Gut, 1992, 33, 973–975

Does nasal oxygen reduce the cardiorespiratory problems experienced by elderly patients undergoing endoscopic retrograde cholangiopancreatography?

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Abstract

Elderly patients undergoing endoscopic retrograde cholangiopancreatography (ERCP) have an increased risk of sedation related complications during the procedure. To determine whether nasal oxygen supplementation (2 l/min) reduces these risks, half of 66 patients aged over 60 undergoing ERCP using minimal midazolam sedation alone were randomised to receive nasal oxygen. The arterial oxygen saturation and pulse rate of all patients were monitored by pulse oximetry before and during the procedure. Only three patients in the oxygen supplemented group (n=33) required any form of intervention for hypoxia compared with six in the control group (n=33). Comparison of mean arterial oxygen saturation between the groups showed significantly higher levels in the nasal oxygen group throughout the procedure. Pulse rate comparisons showed no significant difference from control group values, both groups had short periods of significant tachycardia. We conclude that minimal sedation with midazolam alone still produces hypoxia during ERCP in a substantial number of elderly patients. Nasal oxygen supplementation increases the level of patient oxygenation and reduces the need for intervention, but does not reduce tachycardia in the elderly patient. Because hyoscine may be a significant factor contributing to the tachycardia, sparing rather than routine use of this agent is advisable.

Hypoxia, as reflected by reduced arterial oxygen saturation (SaO_2), is a common occurrence during upper gastrointestinal endoscopy using benzodiazepine sedation[1-5] and is exacerbated by the coadministration of narcotic agents.[6,7] Endoscopic retrograde cholangiopancreatography is more likely to be associated with hypoxia as this procedure is often of longer duration; a combination of sedatives is often used and many patients have underlying cardiorespiratory disorders.

Those patients most at risk when undergoing ERCP are the elderly, and previous workers have shown that age is a predisposing factor to hypoxia during ERCP when narcotic agents are used in conjunction with benzodiazepine sedation.[5,8] The problem of hypoxia during endoscopy in the elderly has not been addressed since the work of Rozen[6] almost a decade ago before reliable methods of non-invasive arterial oxygen saturation measurement were readily available. Rozen reported hypoxia and recommended that narcotics should not be used for gastrointestinal endoscopy in the elderly. More recent studies have recommended that nasal oxygen be used for elderly patients[7,9] or for patients in general.[5,10] Cardiorespiratory problems, mostly sedation related, have been reported to be the most common complication of upper gastrointestinal endoscopy.[11] This prospective study was designed to investigate changes in SaO_2 and pulse rate in the minimally sedated elderly patient undergoing ERCP without narcotic premedication, and to assess the benefit if any of nasal oxygen administration.

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Accepted for publication 28 November 1991

Methods

PATIENTS

In a prospective trial, fully informed consent was obtained from 66 consecutive patients aged over 60 years who were then randomised to undergo ERCP with or without nasal oxygen (2 l/min). All patients were sedated with a bolus dose of midazolam (2–5 mg) and received 40 mg hyoscine butylbromide (Buscopan) intravenously before the procedure. No analgesic agents were administered. Endoscopic retrograde cholangiopancreatography was performed with an Olympus TJF duodenoscope and all examinations were done by one investigator (JRBG).

The SaO_2 and pulse rate of patients was monitored by pulse oximetry (Ohmeda Biox 3700e with reusable finger probe). Continuous recordings were made before the procedure and throughout the examination to provide baseline values. To ensure SaO_2 readings were valid in jaundiced patients, selected patients also had SaO_2 determined by arterial blood gas analysis. SaO_2 and pulse rate data were analysed by two methods. In the first method, data were analysed against set criteria for hypoxia and tachycardia. The number of patients in each group who exceeded these criteria was recorded. For hypoxia and tachycardia respectively, the criteria were summated SaO_2 readings 10% or more below baseline for at least one minute and summated pulse rate readings of 40 beats per minute (bpm) or more above baseline for at least five minutes. In the second method, procedural SaO_2 and pulse rate values were related to presedation values to give relative changes for each patient. The mean change in SaO_2 and pulse rate was then calculated for each patient at two minute intervals throughout the procedure and the readings obtained from each group compared. Data from patients in the control group requiring oxygen during the procedure were excluded from the point where relative SaO_2

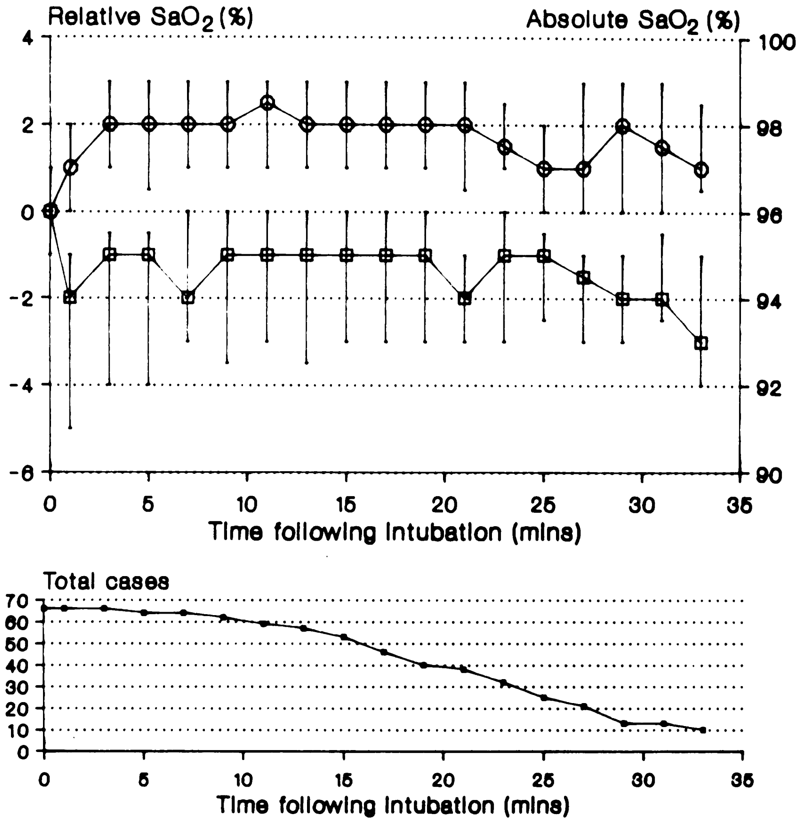

Figure: Median procedural arterial oxygen saturation (SaO_2), relative to presedation values (time 0) and in absolute terms, with interquartile range for control (-⊟-, n=33) and oxygen treated (-⊖-, n=33) groups. Number of cases remaining at each time point indicated.

levels became positive. A simple paired comparison of mean pulse rate data obtained immediately before and during the procedure was also carried out.

All data sets obtained were initially analysed to determine whether data were normally or abnormally distributed. Normally distributed data were analysed by one way analysis of variance or paired t test and abnormally distributed data by Wilcoxon's rank-sum test.

TABLE I *Patient data*

		Oxygen group (n=33)	*Control group (n=33)*
Gender:	Male	17	14
	Female	16	19
Age (yr):	Median	71	79
	Range	60–88	62–97
Bilirubin (μmol/l):	Median	105	130
	Range	7–440	7–488
Midazolam (mg):	Median	3·0	3·0
	Range	2–5	2–5
ERCP duration (min):	Median	23·2	23·0
	Range	7–63	8–52
Procedure:	Therapeutic	16	15
	Diagnostic	17	18

TABLE II *Number and percentage of patients in each group whose SaO_2 fell below 90% with duration of episode given as median value with range in minutes and seconds*

SaO_2 values less than those below	*Controls (n=33)*		*Oxygen treated (n=33)*	
	n (%)	*Duration Min (s)*	*n (%)*	*Duration Min (s)*
90%	15 (45%)	2·00 (0·24–7·24)	2 (6%)	1·06 (0·12–2·00)
85%	6 (18%)	1·48 (0·24–4·48)	1 (3%)	0·36
80%	4 (12%)	1·06 (0·24–2·36)	0	
75%	1 (3%)	0·24	0	

TABLE III *Comparison of mean pulse rates (95% confidence intervals) before sedation and during ERCP for each patient group*

	Preprocedure	*During procedure*	*Significance of difference*
Controls (n=33)	79 (6)	102 (6)	*
Oxygen treated (n=33)	91 (5)	115 (5)	*

*p<0·00001 when compared by paired t test

Results

Both the control and oxygen treated groups were similar in age, gender, bilirubin level, type and length of procedure and dose of midazolam, and proved not to be significantly different when compared by Wilcoxon's rank-sum test (Table I). The SaO_2 values of four patients (bilirubin range 18–457 μmol/l) were almost identical when determined by blood gas analysis (mean 94%, range 91·2–97·5%) or by pulse oximetry (mean 93%, range 91–95%). Interventions of varying intensity were necessary in six patients of the control group and three patients in the nasal oxygen group, but the procedure was completed successfully in all cases except one. Further information on patients whose SaO_2 levels fell below 90% is provided in Table II. Analysis of SaO_2 data showed the number of patients exceeding the set criteria of hypoxia in the control and oxygen treated groups were eight and one respectively. Comparison of relative changes in SaO_2 by Wilcoxon's rank-sum test showed the oxygen treated group to have significantly higher ($p<0·01$) SaO_2 readings at all times until the total number of patients fell to less than 10 because of procedure completion (Figure). Analysis of the relative pulse rate data showed no difference between the two groups. Seven cases in the control group and eight cases in the oxygen treated group exceeded the tachycardia criteria. Similarly the comparison of relative pulse rate values showed no significant differences between the two groups when compared by Wilcoxon's rank-sum test. The simple comparison of mean pulse rate data from before sedation and during the procedure showed both groups experienced a similar degree of tachycardia during the procedure (Table III). For reasons which were not readily apparent the oxygen treated group showed a significantly higher mean pulse rate value than the control group before the procedure.

Discussion

Pulse oximetry using the Ohmeda system was shown to produce valid SaO_2 readings even in highly jaundiced patients although readings obtained were approximately 1% below those of invasive arterial blood gas analysis. The range of bilirubin levels in the patients studied in this way encompassed almost the entire range of the control and oxygen treated groups. There was no indication that increasing jaundice increased the difference between the two methods of SaO_2 analysis.

In the control group, 18% of patients required intervention varying from verbal encouragement to breathe, to the administration of oxygen.

Although the requirement for intervention in the nasal oxygen group was halved, the most extreme example of hypoxia occurred in this group and led to the only termination of the procedure.

Periods of hypoxia were common in the control group, but greatly reduced in patients receiving oxygen. SaO_2 was significantly higher throughout the procedure in patients given oxygen, but there was no difference in pulse rate between the two groups. Some degree of tachycardia was experienced by all patients during the procedure and approximately 23% of patients in each group showed appreciable tachycardia during the procedure. These findings are similar to those reported by previous workers examining hypoxia during ERCP in patients undergoing the procedure after benzodiazepine sedation with narcotic agents.[5 8] This tachycardia may be caused by the hyoscine butylbromide premedication as tachycardia was often apparent in patients after hyoscine administration before intubation. This probably reflects the recognised antimuscarinic properties of this drug.[12] Hyoscine butylbromide is often necessary during ERCP, but should be used in as low a dose as possible and only when really needed rather than routinely.

In conclusion, hypoxia commonly occurs in elderly ERCP patients even with minimal sedation without narcotics. Nasal oxygen supplementation significantly reduces this problem and should be routinely used in patients over the age of 60 undergoing ERCP as this reduces the sedation risks of the procedure. It was disappointing that it had no significant effect on the tachycardia, but this may be helped by more sparing use of hyoscine butylbromide. The results of this study support the guide lines recently published by the British Society of Gastroenterology.[13]

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