Cardiorespiratory changes during upper gastrointestinal endoscopy

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Abstract

Objectives: To determine the changes in oxygen saturation, blood pressure and heart rate during various endoscopic procedures and to find out the risk factors for these changes.

Methods: Forty patients without cardiorespiratory disorders were recruited. Oxygen saturation, blood pressure and pulse rate were monitored during endoscopy using pulse oximeter and automated blood pressure monitor. These were recorded from baseline until 5 minutes after the procedure. The important variables, which were evaluated in relation to these changes, included age, gender, duration of the procedure and drug/dosages.

Results: Baseline mean oxygen saturation was 96.8± 1.55%. It decreased significantly to 94.53±3.30%(p= 0.002) during insertion of probe. Mild to moderate hypoxia was found in 19 (47.5%) patients. Severe hypoxia was found in 5 (12.5%) patients. The variables that reached statistical significance for desaturation were age greater than 50 years and duration longer than 27 minutes. Changes in pulse rate were significant post-sedation, during probe insertion, during scoping, at removal of probe and immediately post-procedure ($p<0.02$). The mean change in systolic blood pressure was not significant throughout the procedure when compared to baseline, however 14 (35%) patients developed transient hypertension.

Conclusions: Mild to moderate hypoxia is common during endoscopic procedures and of no serious consequence. However severe hypoxia is less common. We recommend a non-invasive monitoring in patients with age greater than 50 years and procedure longer than 27 minutes.

Keywords: Endoscopy, oxygen saturation, heart rate, blood pressure.

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Introduction

Endoscopy of the proximal gastrointestinal tract (GI) using fibreoptic instruments has taken an increasing dominant role in diagnosis and therapy since the introduction of the first panendoscope by Hirschowitz in 1963 [1]. Although upper GI is reasonably safe, it is not perfectly so. The complication rate of gastrointestinal (GI) endoscopy is about 0.1% for upper GI and 0.2 % for lower GI procedures with cardiopulmonary events predominating [2-4]. Cardio-pulmonary complications may account for over 50% of all reported complication. The majority of complications are due to aspiration, oversedation, hypoventilation, vasovagal episodes and airway obstruction [5].

In view of these complications, the British Society of Gastroenterology revised their recommendations in 2003 on safety and sedation during endoscopic procedures. The guidelines now recommend identifying risk factors prior to endoscopy. These risk factors include age, obesity, and co-mobodities like cardiorespiratory disorders. ECG and blood pressure monitoring should be readily available for high-risk patients. Pulse oximetry monitoring should be used in all sedated patients. Despite these recommendations anecdoctal evidence shows that only few centers routinely monitor patients undergoing upper GI endoscopy.

We set out to identify the changes in oxygen saturation (SaO_2), blood pressure and heart rate during upper GI endoscopic procedures in various groups of patients and to find out factors responsible for these changes, with a view to providing necessary interventions.

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Methods

Forty consecutive patients undergoing upper GI endoscopy were involved in this observational study done in the Endoscopy suite of LAUTECH Teaching Hospital, Osogbo, from May 2006 to October 2006. Patients who had active ischemia, respiratory distress, baseline oxygen saturation less than 95% and requiring oxygen therapy before the procedure were excluded from the study. Hand-held NONIN pulse oximeter was

used for oxygen saturation and pulse monitoring. Automated blood pressure apparatus monitored blood pressure continuously before, during and up to 5 minutes after the procedure. After explaining procedure to the patient, the patients had 4% lignocaine throat spray. The same consultant gastro-enterologist performed all the procedures, assisted by a registrar and two trained endoscopy nurses. A consultant anaesthetist, assisted by a registrar was responsible for monitoring. The oxygen saturation monitoring was done for one minute before the procedure and stable reading taken. The base-line pulse rate and systolic blood pressure were also recorded. Similar readings were taken after sedation, at introduction of the scope, during scoping, at removal of scope and five minutes after the procedure. Except for the oxygen saturation, the highest reading was used for statistical analysis. Diazepam 2.5-10 mg was used in all procedures. Some patients also had 5-20mg of Buscopan. Other patient's characteristics recorded included age, gender, presence of co-existing disease, duration of the procedure and presence of complications. Tachycardia was defined as >100bpm or increase of >20bpm from base line. Bradycardia was defined as <60bpm. Hypertension was defined as systolic BP greater than 160 mmHg and hypotension <90 mmHg. Mild to moderate oxygen desaturation was considered as between 94-90%. Severe desaturation was considered as <90%. Supplemental oxygen was to be given at 3-5 L/minute by nasal cannula if oxygen saturation remained <90% for longer than 3minutes. The results were expressed as mean± SD. Paired t-test was used for statistical analysis. P-value less than 0.05' was taken as significant.

Results

Of the 40 patients, 19 (47.5%) were male and 21 (52.5%) female. Mean age was 49.5± 16.1 years. All patients underwent diagnostic procedures. All the patients had conscious sedation with diazepam (mean dose is 6.31±2.4), however some had buscopan 18(45%) (Mean dose is 7.87±9.4) in addition to the diazepam. Mean duration of procedure is 26.75±8.91. The provisional diagnosis is presented as in Table I.

The mean oxygen saturation, blood pressure and heart rate during various stages of procedure are presented in Table II. Baseline mean oxygen saturation was 96.8± 1.55%. It decreased significantly to 94.53±3.30%(p<0.002) during insertion of probe. The saturation improved 5 minutes post-procedure (95.90±2.22%) though still lower than baseline. A line graph of changes in oxygen saturation is presented in Figure 1.

Table 1. Frequency of diagnosis

Diagnosis	Frequency	Percentage (%)
Peptic ulcer disease	23	57.5
Gastritis	3	7.5
Gastric outlet obstruction	2	5.0
Duodenal ulcer	1	2.5
Upper gi bleeding	7	17.5
Corrosive oesophagitis	2	5.0
Dyspepsia	2	5.0

There were 6 episodes of severe hypoxia that lasted less than 3 minutes and so did not require oxygen administration. Three were observed during the introduction of the probe, while 2 were during the procedure and 1 post-procedure in 5 patients (12.5%). Four of the 6 episodes of severe hypoxia were recorded in patients above 50 years. Twenty-seven episodes of mild to moderate hypoxia were recorded in 19 patients (47.5%). No patient was given oxygen therapy as per protocol; neither did any patient complained of chest pain or signs of hypoxia. . Patients aged more than 50 years desaturated to 93.18±4.02% as compared to less than 50 years desaturating to 95.52±2.27% during introduction of the probe. These changes were statistically significant (p=0.024). The doses of diazepam in the two groups are not statistically different (p=0.33). The lowest drop in oxygen saturation was 84%, this was noticed during probe insertion. In patients whom the duration of procedure lasted more than 27 minutes, the mean oxygen saturations dropped to 94.35±2.91% and 94.65±1.95 while scoping and during removal of the probe respectively.

These were statistically significant when compared to the baseline (p<0.002). The mean change in systolic blood pressure was not significant throughout the procedure when compared to baseline as given in Table II. Hypertension was noted in 14 patients. Blood pressure normalized in these patients after stopping the procedure. The changes in pulse rate were significant post-sedation, during probe insertion, during scoping, at removal of probe and immediately post-procedure (p<0.02). One hundred and eleven episodes of asymptomatic tachycardia were noted in all but 5 patients some time during the procedure, however heart rate approached normal at the end of procedure.

Table 3. Line graph of changes in oxygen saturation during various stages of the procedure.

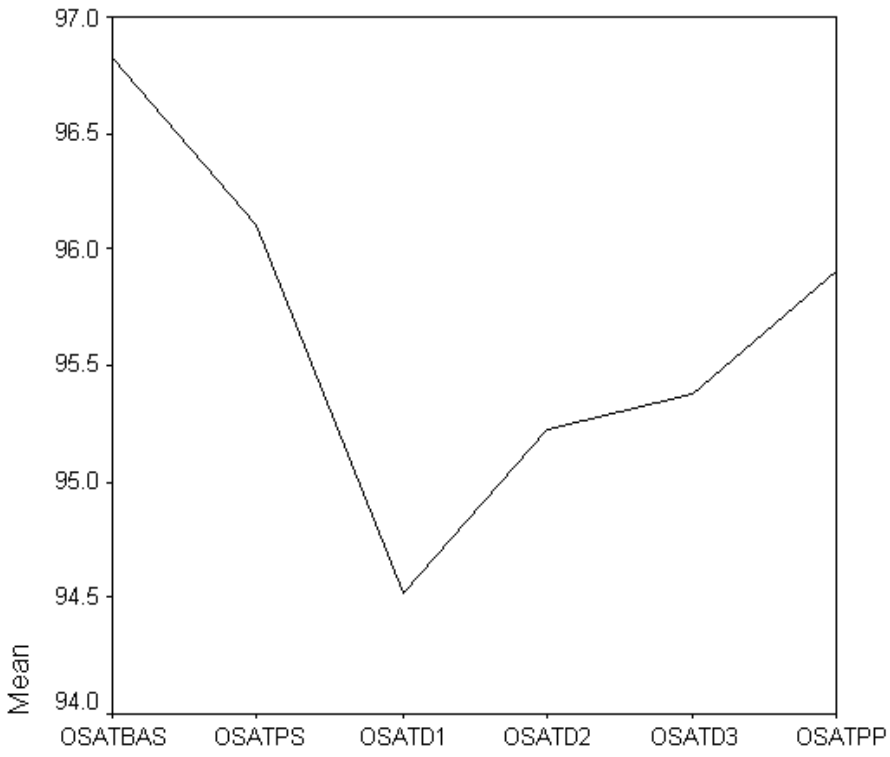

Table 2. Mean systolic blood pressure, oxygen saturation, pulse and respiratory rate during various stages of the procedure.

	Baseline	Postsedation	Probe insertion	During scoping	Probe removal	Post-procedure
Pulse rate (beats/min)	88.92±16.20	96.03±17.40*	109.33±19.01*	110.55±18.17*	113.25±19.31*	98.48±16.99*
Systolic blood pressure (mmHg)	139.38±22.13	134.25±24.72	145.32±28.91	136.70±27.10	132.30±24.83	127.25±18.16
Oxygen saturation (%)	96.82±1.55	96.10±1.71*	94.53±3.30*	95.23±2.66*	95.38±2.24*	95.90±2.22*

$P < 0.002$

Discussion

In consonant with other studies [5,6], we observed statistically, but not clinically significant cardiopulmonary complications during this study. Cardiopulmonary complications are commonly seen with diagnostic endoscopy, it accounted for up to 46% of complications reported in the American Society of Gastro-intestinal Endoscopy (ASGE) survey [7].As observed in this study, complications observed included blood oxygen desaturation, tachycardia, hypertension and tachypnoea.

Oxygen desaturation of < 90% has been found to occur in 15-50% of the sedated or non sedated patients during upper gastrointestinal endoscopy [8 - 11]. In this study, we observed an incidence of 47.5% for mild to moderate oxygen desaturation, and severe desaturation accounting for 12.5%. The non-requirement for oxygen therapy may be because of the dose of diazepam employed (mean dose-6.31± 2.4) and not using narcotic agents. Combining benzodiazepines with narcotic agents as pre-medication can further compromise saturation[12,13], though it has been established

that narcotic-benzodiazepine combinations produce better operating conditions than benzodiazepines alone and reduce the dose of benzodiazepines required [14-15] .

Our findings that oxygen desaturation increases with duration of procedure [8],as well as the association with increasing age [8,9,11,13] have been reported. Other factors incriminated in oxygen desaturation include difficulty with intubation, which may be related to the size of the endoscope, patient factors like history of cardiovascular/pulmonary disease and complications arising from the procedure itself, such as vaso-vagal reflex secondary to the intubation process and/or to overinsufflation of air [7]. The findings of the trio of (a) lowest mean oxygen saturation, (b) lowest drop in oxygen saturation and (c) highest mean systolic blood pressure occurring during insertion of endoscopy probe suggests that the period is associated with considerable sympathetic over-stimulation and disordered breathing. Therefore, it is needful that patients with unstable cardiac and respiratory systems be adequately monitored during this period.

It has been shown that apnea/disordered respiration occurs commonly during upper GI endoscopy, and frequently precedes the development of hypoxemia and these potentially important abnormalities in respiratory activity may not be detected with pulse oximetry and visual assessment [16].Rise in heart rate during endoscopy has been reported by many workers.[17,18] .This study too demonstrated similar result during all phases of the procedure. In all the cases, the tachycardia disappeared spontaneously in the post-endoscopic phase within 5 minutes. None of our patients developed bradycardia, although a few studies have reported bradycardia during upper GI endoscopy. [7, 19]. Fall in the blood pressure has been documented immediately after pre-medication [20] and the present study also confirmed this. Hypertension during endoscopy procedure have been reported in the range of 4.5% to 94% [21,22].Though our study had an incidence of hypertension (87.5%), the mean systolic blood did not change significantly during endoscopy. None of our patients with elevated blood pressure developed any cardiovascular or cerebrovascular events.

Concerning the use of sedation during endoscopy, it is accepted that the main end points are patients' satisfaction and safety. Benzodiazepines can be safely administered without the presence of a qualified anesthetist. Intravenous propofol, either alone or with concomitant benzodiazepines or opioids has generated wide spread interest.The quality of sedation is better and recovery time shorter but the narrow therapeutic range and the mode of administration of propofol precludes its widespread use during endoscopy [23]. An important aspect of sedation procedures is prevention of cardiopulmonary complications. Therefore proper patient selection and the use of electronic monitoring techniques for detecting potentially important abnormalities in cardiac and respiratory activity in patients undergoing gastrointestinal endoscopy would go a long way in preventing serious complications [23].

Conclusion

Transient cardiorespiratory changes are not uncommon during upper gastrointestinal endoscopy. This study showed that tachycardia, hypertension and mild to moderate hypoxia are common, transient and probably of no clinical consequences. All these may be physiological responses to the intubation process. Severe hypoxia was less common. We recommend a non-invasive monitoring in patients with age greater than 50 years and procedure longer than 27 minutes.

References

1. Hirschowitz B.I. A fibreoptic flexible oesophagoscope. Lancet 1963; 2: 388.
2. Faigel DO, Baron TH, Goldstein JL, Hirota WK, Jacobson BC. Guidelines for the use of deep sedation and anesthesia for GI endoscopy. Gastrointest Endosc 2002; 56: 613-7.
3. Freeman ML. Sedation and monitoring for gastrointestinal endoscopy. Gastrointest Endosc Clin N Am 1994; 4: 475-99.
4. Carey WD. Indications, contraindications and complications of gastrointestinal endoscopy. In: Sivak MV, (edi). Gastroenterologic endoscopy, Philadelphia: WB Saunders, 1987: 868-80.
5. Hart R, Classen M. Complications of diagnostic gastrointestinal endoscopy. Endoscopy 1990; 22: 229-33.
6. Silvis SE, Nebel O, Rogers G, Sugawa C, Mandelstam P. Endoscopic complications. Results of the 1974 American Society for Gastrointestinal Endoscopy Survey. JAMA 1976; 235:928.
7. 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 gastroin-testinal endoscopy. Gastrointest Endosc 1991; 37:421.
8. Javid G, Khan B, Wani MM, Shah A, Gulzar GM, Khan B. Role of pulse oximetry during non-sedated upper gastrointestinal endoscopic procedures. Indian J Gastroenterol 1999; 18: 15-7.
9. Dhariwal A, Plevris JN, Lo NT, Finlayson ND, Heading RC, Hayes PC. Age, anemia and obesity-associated oxygen desaturation during upper gastrointestinal endoscopy. Gastrointest Endosc 1992; 38: 684-8.
10. Mistry FP, Abraham P, Bhatia SJ. Oxygen desaturation and

tachycardia during upper gastrointestinal endoscopy are transient and benign. J Assoc Physicians India 1992; 40: 524-7.
11. Dark DS, Cambell DR, Wesselius LJ. Arterial oxygen desaturationduring gastrointestinal endoscopy. Am J Gastroenterol 1990; 85: 1317-21.
12. Jurell KR, 'O' Connor KW, Slack J, Fraiz J, Shaar CJ, Kent L, et al. Effect of supplemental oxygen on cardiopulmonary changes during gastrointestinal endoscopy. Gastrointest Endosc 1994; 40: 665-70.
13. Donnelly MB, Scott WA, Daly DS. Sedation for upper gastrointestinal endoscopy: a comparison of alfentaml-midazolam and mepridine-diazepam. Can J Anesth 1994; 41: 1161-5.
14. Berg JC, Miller R, Burkhalter E. Clinical value of pulse oximetry during routine diagnostic and therapeutic endoscopic procedures. Endoscopy 1991; 23: 328-30.
15. O'Connor KW, Jones S. Oxygen desaturation is common and clinically underappreciated during elective endoscopic procedures. Gastrointest Endosc 1990; 36: 2-4.
16. Vargo J, Zuccaro G, Dumot JA et al. Automated graphic assessment of respiratory activity is superior to pulse oximetry and visual assessment for the detection of early respiratory depression during therapeutic upper endoscopy. Gastrointest. Endosc. 2002;55 (7):826-831.
17. Oei-Lim VL, Kalkman CJ, Bartelsman JF, Res JC, van Wezel HB. Cardiovascular responses, arterial oxygen saturation and plasma catecholamine concentration during upper gastrointestinal endoscopy using conscious sedation with midazolam or propofol. Eur J Anaesthesiol 1998; 15: 535-43.
18. Mathew PK, Ona FV, Damvski K, Wallace WA. Arrhythmias during upper gastrointestinal endoscopy. Angiology 1979; 30: 834-40.
19. Vawter M, Ruiz R, Alaama A, Aronow WS, Dagradi AE. Electro-cardiographic monitoring during colonoscopy. Am J Gastroenterol 1975; 63: 155-7.
20. Ristikankare M, Julkunen R, Mattila M, Laitinen T, Wang SX, Heikkinen M, et al. Conscious sedation and cardiorespiratory safely during colonoscopy. Gastrointestinal Endosc 2000; 52: 48-54.
21. Freerman ML, Hennessy JT, Cass OW, Pheley AM. Carbondioxide retention and oxygen desaturation during gastrointestinal endoscopy. Gastroenterology 1993; 105: 331-9.
22. Malhotra HS, Rana S, Pal LS, Dasgupta DJ. Electrocardiographic changes during upper gastrointestinal endoscopy in ambient hypoxia. J Assoc Physicians India 1991; 39: 692-3.
23. Lazzaroni M, Bianchi Porro G. Preparation, premedication and surveillance. Endoscopy 2003; 35:103-11.