

## Arterial Oxygen Saturation during Unsedated Upper Endoscopy

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### ABSTRACT

**Aim:** To determine the incidence of hypoxia, to identify the clinical value of pulse oximetry during unsedated endoscopy.

**Methods:** A prospective study conducted at Al-Kuwait University Teaching Hospital, and Police Typical Hospital, Sana'a. Sixty eight consecutive patients underwent Upper gastrointestinal endoscopy (UGIE) were enrolled in the study. Arterial oxygen saturation, pulse rate and blood pressure were monitored with continuous pulse oximetry and automated blood pressure monitor before the procedure, at regular intervals during the procedure, during initial recovery and upto 10minutes after the procedure. We study the effect of risk factors on oxygen desaturation in unsedated upper endoscopy to determine whether or not pulseoximetry is useful.

**Results:** Mean age of the patients was  $47.06 \pm 12.45$  (53 men and 15 female). Mean endoscopic time was  $14.71 \pm 4.81$  minutes (ranged from 10 to 38 minutes). Cardiopulmonary changes observed during the present study were transient and of no disastrous consequences. Mild oxygen desaturation was observed in 13 patients (19.1%). Severe hypoxia ( $\text{SaO}_2 < 85\%$ ) was rare episode (1.47%). Three patients (4.4%) suffered significant decrease in oxygen saturation and required oxygen supplementation. Mean oxygen saturation before the procedures, during insertion of the endoscope, during scoping, and after procedure were  $95.65 \pm 2.58$ ,  $91.44 \pm 2.63$ ,  $92.43 \pm 2.65$  and  $94.25 \pm 2.44$  respectively. Oxygen saturation decreased significantly during probe insertion, during scoping of endoscope, and after procedure as compared with baseline oxygen level ( $P < 0.05$ ). The changes in oxygen saturation were significant during endoscopic insertion in patients  $\geq 50$  years when compared to those  $< 50$  years ( $P < 0.05$ ).

**Conclusions:** Mild hypoxemia is a common adverse event during non-sedated endoscopic procedure and of no disastrous consequences. Furthermore, oxygen desaturation developed during the endoscopy may have resulted in undetected hypoxemia with serious consequences. We recommend pulseoximetry monitoring in patients at risk for desaturation. Patients at risk are elderly and patients with respiratory diseases

**Keywords:** Pulseoximetry, upper gastrointestinal endoscopy, oxygen saturation.

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### INTRODUCTION

Upper gastrointestinal endoscopy (UGIE) is the most effective and widely available technique used for management of gastrointestinal disorders and has morbidity and mortality<sup>1,20</sup>. Reported cardiopulmonary and non-cardiopulmonary adverse events during UGI are related to sedation in the majority of procedures<sup>2,3,4</sup>. Currently, unplanned adverse events were reported in 1.4% of procedures; 0.9% was associated with cardiorespiratory unplanned events<sup>5</sup>.

Marked reduction in arterial oxygen desaturation are more common problem in sedated UGI. Ethanol-sedated, reduce incidence of hypoxia during non-sedated endoscopy still debated. Although sedation induced hypoxemia considered

the most common hazard of the procedure, combination of ventilator function monitoring and unsedated endoscopy can minimize procedure hazard and perform it safely. Moreover, arterial oxygen desaturation developed during the endoscopy may have resulted in undetected hypoxemia with serious complications and often becomes problematic in preexisting respiratory diseases, elderly patients and co-morbidity like cardiopulmonary diseases. Hence pulseoximetry monitoring during GIE is indicated for detecting early oxygen desaturation but not ventilation in sedated patients and in any clinical setting where hypoxemia may occur. The American Society of Anesthesiologists (ASA) guideline for sedation and analgesia states that "For procedures performed without medications, the types of and levels of monitoring should be individualized"<sup>8</sup> in Yemen Republic as most of non-developed countries gastrointestinal endoscopy performed without sedation.

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The aims of this study are to determine the incidence of hypoxemia during unsedated endoscopy, to identify the clinical value of pulseoximetry and to investigate the risk factors associated with change in oxygen desaturation.

**PATIENTS AND METHODS**

This was observational study conducted at Al-Kuwait University Hospital, and Police Typical Hospital, Sana'a, Yemen during the period from September 2012 until February 2013. We have prospectively examine continuous arterial oxygen saturation monitoring in 68 consecutive patients underwent upper endoscopy. Endoscopy procedure without sedation was carried out by 25 year experienced gastroenterologist. Intra-procedural monitoring including pulseoximetry with the finger probe applied to right hand was performed according to guideline published by American Society of Anesthesiologists (ASA) for sedation and analgesia: before the procedure is begun, after administration of sedative-analgesic agents, at regular intervals during the endoscopic procedure, during initial recovery, and just before discharge<sup>8</sup>. Automated blood pressure and heart rate was performed before the procedure is begun, at regular intervals during the procedure, during initial recovery and 10 minutes after the procedure. Smoking history, demographic data (age, gender), clinical data (hemoglobin level, co-morbidity, current medications) and indications for endoscope were taken. During and after the procedure, minimum oxygen saturation, maximum heart rate values, blood pressure, total time of the procedure, duration of hypoxia and time to hypoxia were recorded.

Cardiopulmonary events was defined as oxygen desaturation <90%, hypertension as systolic blood pressures >160mmHg, hypotension <90mmHg, tachycardia 100>bpm Police Hospital between November 2012 and June 2013 were enrolled in the study. Mean age of the patients were 73.06±12.45 (53 men and 15 female) and bradycardia <60bpm. All patients had basal SaO<sub>2</sub> ≥90%. Oxygen saturation were classified according to the minimum SaO<sub>2</sub> recorded: Normal (absence of hypoxemia) with SaO<sub>2</sub> >90%, mild hypoxemia SaO<sub>2</sub> <90% and severe hypoxia (SaO<sub>2</sub> <85%). A decrease in oxygen saturation to less than 85% were indicated for oxygen supplementation (2-3L/minute) by intranasal cannula under strict observation or termination of the procedure in patients with risk factors related adverse event. The study population was all referred patients for upper endoscopy. Exclusion Criteria were patient age less than 20 and more than 75 years old years, unstable hemodynamic state, anemia (Hb less than 10g/dl),

baseline oxygen saturation level less than 90% and patients who could at least perform their own daily tasks (patients who were in III or higher class according to American Society of anesthesiologists' classification). The inclusion criteria were hemoglobin more than 10mg/dL and absence of chronic liver diseases, chronic renal diseases, acute cardiorespiratory disorders and emergency procedure. Written, informed consent was obtained from each patient. Aerosol doses of lignocaine were sprayed into the oropharynx. Endoscopic procedures were performed with Karl Storz endoscope system (Karl Storz 13801PKS-X endoscope with a Camera Processor Karl Storz Telecom SL 1120213020, Processor Karl Storz Xenon 100201325. 20 and Sony color video printer UP21MD) All participants provided written informed consent before the endoscopic examination.

Data analysis was performed with SPSS version 20 and the results were described by means±SD. For statistical analysis paired t-test was used and P value of less than 0.05 was considered to be statistically significant. Wilcoxon test was used when appropriate.

**RESULTS**

Total of sixty eight patients were enrolled in the study. Demographic characteristic, clinical and endoscopic diagnosis of the patients were presented in table 1. The reasons for upper endoscopy were epigastric pain, nausea vomiting, and hematemesis. Other indications were dyspepsia, anemia, dysphagia, and reflux symptoms. All patients underwent diagnostic UGIE in Al-Kuwait and

Table 1 Baseline characteristic, clinical and endoscopic diagnosis of the patients enrolled in the study

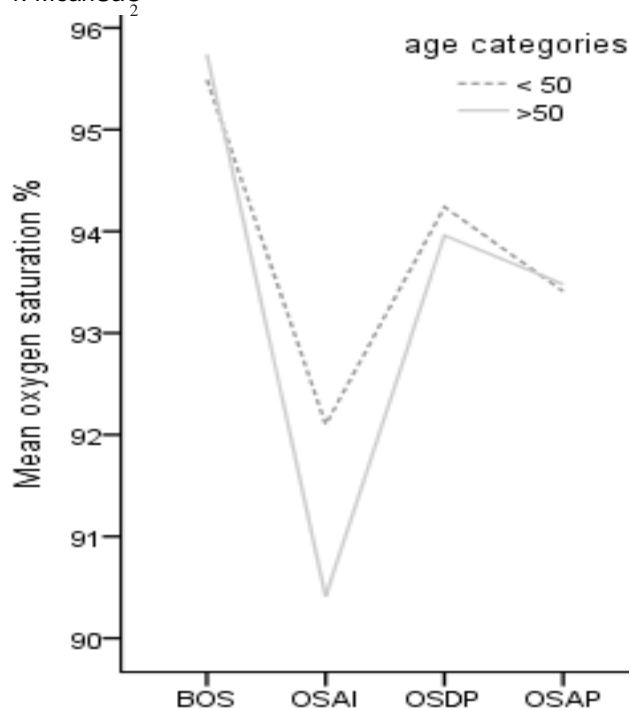
Variables	
No of patients	68
Age in years (mean±SD)	47.06±12.45
Male	53(77.9%)
Female	15(22.1%)
Hemoglobin (g/dl)	12.11±1.16
Smoke	22(32.4%)
Mean endoscopy time (min)	14.7±4.81
Chronic obstructive pulmonary disease	10(14.7%)
Predominant symptom	
Abdominal pain	44 (64.7%)
Nausea and vomiting	15 (22.1%)
Hematemesis	9 (13.2%)
Endoscopic diagnosis	
Gastritis and duodenitis	49 (72.1%)
Peptic ulcer	12 (17.7%)
Esophageal varices	7 (10.3%)

Table 2: Comparison of mean oxygen desaturation (OSat), mean systolic blood pressure (SBP) and mean heart rate (HR) at various stage of upper endoscopy.

	OSat(%)	HR(bpm)	SBP(mmHg)
Baseline	95.65±2.58	88.04±18.00	121.76±7.70
At insertion	91.44±2.63	107.06±20.35	138.69±8.34
DuringUGIE	92.43±2.65	99.24±19.77	124.87±10.15
AfterUGIE	94.25±2.44	90.07±15.01	126.57±10.39

The mean SaO<sub>2</sub> during endoscope was below the lower limit of normal in many subjects it fell significantly further. Mean oxygen saturation before the procedure, during the patients older than 50 years and younger than 50 years during the procedure. The change in oxygen saturation was significant during endoscopic insertion in patients ≥50 years when compared to those <50 years (P<0.05). Systolic blood pressure changed significantly during insertion of endoscope, during scoping, and after the procedure as compared to baseline (P<0.05). Hypertension was not observed. Pulse rate changes significantly during probe insertion and during the procedure as compared to baseline (P<0.001). Mean systolic blood pressure fall and heart rate rose during UGIE and return to baseline level after the procedure. Although mean systolic blood pressure and pulse rate were significantly changed during the procedure, recovered to their baseline occurred five and 10minutes after procedure, respectively.

Fig-1: MeanSaO<sub>2</sub>



## DISCUSSION

Gastrointestinal Endoscopy is considered to be safe and diagnostically invaluable procedure associated with rare serious complication. Majority of UGIE in United States and United Kingdom carried out with sedation, while non-sedated UGIE is frequently performed in developed (i.e., Spain, Japan, Germany, and Sweden) and non-developed countries<sup>9,10</sup>. Most Authors have observed arterial oxygen saturation during sedated endoscopy and less number of studies has assessed oxygen saturation during non-sedated endoscopy. Previous studies observed that arterial oxygen saturation is the most common unplanned adverse events during upper endoscopy. Moreover, incidence of hypoxemia varied widely between studies<sup>5,11,12,13</sup>.

A variation in rates of hypoxemia among studies are likely older than 50 years and younger than 50 years during different stages of endoscope stages of endoscopy due to differences in definition of hypoxemia, methodology, patients population, duration of follow up, type of endoscopy, and level of sedation<sup>3,13,14,15</sup>. Cardiopulmonary change observed during the present study was transient and of no disastrous consequences. Our study show that there is a marked decrease in arterial SaO<sub>2</sub> during the procedure probe insertion, during scoping and after the procedure were 95.59±2.58, 91.43±2.56, 93.44±2.49, and 94.65±2.62 respectively (Table 2). Oxygen saturation decreased significantly during probe insertion, during scoping of endoscope and after the procedure as compared with baseline (P<0.05). The saturation rose to 94.65±2.62 and remains below the baseline level 10 minutes after the procedure. The mean endoscopic time was 14.71±4.81 minutes (ranged from 10 to 38 minutes). Mild oxygen desaturation was observed in 13 patients (19.12%). Severe hypoxemia (SaO<sub>2</sub><85%) was rare episode (1.47%) and observed in one patient of old age. Oxygen desaturation observed during insertion of endoscope was transient in 10 patients and oxygen desaturation recovered to within normal level 10 minutes after removal of the endoscope without treatment. Two patients suffered significant decrease in oxygen desaturation that required oxygen supplementation. Also one old patient (65 years) developed more prolonged hypoxemia and received oxygen supplementation. Procedure was terminated in one patient due to risk factors related adverse events. Endoscopic procedures were completed successfully in all cases except one patient with 7% decrease in oxygen saturation reading from baseline that require termination of procedure. There were no significant differences between saturations at baseline and at the end of procedure. Fig-1 shows

mean oxygen saturation comparison between and mild oxygen desaturation is common adverse event (19.1%), while severe hypoxemia is a rare (1.5%) episodes. This is consistent with the results reported in large study of 481 unsedated patients by Alcainet al<sup>10</sup>. Similar findings have been reported in other studies<sup>14,16</sup>. Transient oxygen desaturation occurred during the procedure was benign episode in 12 patients and oxygen saturation recovered to within normal level five minutes after removal of the endoscope without treatment in 10 patients and with oxygen therapy in two patients. Also oxygen supplementation was given to one patient with severe hypoxemia (SaO<sub>2</sub><85%). Of the 13 patients with mild hypoxemia, 8(61.5%) patients had COPD. Endoscopic procedure was completed successfully in all cases except one patient with 7% decrease in oxygen saturation reading from baseline that require procedure withdrawal. Our data found that the incidence of oxygen desaturation during probe insertion is more frequent in older patients (age>50 years) compared with patients aged<50 years. These findings are in agreement with the findings of other authors<sup>10,14,17</sup>.

Several studies of ventilator function monitoring during UGIE have shown that hypoxia occurs. Vargo JJ et al<sup>19</sup> found that apnea and disordered respiration occurs commonly during upper endoscopy and frequently precedes the development of hypoxia. Also EM-A Melleney et al. studied pulseoximetry monitoring during non-sedated upper endoscopy and found that significant hypoxemia most commonly only occurs transiently and routine pulse oximetry is not necessary for non-sedated gastroscopy but oximetry monitoring may be important in selected cases<sup>18</sup>. Hypoxemia is not uncommon problem in unsedated patients undergoing upper endoscopy and oxygen desaturation observed during the endoscope may have resulted in undetected hypoxemia with serious complications. Consequently, pulseoximetry monitoring during upper endoscopy is indicated in any clinical setting where hypoxemia may occurs<sup>3,6,7,8</sup>. The current study observed that although oxygen desaturation in most cases is transient and benign episodes, termination of the procedures due to comorbidity were required in one old patient. In addition older patients suffered more significant desaturation than young patients and 4.4% of patients received oxygen supplementation. The largest decrease in oxygen saturation from baseline was 7% recorded immediately at insertion of endoscope in one patient (1.5%) who required administration. Although oxygen saturation observed during UGIT are sedation induced in the most of the procedures, debate continuous on the role of risk factors in the occurrence of desaturation. So careful

selection of patients with effective clinical observation and identification of risk factors contribute to desaturation in non-sedated endoscopy may help to minimize procedure hazard, perform the procedure safely and improve the overall quality of endoscopy.

We conclude that mild hypoxia is common adverse event during non-sedated endoscopic procedure and of no serious complications. Furthermore, oxygen desaturation developed during the endoscopy may have resulted in undetected hypoxia with serious consequence. So, we recommend pulseoximetry monitoring in patients at risk for desaturation. Patients at risk are elderly and patients with respiratory diseases.

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