checkbox"/>					
3	Midazolam	34%									
(c) Do you routinely use other intravenous drugs in conjunction with those mentioned in 5(b)?											
1	Yes	13%	2	No	87%	<input type="checkbox"/>					
(d) If YES, is it											
1	Pethidine	55%	2	Other (state)		<input type="checkbox"/>					
(e) How are intravenous drugs given?											
1	As a bolus	36%	2	Titrated	63%	<input type="checkbox"/>					
(f) For how long has this been your routine practice?											
1	Less than 1 year	2%	2	More than one year	98%	<input type="checkbox"/>					
6. How often have your patients needed oxygen during or after endoscopy?											
1	Never	41%	3	3-8 times a year	9%						
2	Once or twice a year	48%	4	About monthly or more often	2%	<input type="checkbox"/>					
7. In the past 2 years, as far as you (or your nursing staff) can recall, how many patients have suffered the following during or shortly after endoscopy? (Put numbers in boxes or 0 if nil)											
										% Reporting at least one	
1	Severe hypoventilation requiring oxygen					40%	<input type="checkbox"/>				
2	Respiratory arrest requiring resuscitation but short of cardiac arrest					14%	<input type="checkbox"/>				
3	Cardiac arrest					5%	<input type="checkbox"/>				
4	Death (only those where endoscopy may have contributed)					7%	<input type="checkbox"/>				
8. In the past 2 years, how many times have you or the nursing staff called the cardiac arrest team for one of the above?											
										5%	<input type="checkbox"/>
9. In the past years do you know of any patients being endoscoped by others in your hospital who have suffered a respiratory or cardiac arrest or death?											
1	Yes, 1 or 2	34%	3	Yes, 5 or more	0.3%						
2	Yes, 3-4	6%	4	No	60%	<input type="checkbox"/>					
10. Any comments about your own practice or experience of adverse outcomes?											

agents ($\chi^2=1.3, p>0.1$). A slightly greater proportion of consultant and junior surgeons gave intravenous drugs as a bolus compared with consultant and junior physicians (41% v 34%; $\chi^2=2.1, p>0.1$).

ADVERSE OUTCOMES REPORTED

The overall frequency of adverse outcomes reported is given in Table III. A total of 52 deaths was reported by 48 respondents, of whom four reported two deaths each. A further 119 respiratory arrests and 37 cardiac arrests were also reported. Most endoscopists (59%) said that they had patients who needed supplementary oxygen at least once a year: 40% could recall having patients in the previous two years with severe hypoventilation and 11% of endoscopists recalled that this occurred on three or more occasions.

The frequency of adverse outcomes was analysed in terms of the grade and specialty of the respondents, number of endoscopies performed, type of intravenous sedation used, use of additional sedation, and whether sedation was given as a bolus or titrated according to effect. Consultant physicians reported more adverse outcomes than other groups (Table III). This was accounted for in part by the greater number of endoscopies they reported performing. Although there was a tendency for adverse outcomes to be more commonly reported as the number of endoscopies increased, this trend was mainly due to the much lower frequency of adverse outcomes reported by endoscopists doing fewer than 15 endoscopies in the previous month (Table IV).

The type of intravenous benzodiazepine used seemed to be unrelated to the frequency of adverse outcomes being reported equally often by users of diazepam and midazolam (Table V).

Those who 'titrated' sedation more frequently reported adverse outcomes than those who gave intravenous sedation as a bolus injection. Episodes of severe hypoventilation were reported by 47% of those who titrated sedation compared to 37% of those who gave a bolus injection ($\chi^2=5.1, p<0.05$).

Adverse outcomes were reported more frequently by respondents who used other intravenous sedation, usually pethidine, in addition to a benzodiazepine (Table V). Of the 82 respondents who used other intravenous sedation, 43 (52%) reported having patients with severe hypoventilation compared with 223 (40%) of the 557 respondents not using other intravenous sedation ($\chi^2=4.5, p<0.05$).

Comments about their own practice or experience of adverse outcomes were added by 301 respondents. These mainly consisted of accounts of adverse outcomes usually in patients with cardiorespiratory disease or comments on the rarity of problems. Ten respondents commented on problems associated with joint use of pethidine and a benzodiazepine. Thirty nine respondents commented on their experience with midazolam compared with diazepam. Of these, 17 commented favourably about its safety and amnesic effect. Thirteen respondents, 10 of whom used midazolam routinely, cautioned

the proportion who used sedation for up to half of endoscopies was similar in all groups. Midazolam was used by about a third of respondents in all groups except for clinical assistant and general practitioner endoscopists, of whom 10 of 17 used midazolam. Ten per cent of consultant and junior physicians compared to 14% of surgeons reported using additional intravenous

TABLE II *Reported number of endoscopies performed in previous month according to grade and speciality*

No of endoscopies	Consultant (%)		Senior registrars or lecturers (%) (n=48)	Registrars or senior house officers (%) (n=33)	Others (%) (n=37)	Total (%) (n=625*)
	Physicians (n=261)	Surgeons (n=246)				
<5	5	10	10	6	14	8
6-15	15	35	10	30	14	23
16-30	23	29	25	24	27	26
31-45	23	13	23	18	32	19
46-60	16	4	21	6	11	11
61-100	13	6	10	9	3	9
>100	7	3	0	6	0	4

*For 40 information about status or number of endoscopies was missing.

TABLE III *Adverse outcomes reported by grade and speciality of respondents*

	Consultant physicians (n=268) (%)	Consultant surgeons (n=249) (%)	Junior physicians (n=42) (%)	Junior surgeons (n=40) (%)	Others (n=38) (%)
Severe hypoventilation	52	30	57	33	37
Respiratory arrest	23	6	12	5	16
Cardiac arrest	9	0	7	3	11
Death	12	3	2	5	11

about difficulties in elderly and frail patients and the need for small doses, and nine respondents who reported using Diazemuls routinely added comments about a tendency to oversedate with midazolam.

Discussion

This survey was carried out to establish the pattern of routine premedication and sedation practice and to make a preliminary assessment of the frequency of adverse outcomes. The number of doctors approached and their response rate need to be considered in the light of these objectives. As expected, the sample was heavily weighted in favour of consultants. Although we omitted to ask doctors who did not do upper gastrointestinal endoscopy to return their questionnaires, some did return them indicating this and we suspect that many unreturned questionnaires were sent to doctors who did not do endoscopy. Nevertheless, the number of replies was sufficiently large that we think at least half and possibly three quarters of all consultants who do regular endoscopy responded. There is no reason to think that non-response has biased our assessment of what is routine premedication and sedation practice by consultants. It also seems unlikely that the practice of their junior hospital staff would be appreciably different.

The survey has established that in general premedication and sedation practice is fairly uniform. Over 90% of respondents use an intravenous benzodiazepine, mostly with local oropharyngeal anaesthesia but no other intravenous drugs. A few, however, reported

routinely using other intravenous sedatives as well, usually pethidine, and these endoscopists also reported having more patients who required oxygen for hypoventilation. Taken together with the spontaneous comments we received, this supports the view that the use of pethidine for sedation for endoscopy is relatively hazardous. We found no evidence that adverse outcomes were more frequently experienced by respondents who used midazolam, but there were sufficient anecdotal statements to suggest that further study is necessary. Our finding that adverse outcomes were more frequently reported by consultant physicians and by those who 'titrate' sedation dose compared to those who give a bolus dose probably reflects differences in the characteristics of the respondents or a more cautious approach based on past experience rather than a causal relation.

As expected, severe hypoventilation was the most frequently reported adverse outcome. Recognition and recall of such episodes is likely to be more variable than for other outcomes to the extent that some might question whether they should be classified as adverse outcomes at all. Hypoventilation is likely to result in a degree of hypoxia, which in a small proportion of endoscopies is severe.^{5,6} Although the hypoxia is usually of no clinical relevance, the cardiac arrhythmias often observed during endoscopy occur most frequently during periods of maximum oxygen desaturation.^{5,12,13} We suspect, therefore, that sedation practices that are more frequently associated with episodes of severe hypoventilation are also more likely to be associated with more serious adverse outcomes.

As far as the frequency of adverse outcomes is concerned, the reliability of retrospective statements, usually made without the help of records, are obvious. Nevertheless, we think it unlikely that such assessments will greatly inflate the number of such events, particularly the number of deaths. Our respondents recalled a total of 52 deaths over the past two years. From the estimates given of the number of endoscopies performed a month this represents a mortality of one in every 7500 to 11 000 endoscopies. It is possible that some deaths have been counted more than once by endoscopists working in the same unit. On the other hand, the underrepresentation of training grades in our respondents may have reduced the numbers reported. Consequently, this estimate must have fairly wide confidence limits. We suspect that the true figure may be as high as 100 or as low as 25 a year.

We did not seek to record the circumstances and patient details for those who died or had other cardiorespiratory complications during or after endoscopy. It is evident, however, that the

TABLE IV *Endoscopists' reporting of adverse outcomes by number of endoscopies performed*

	Reported No of endoscopies performed in previous month								
	<5 (n=49) (%)	6-15 (n=145) (%)	16-30 (n=161) (%)	31-45 (n=119) (%)	46-60 (n=69) (%)	61-75 (n=27) (%)	76-100 (n=29) (%)	>100 (n=26) (%)	Total (n=625) (%)
Severe hypoventilation	13	25	47	52	51	50	55	44	41
Respiratory arrest	2	6	20	13	14	26	31	15	14
Cardiac arrest	2	2	6	7	9	4	10	0	5
Death	4	5	7	7	10	22	17	4	8

TABLE V Percentage of respondents reporting adverse outcomes in previous two years by type and method of intravenous sedation routinely used

Adverse outcome	Diazepam/ Diazemuls (n=397) (%)	Midazolam (n=215) (%)	Bolus (n=195) (%)	Titrated (n=343) (%)	No other intravenous sedation (n=557) (%)	Other intravenous sedation (n=82) (%)
Severe hypoventilation:						
At least 1 episode	42	42	37	47	40	52
2 episodes	13	15	11	17	12	18
3 or more episodes	11	11	11	12	12	18
Respiratory arrest	14	14	15	16	14	18
Cardiac arrest	4.8	5.6	4.6	5.8	4.8	6.1
Death	7.5	7.5	6.1	8.5	7.0	8.5

number of deaths and other complications reported are sufficient to merit prospective study to identify individual circumstances and risk factors associated with an adverse outcome.

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