CARDIOPULMONARY CHANGES DURING UPPER GASTROINTESTINAL ENDOSCOPY

By

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of the requirements for the degree of

M.D.

In

GENERAL MEDICINE

Under the Guidance of

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LIST OF ABBREVIATIONS

ACG	-	American College of Gastroenterology
ASGE	-	American Society for Gastrointestinal Endoscopy
BP	-	Blood Pressure
CNS	-	Central Nervous System
Co2	-	Carbon dioxide
ECG	-	Electrocardiogram
EGD	-	Esophagogastroduodenoscopy
EKG	-	Electrocardiogram
ERCP	-	Endoscopic Retrograde CholangioPancreatography
EUS	-	Endoscopic Ultrasound
GI	-	Gastro Intestinal
GTN	-	Glyceryl Trinitrate
HR	-	Heart Rate
IHD	-	Ischemic Heart Disease
IV	-	Intravenous
MI	-	Myocardial Infarction
PaCo2	-	Partial pressure of Carbon dioxide in arterial blood
O_2	-	Oxygen
Sao2	-	Arterial oxygen saturation
SD	-	Standard Deviation
Spo2	-	Saturation of peripheral oxygen
SVT	-	Supra Ventricular Tachycardia
TIA	-	Transient Ischemic Attack
VF	-	Ventricular Fibrillation
VT	-	Ventricular Tachycardia

ABSTRACT

Background and objectives: Upper gastrointestinal endoscopy is a commonly performed diagnostic and therapeutic procedure and has many adverse effects like cardiopulmonary complications, complications related to sedation, infectious complications, bleeding and perforation. So this study was undertaken to evaluate important variables like patient's age, gender and stage of the procedure in relation to the cardio pulmonary changes during diagnostic upper gastrointestinal endoscopy by monitoring oxygen saturation, blood pressure, heart rate and Electrocardiogram.

Materials and methods: This is a prospective longitudinal hospital based study involving a total of 140 consecutive patients, at Shri BM Patil Medical College, hospital and research centre between November 2007 and September 2009.

Results: Cardio pulmonary changes during Upper GI scopy are more common in the age groups of 51 to 80, with equal frequency in both male and female. SPo2 levels decreased by about 4% in both sexes during introduction of endoscopy blade. Mild to moderate hypoxia was found in 32% of the study group. Severe hypoxia was found in 5% of the patients, mostly in those people who are above 50 years age. Tachycardia was noted in 88% of the study group patients. Blood pressure increased to hypertension levels in 22 patients (15.7 %) which returned to normal within few minutes after the procedure, S-T depression noticed in 4% and T wave inversion in 8% during upper GI endoscopy. All these changes disappeared 10 minutes after endoscopy.

Conclusion: Cardio pulmonary changes are common during upper gastrointestinal endoscopy. Maximum changes in SPO2, heart rate and blood pressure occurred immediately after the introduction of endoscope. The cardiopulmonary changes didn't manifest into any identifiable clinical symptoms. The rate of recovery was faster in younger age groups and women.

Keywords: Upper gastrointestinal endoscopy; Cardiopulmonary complications; Oxygen desaturation; SPo2 Monitoring; Hypoxia; Electrocardiogram; Heart rate; Blood pressure

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INTRODUCTION

Upper gastrointestinal (GI) endoscopy or esophagogastroduodenoscopy (EGD), also known as Gastroscopy, refers to examination of the esophagus, stomach and upper duodenum by means of a flexible fibre-optic endoscope.

Upper GI endoscopy is a commonly performed procedure used to investigate a wide range of symptoms and treat a variety of complaints. Gastroscopy is commonly used for diagnostic evaluation for signs and symptoms suggestive of upper GI diseases like dyspepsia, dysphasia, non cardiac chest pain and recurrent emesis. It is also used for surveillance for upper GI cancer in high risk settings like Barrett's esophagus and polyposis syndromes and also used for Biopsy for known or suggested upper GI diseases like malabsorption syndromes, neoplasms and infections. Gastroduodenoscopy is also useful for therapeutic intervention in removal of foreign bodies, control of GI hemorrhage, dilatation or stenting of strictures, ablation of neoplasms and for gastrostomy placement.

The relative safety of upper GI endoscopy has encouraged its use even in elderly patients and those with significant co-morbidity. However it is an invasive procedure and carries with it a range of complications and a small but well recognized mortality. As some complications are inevitable during prolonged endoscopic procedures, knowledge of potential complications and their expected frequency can lead to improved risk benefit analysis by physician as well as by the patient. Early recognition of complications and prompt intervention may minimize morbidity. The complications are cardiopulmonary problems, bleeding, perforation and infection which are responsible for major morbidity.

This study is undertaken to determine the changes in oxygen saturation (Spo2), blood pressure (BP), heart rate (HR) and ECG during various upper GI endoscopic procedures.

AIMS AND OBJECTIVES OF THE STUDY

The effects of upper GI endoscopy on cardiac and respiratory systems of these patients were recorded by noting the changes in their blood pressure, heart rate, electrocardiogram and Spo2 and these changes were studied in particular relation to age of the patient, gender and duration of the procedure. In those patients aged above 50 years, the need for non invasive monitoring was assessed.

REVIEW OF LITERATURE

UPPER GASTROINTESTINAL ENDOSCOPY

Upper GI endoscopy is a procedure during which a small flexible endoscope is introduced through the mouth and advanced through the pharynx, esophagus, stomach, and duodenum. Upper GI endoscopy is used for both diagnostic and therapeutic procedures.

The gastroscope was first developed in 1952 by a Japanese team of a doctor and optical engineers. Mutsuo Sugiura, in association with Olympus Corporation, worked with Dr. Tatsuro Uji and his subordinate, Shoji Fukami, to develop what he first called a "gastro camera". It consisted of a tiny camera attached to a flexible tip with a light bulb. With it, they were able to photograph stomach ulcers that were undetectable by X-ray and find stomach cancers in early stage.[1] Then came new innovations like remotely operated surgical instruments contained within the endoscope itself.

The investigations and management of patients with digestive problems was revolutionized in the 1960s with the introduction of flexible endoscopes, based on fiberoptic light transmission. Their diagnostic potential became obvious with improved visualization, increased tip control and biopsy capability. Subsequent developments, such as video-endoscopy, and the proliferation of therapeutic applications moved endoscopy into the mainstream of gastroenterology, and fueled its enormous expansion worldwide.

So the history of endoscope can be divided into 3 periods:

1. The rigid endoscope (1868- 1932)
2. The semiflexible endoscope (1932-1957)
3. The fibreoptic endoscope (1957-1983)

The recognition of the value of Diagnostic Endoscopy has resulted in a revolution in the ability to assess the gastrointestinal tract and allow direct visualization of and sampling the mucosa. From this experience, the technique of interventional endoscopy has developed with specialist therapeutic endoscopes. The introduction of modern solid-state devices has provided the next step in the development of flexible endoscopy and most recently capsule endoscopy. Fibreoptic endoscopy is still the standard method of assessing the upper gastrointestinal tract.

Investigation of the small intestine or esophagus with regular diagnostic facilities is very difficult. Wireless video capsule endoscopy was developed recently from an idea of an Israeli physician Gavriel Iddan. The capsule contains a miniature camera which can take pictures of the lining of the small intestine as well as esophagus. It is very useful in identifying diseases of small intestine like Crohn's disease, celiac disease, reflux disease, tumors, Barret's esophagus and esophagitis. Wireless capsule technology is superior to barium x rays in identifying polyps present in the small intestine. [2]

Recent improvements include Endoscopic ultrasonography, which allows to look beyond GI walls, like studying pancreatic tumors. New updates in technology are helping in the development of high resolution endoscopes, magnification endoscopes, chemoendoscopes and confocal endomicroscopy.

In the management of severe gastrointestinal bleeding, Endoscopy has now become the first and primary therauptic modality. To improve patients' outcomes and to reduce morbidity and mortality from severe GI haemorrage, Endoscopists are using panendoscopy, push enteroscopy and colonoscopy. Recent improvements in endoscopic hemostatic techniques and imaging modalities using wireless capsule endoscopy suggest that diagnostic and therapeutic GI endoscopy will be even more important in determining patient outcomes in the future.[3]

ENDOSCOPE

The conventional endoscope consists of an umbilical cord, control head, insertion tube of 100 cm length and 8-11 mm external diameter, and bending section at the tip. The endoscope contains a lumen for insufflation of air and water, a working channel of 2-3 mm diameter used for suctioning and passage of instruments, control wires for moving the tip of the endoscope, and the imaging system that is either video or fiberoptic. Multiple instruments like biopsy forceps, snares, sclerotherapy needles, heater probes, electrocautery probes, balloon-dilation devices, nets, and baskets can be introduced through the working channel of the endoscope.

PREPARATION OF THE PATIENT

Psychological: It has been shown that less sedation is required if patient is psychologically prepared prior to upper gastrointestinal endoscopy. Patient education and relaxation techniques have shown to improve the rate of endoscopy acceptance by the patient. The patient has to be introduced to the endoscopist prior to the procedure, so

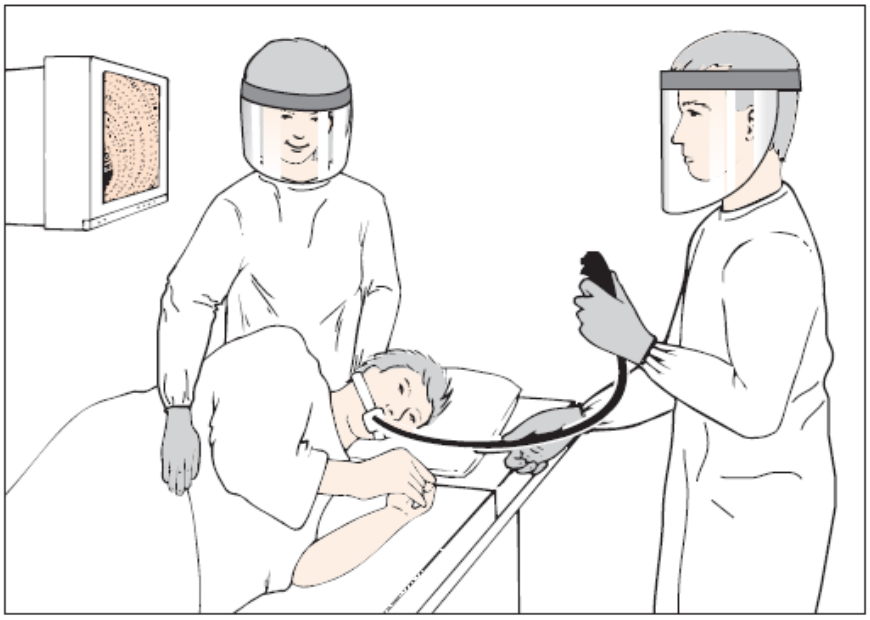
rapport and confidence is established. The endoscopist explains the specific purpose of the procedure and what difficulties or lack of them may be expected by the patient.[4]

General preparation: Nil by mouth for at least 6 hours prior to the procedure is ideal to allow for adequate gastric emptying. If conscious; sedation is used, intravenous access and standard monitoring are also needed. Informed consent should be obtained from the patient or from their legal representative prior to the procedure.

THE PROCEDURE

The patient is usually placed in the left lateral position. Topical and/or intravenous sedation is administered to minimize gagging and to facilitate the procedure. The endoscope is passed under direct vision into duodenum. Air is insufflated to distend the lumen to aid in viewing. The procedure and findings can be documented with video system. Biopsy can be obtained. Therapeutic procedure can be performed.

Fig 1: Ongoing Upper GI Endoscopy



SEDATION

Topical anaesthesia (e.g. lidocaine): Advantages are, it requires less time and eliminates the risk of sedation.

When conscious sedation is being administered, the patient must be monitored throughout the procedure. Pulse oximetry, heart rate, and blood pressure are commonly monitored. Electrocardiographic monitoring is recommended in patients with cardiopulmonary disease, in elderly patients, and during a prolonged procedure.

Commonly used sedatives are:

1. *Midazolam*: peak effect is 3-5 minutes with duration of action of 1-3 hours. Major adverse effects are respiratory depression, hypotension, and paradoxical agitation. Lower doses should be administered to elderly patients with cardiopulmonary problems to avoid serious complications.

2. *Meperidine*: an opioid narcotic analgesic. Adverse effects include respiratory depression, hypotension, nausea, and vomiting.

3. *Fentaynil*: mildly sedative narcotic agent. It is the preferred agent for outpatient endoscopic procedure. Peak effect is 5-8 minutes, and the duration of action is 1-3 hours. Side effect is respiratory depression.

Reversal agents

1. *Flumazenil*: used for reversal of benzodiazepine-induced sedation and respiratory depression.

2. *Naloxone*: reverses opioid-induced analgesia, CNS effects, and respiratory depression.

ASSESSMENT OF THE PATIENT

A complete history should be obtained, and a physical examination should be performed. Special attention is given regarding cardiovascular and pulmonary diseases. History of drug allergies and previous abdominal surgeries should also be obtained.

INFORMED CONSENT

Prior to endoscopic procedure, it is must to obtain the informed consent from patient. The indications, nature and details of endoscopic procedure should be explained to the patient. Risks, benefits, alternatives, and complications should also be explained.

ANTIBIOTIC PROPHYLAXIS

Transient bacteraemia may occur during most endoscopic procedures. Antibiotic prophylaxis is recommended when patients with an underlying high-risk condition for infectious complications (e.g., prosthetic heart valve, history of endocarditis) undergoes a high-risk endoscopic procedure, such as stricture dilation, sclerotherapy of varices, and ERCP, or in the presence of an obstructed biliary tree.

RECOVERY

Recovery room observation and monitoring for any adverse effects from the procedure or sedation has to be done. The length of follow up observation is dependent on the perceived risk to the patient.[5, 6]

INDICATIONS FOR UPPER GI ENDOSCOPY

1. Diagnostic

- Unexplained anemia (usually along with a colonoscopy)
- Upper gastrointestinal bleeding as evidenced by hematemesis or melena
- Persistent dyspepsia in patients over the age of 40-45 years
- Heartburn and chronic acid reflux - this can lead to a precancerous lesion called Barrett's esophagus
- Persistent vomiting
- Dysphagia - difficulty in swallowing
- Odynophagia - painful swallowing

2. Surveillance

- Surveillance of Barrett's esophagus
- Surveillance of gastric ulcer or duodenal ulcer
- Occasionally after gastric surgery

3. Confirmation of diagnosis/biopsy

- Abnormal barium swallow or barium meal
- Confirmation of celiac disease (via biopsy)

4. Therapeutic

- Treatment (banding/sclerotherapy) of esophageal varices
- Injection therapy (e.g. epinephrine in bleeding lesions)

- Cutting off of larger pieces of tissue with a snare device (e.g. polyps, endoscopic mucosal resection)
- Application of cautery to tissues
- Removal of foreign bodies (e.g. food) that have been ingested
- Tamponade of bleeding esophageal varices with a balloon
- Application of photodynamic therapy for treatment of esophageal malignancies
- Endoscopic drainage of pancreatic pseudocyst
- Tightening the lower esophageal sphincter
- Dilating or stenting of stenosis or achalasia
- Percutaneous endoscopic gastrostomy (feeding tube placement)
- Endoscopic retrograde cholangiopancreatography (ERCP) combines EGD with fluoroscopy
- Endoscopic ultrasound (EUS) combines EGD with 5-12 MHz ultrasound imaging

5. Newer interventions

- Endoscopic trans-gastric laparoscopy
- Placement of gastric balloons in bariatric surgery[6]

CONTRAINDICATIONS FOR UPPER GI ENDOSCOPY

Contraindications:

1. Severe shock
2. Possible visceral perforation

Relative contraindications

1. Recent myocardial infarction
2. Medically unstable patients

3. Unwilling patients.

4. Anticoagulation

5. Pharyngeal diverticulum

6. Head and neck surgery.

COMPLICATIONS OF UPPER GI ENDOSCOPY[10]

An endoscopic procedure is considered appropriate if the benefit for the patient exceeds the risks by a sufficiently wide margin.

The complication rate of upper GI endoscopy is about 0.1% with cardiopulmonary events predominating, which account for 50% of all reported complications. Most complications of cardiopulmonary origin are as a consequence of hypoxemia, which may be related to the procedure itself or due to the effect of sedatives. According to ASGE survey, 46% of cardiopulmonary complications are related to sedation. Significant oxygen desaturation (<90%) has been found in many of them.

ST-T changes and arrythmias are also frequently reported in Electrocardiogram's (ECG's) recorded during endoscopy**.** As more numbers of elderly and high risk patients are being subjected to this procedure, the incidence of cardiopulmonary complications is also increasing in proportion.

Endoscopists, while using drugs for sedation should recognize that any drug which depresses CNS has the potential to impair respiration, circulation or both. Most complications of endoscopy are cardiopulmonary. Sedation should be kept to a minimum required level for patient's comfort and safety particularly in the elderly. A retrospective analysis identified that cardiopulmonary incidents were noted in the immediate post procedure period. Aspiration pneumonia, embolism and myocardial infarction were

noted in the later period. Supplemental oxygen administration has been shown to reduce the magnitude of oxygen desaturation when given during endoscopic procedures.

Continuous electrocardiogram (ECG) monitoring is warranted in high risk patients. Patients who may benefit from ECG monitoring include those who have history of significant cardiac or pulmonary disease, elderly patients and those on whom prolonged procedures are anticipated. End- tidal Co2 monitoring is useful in cases which take time for the procedure especially so if associated with a compromised cardio respiratory status.[5]

Still, Diagnostic upper GI endoscopy is a remarkably safe procedure. Although there are no recent high quality prospective studies of complications following diagnostic upper GI endoscopy, one large US study estimated an overall complication rate (including mucosal biopsy) of 0.13% and an associated mortality of 0.004%.[7]

The major complications of EGD are

1. Cardiopulmonary problems
2. Bleeding
3. Infection
4. Perforation

Approximately 1 complication occurs for every 1000 procedures. The mortality rate is estimated to be 0.5-3 deaths for every 10,000 procedures. Cardiopulmonary events comprise 50% of all major complications, and most of these events result from the medications used for conscious sedation.

1. CARDIO-PULMONARY COMPLICATIONS

Cardio-pulmonary complications account for about 50% of the potentially serious morbidity and approximately 50% of all the procedure-related deaths associated with GI Endoscopy. Complications range from minor changes in vital signs to arrhythmias, myocardial infarction, respiratory arrest, shock and death.

Cardio respiratory complications related to sedation and analgesia are the commonest complication of diagnostic upper GI endoscopy. In many cases these complications are a direct or indirect consequence of elderly, frail or at-risk patients being given unnecessarily high doses of IV sedation[8, 9]

Elderly patients and those with pre-existing cardiopulmonary disease are at increased risk. Hypoxia is particularly common when intravenous sedation is combined with intravenous analgesia.

The important cardio pulmonary complications are: [10]

A. Drug induced respiratory depression with hypoxia and CO2 retention

B. Aspiration pneumonia

C. Cardiac arrhythmias

D. Hypertension, hypotension and/or vaso-vagal syncope

E Angina and myocardial infarct

F. Stroke

G. Nausea and vomiting

A.Drug Induced Respiratory Depression

Intravenous benzodiazepines (midazolam and diazepam) can cause respiratory depression as a result of the drug occupying brainstem benzodiazepine receptor sites which in turn may reduce respiratory drive.

Intravenous opioids (pethidine and fentanyl) occupy opioid receptor sites within the brain and brainstem and can similarly cause respiratory depression with resulting falls in both tidal volume and respiratory rate. Drug induced hypoventilation may cause both hypoxaemia and CO2 retention which in extreme cases may progress to apnoea and even respiratory arrest.

Pulse oximetry is a very useful indicator of oxygenation but not ventilation. However when supplemental oxygen is used, the fall in SpO2 may be significantly delayed for between 30–90 seconds after the onset of severe drug induced respiratory depression/apnoea. It is for this reason that continuous capnography is recommended in patients being sedated with propofol[11, 12]

Recognition And Management Of Respiratory Depression:

As for oversedation, loss of verbal contact due to reduced conscious level may be the first sign of impending respiratory depression. Reduction in SpO2 on pulse oximetry is a good indicator but it can be a late sign of respiratory depression. Increased paCO2 (where capnography is available) is the most sensitive early warning of respiratory depression.

Treatment of respiratory depression:

Stimulate the patient to wake up and take deep breaths. Reverse agonist sedative effect with antagonist flumazenil plus (if necessary naloxone). The airway may need to be protected with chin lift, jaw thrust, plus, if necessary, airway, laryngeal mask.

B. Aspiration Pneumonia

Aspiration of gastric contents into the lungs is common, causes pneumonia and may result in death.[8, 9] It is at particular risk of occurring in oversedated patients as a result of an unprotected airway and where there is an increased propensity to vomit e.g. in patients with GI bleeding, gastric stasis, gastric outlet obstruction or those patients who have simply eaten or drunk fluid within the last 4 hours. It can also occur when a local anaesthetic spray such as lignocaine is used in combination with IV sedation; there is some evidence of an increased risk of aspiration.

Elderly patients have an increased tendency to aspirate and this may be further confounded by an already poor gag reflex. Aspiration is common in obtunded patients e.g. those with hepatic encephalopathy.

Diagnosis – Aspiration may be suspected when a patient starts coughing violently either during or soon after an endoscopic procedure. Cyanosis may occur.

Treatment -

• Suction of fluids from oral cavity and throat

• Increasing the rate of supplemental oxygen

• Encouraging the patient to cough;

• Chest X-ray, IV antibiotics and physiotherapy.

C.Cardiac Arrhythmias

Cardiac arrhythmias are frequently observed during GI endoscopic procedures. Fortunately, most are not clinically significant.

1. Sinus Tachycardia
2. Sinus Bradycardia
3. Other Arrhythmias

Sinus tachycardia: (*Heart rate >100 beats per minute or increase of 20bpm from base line.)*

It is caused by anxiety or is related to pain. It can occur as a compensatory mechanism in patients who are hypotensive as a result of either dehydration or blood loss. It is also seen following administration of IV anticholinergics such as buscopan.

The following ECG trace shows a fast, regular heart rate at 150 bpm. Each QRS complex (shaded) is preceded by a P wave (arrowed) of regular shape and offset.

Fig 2: Sinus Tachycardia

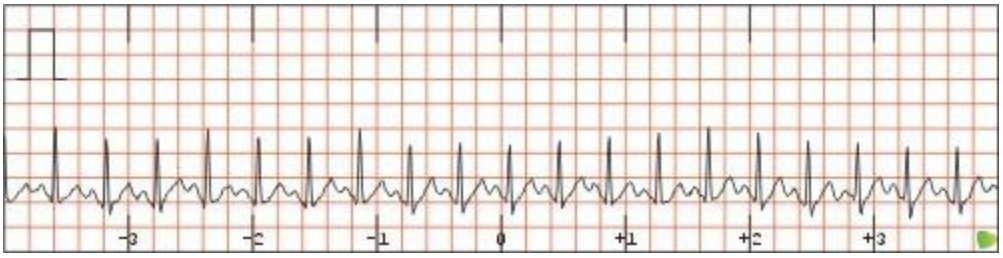
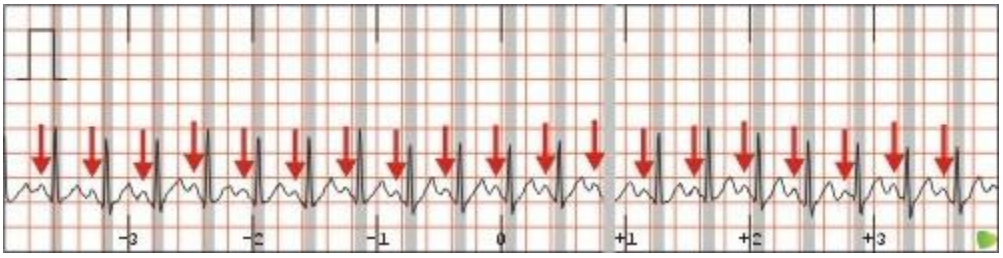


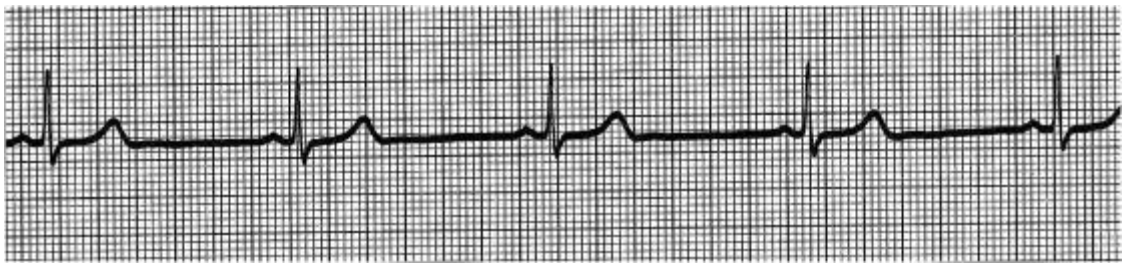
Fig 3: Sinus Tachycardia



Sinus bradycardia: (*Heart beat less than 60bpm)*

It is most frequently seen in patients who are taking beta blockers either for hypertension or IHD. It can also be induced by vagal stimulation, which occurs at the time of intubation of the oesophagus.

Fig 4: Sinus Bradycardia



Each cycle commences with a P wave and the PR interval is normal. Therefore, rhythms are sinus-paced and differ only in rate: normal sinus rhythm, sinus bradycardia, or sinus tachycardia. In this case, it is sinus bradycardia, because the rate is <60.

Other frequently observed cardiac arrhythmias include atrial and ventricular ectopic beats, atrial fibrillation and supraventricular tachycardia. Ventricular tachycardia and even cardiac arrest due to VF have been described but fortunately are rare.[9]

Supraventricular Tachycardia

As ventricular conduction follows the normal pathways, the ECG will show heartbeats with a normal morphology QRS complex and T wave.

The ECG trace below shows four sinus beats (arrowed), at a rate of 106 bpm (the RR interval is approximately three boxes), followed by a fast, regular heart rate at 147 bpm (the RR interval is approximately two boxes).

Fig 5: Supraventricular Tachycardia

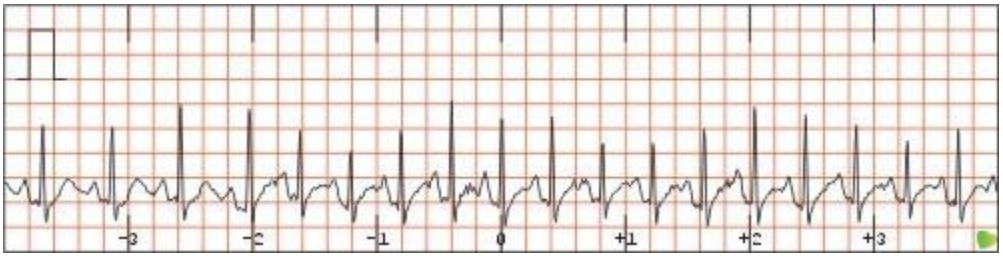


Fig 6: Supraventricular Tachycardia

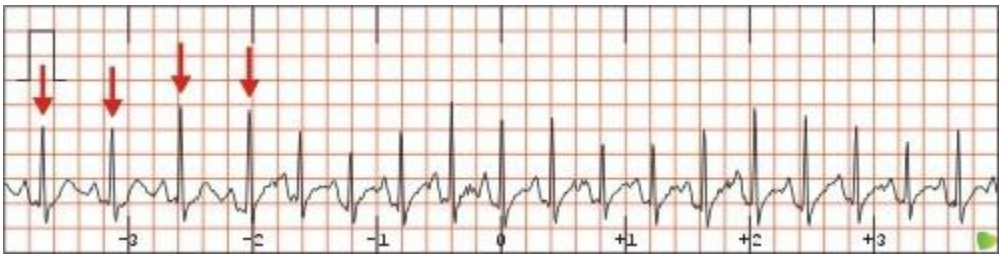
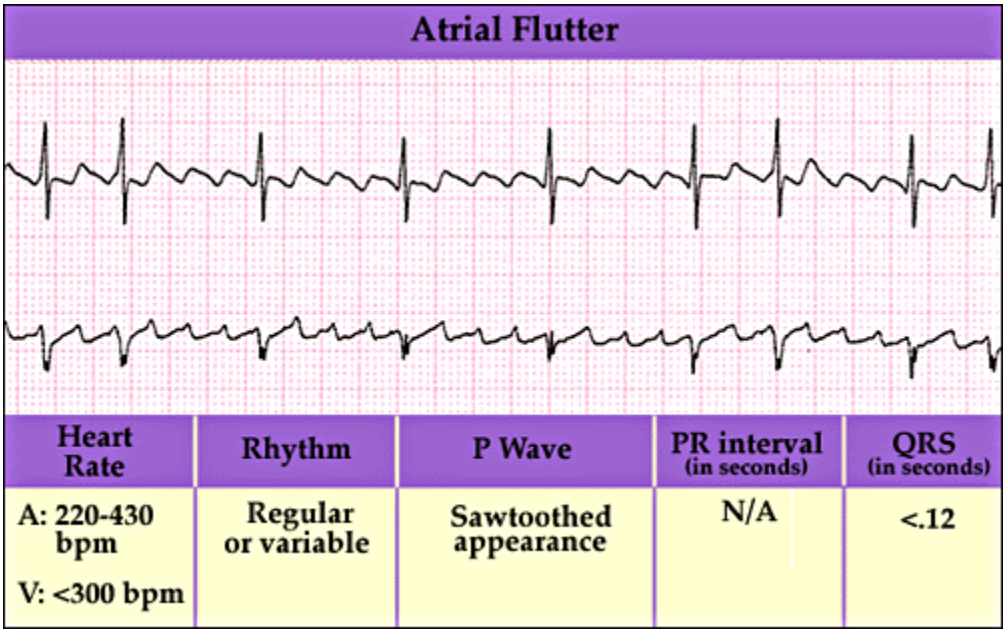


Fig 7: Atrial Flutter



Regular atrial activity with a "clean" ***saw-tooth*** appearance in leads II, III, aVF, and usually discrete 'P' waves in lead V1. The atrial rate is usually about 300/min, but may be as slow as 150-200/min or as fast as 400-450/min

So, continuous ECG monitoring is recommended for high risk patients with a relevant cardiac history.

D.Hypertension, Hypotension And Vaso-Vagal Syncope

Hypertension *(systolic BP greater than 160mm hg)* can occur due to background systemic hypertension, anxiety or pain. In some patients intubation of the oesophagus can cause a reflex pressor response raising blood pressure.

Hypotension *(systolic BP less than 90)* ***is*** due to a fall in either cardiac output or total peripheral resistance lowering the patient's mean arterial pressure. Sedation with benzodiazepines has a mild vasodilatory effect and usually produces only a slight fall in BP in normal sedative doses. Profound fall in BP is commonly seen in hypovolaemic patients e.g. due to blood loss or dehydration. In Endoscopic procedures using a benzodiazepine and opioid as sedatives can drop blood pressure profoundly. Bradycardia of any cause can cause hypotension.

For prevention of hypotension, relevant medical and drug history must be taken before endoscopic procedure. Patient should also be enquired about use of antihypertensive, anti-anginal and anti-arrythmic drugs and particularly about timing of their last dose. Blood pressure and pulse should be recorded before, during and after any endoscopic procedure at frequent intervals.

E. Angina and Myocardial Infarction

Myocardial infarction occurs either during or in the few days after endoscopic procedures with or without sedation.[8, 9, 11] A proportion of these are undoubtedly causally related to the endoscopic procedure[8, 9, 11]

Cause of Angina/Myocardial Infarction:

It occurs due to increased myocardial oxygen need, because, both sedated and non-sedated endoscopic procedures cause an increase in the 'rate/pressure product' (mean arterial BP X heart rate), which is an indirect measure of myocardial oxygen consumption. This can cause angina pectoris in patients with IHD or it may cause occult symptomless myocardial ischaemia which is only apparent with sophisticated monitoring e.g. myocardial perfusion study.[11] Hypotension and/or bradycardia will reduce myocardial muscle perfusion, predisposing to angina.

Prevention or Minimization of Myocardial Ischaemia during Endoscopy

• Pre-oxygenate at risk patients and give continuous supplemental oxygen.

•Angina developing during an endoscopy is usually best managed by giving sublingual GTN and oxygen and discontinuing the examination.

• If angina or a frank MI is suspected during or following an endoscopy, an ECG should be taken immediately. If the result is equivocal or if the chest pain prolonged, then admission to the CCU is warranted to exclude an MI.

F.Cerebrovascular Attacks:

Both TIAs and fully completed strokes can occur during and following endoscopic procedures [8, 9, 11]

Possible mechanisms include

• Periods of either hypo or hypertension

• Cardiac arrythmias or

• As a consequence of an MI.

2. BLEEDING

Bleeding is a rare complication of diagnostic upper GI endoscopy and is seen in individuals with thrombocytopenia and coagulopathy. Mallory-Weis tears without much bleeding can occur rarely.

3. INFECTIOUS COMPLICATIONS

Infectious complications in patients undergoing diagnostic endoscopy occur from the procedure itself or from the use of contaminated equipment. Transient bacteraemia can occur during a diagnostic endoscopic procedure and is found more often for therapeutic procedures. The incidence is very low and the rate of bacterial endocarditis or other complications in patients not at risk for endocarditis (e.g., normal cardiacvalves) is extremely low and estimated to be 1 in 5 to10 million. Rarely retropharyngeal and retroesophageal abscess can occur due to trauma. [13]

4. PERFORATION

Perforation of the upper GI tract related to diagnostic endoscopy is relatively low. In 1974 ASGE survey, the perforation rate was found to be 0.03%, with a mortality rate of 0.001%.

Predisposing factors to perforations include esophageal strictures, Zenker's diverticulum and malignancies. Perforations of the esophagus although rare are associated with a relatively high mortality rate. Common symptoms of perforation are chest pain, crepitus, pleurisy, pleural effusion and leukocytosis. X rays of neck and chest helps in diagnosis and has to be confirmed by contrast. [14]

QUALITY INDICATORS FOR ENDOSCOPIC PROCEDURES: [15]

It is important to have the assurance that high quality endoscopic procedure is performed. A high quality endoscopy ensures that the patient receives the indicated procedure, that correct and clinically relevant diagnoses are made or excluded, that therapy is properly performed and that all these things are accomplished with minimum risk. So quality indicators have been developed by the task force of ASGE (American Society for Gastrointestinal Endoscopy) and ACG (American College of Gastroenterology).

For any Endoscopic procedure, indicators were considered for 3 time periods: pre procedure, intra procedure and post procedure. Important issues during preprocedure period include proper indication, patient consent for the procedure, patient clinical status and risk assessment, steps to reduce risk such as through the use of prophylactic antibiotics, and maintaining time in the performance of the procedure. The intraprocedure period extends from the administration of sedative or insertion of endoscope to removal of endoscope. During sedated endoscopic procedure, the following parameters have to be monitored: oxygen saturation with pulse oximetry, pulse rate and blood pressure. Blood pressure and pulse rate should be recorded at intervals no greater than 5 minutes. The postprocedure period extends up to subsequent follow-up. Postprocedure activities include providing instructions to the patient, recognition and documentation of complications, follow-up of pathologic conditions, and assessing patient satisfaction.

Quality indicators for Endoscopic procedures:

1. Proper indication

2. Informed consent

3. History and physical examination

4. Risk stratification

5. Prophylactic antibiotics

6. Sedation plan recorded

7. Anticoagulants recorded

9. Photo documentation of major abnormalities

10. Patient monitoring

11. Medications are documented

12. Reversal agents

13. Discharge criteria

14. Discharge instructions

15. Pathology follow-up

16. Procedure report

17. Reporting of complications

18. Patient satisfaction

19. Communication with referring provider(s)

PULSE OXIMETER AND SPO2

A pulse oximeter is a medical device that indirectly measures the oxygen saturation of a patient's blood and changes in blood volume in the skin, producing a photoplethysmograph. It is often attached to a medical monitor so staff can see a patient's

oxygenation at all times. Most monitors also display the heart rate. The original oximeter was made by Milliken in the 1940s. The precursor to today's modern pulse oximeter was developed in 1972, by Aoyagi using the ratio of red to infrared light absorption of pulsating components at the measuring site.

Although Pulse Oximetry is not a prerequisite to perform routine unsedated diagnostic endoscopy of upper GI tract, it is useful in patients with systemic disease.

ELECTROCARDIOGRAPHIC MONITORING OF UPPER GI ENDOSCOPY

The Electrocardiogram was introduced by William Einthoven in 1893 at a meeting of Dutch medical society. In 1924, Einthoven received the noble prize for his life's work in developing the ECG. The standard 12 lead ECG that is used throughout the world was introduced in 1942. The electrical currents generated by the heart are commonly measured by electrodes placed on the body surface and this tracing is called an Electrocardiogram (ECG, or EKG). Normally, when an ECG is recorded, all leads are recorded simultaneously, giving rise to what is called a 12-lead ECG.

BLOOD PRESSURE MONITORING DURING UPPER GI ENDOSCOPY

Hales was the first to measure blood pressure in 1733 by inserting tubes directly into the arteries of animals. Riva Rocci, an Italian physician, developed the first conventional sphygmomanometer in 1896. In 1905, Nicolai Korotkoff described various sounds while auscultating over the brachial artery during deflation of a Riva Rocci cuff.

Blood pressure measurement is taken at least 1 hour after drinking coffee, 30mts after smoking or vigorous exercise and without any stress. The patient should be sitting upright in a chair with both feet flat on the floor for a minimum of five minutes prior to

taking a reading. The patient should not be on any adrenergic stimulants, such as those found in many cold medications.

CARDIOPULMONARY CHANGES DURING UPPER GI ENDOSCOPY

INTRODUCTION

Endoscopy of the upper GI tract using fibre optic instruments has taken an increasingly dominant role in diagnosis and therapy since the introduction of the first panendoscope by Hirschowitz in 1963[16]

Although upper GI Endoscopy is a routine diagnostic method used widely around the world, it does carry some risk for all patients. It is generally accepted that patients who suffer from cardiac or pulmonary illness are at increased risk while undergoing this procedure. When carefully managed, endoscopy plays a vital role in diagnosis and therapy even in these elderly cardiac patients.[17]

Outpatient upper GI endoscopy is a commonly performed procedure and is very safe. The complication rates quoted for upper GI endoscopy varies between 0.02% and 1.1% with a mortality rate of 0% -0.12%**.** In a recent review of guidelines for endoscopy, it was mentioned, even today cardio pulmonary complications account for about 50% of the potentially serious morbidity and approximately 50% of all the procedure related deaths associated with GI endoscopy.[10]

Osinike BB et al studied 100 patients without cardiopulmonary disorders for important variables like age of the patient, sex and duration of the diagnostic procedure. They monitored oxygen saturation, blood pressure and pulse rate during endoscopy using pulse oximeter and automated BP monitor. ECG was recorded before, during and after endoscopy. Then they evaluated important variables in relation to these changes for age,

gender, duration of the procedure and drugs used and had similar readings in all of them.[18]

Arterial hypoxemia is well documented during endoscopy and may predispose patients to cardiovascular sequeale including arrhythmias and ECG changes. Patients at high risk for these complications include the elderly, those with pre existing coronary artery disease, valvular heart disease and chronic obstructive pulmonary disease. Since these patients constitute a majority of patients undergoing endoscopy, the problem of hypoxemia has increased.[23] Continuous ECG monitoring has revealed ST-T changes and arrhythmias more frequently in cardiac patients during endoscopy than in others.[19, 20] But in another study, Sachdev et al however did not find more frequent changes in cardiac subjects.[21] Elderly subjects have more frequently demonstrated ECG changes during endoscopy. Overactivity of the sympathetic system due to apprehension or stress of the procedure, distension of the stomach by air insufflation,[22] and hypoxemia[20] resulting from the presence of the endoscope in the throat have all been blamed for the ECG changes. Diazepam as premedication has reduced the incidence of abnormal ECG during endoscopy.[19] Administration of 2 litres of O_2 during the procedure also proved to be beneficial.

HYPOXIA AND DESATURATION

Hypoxia is common in patients undergoing upper gastrointestinal endoscopy with or without sedation. Sedation significantly increases the incidence of desaturation and hypoxia. Supplementary nasal oxygen at 4 litres/minute in sedated patients abolishes desaturation and hypoxia. Wang Cy, Ling LC et al studied the incidence of arterial oxygen desaturation in sedated and nonsedated patients breathing room air who

underwent diagnostic upper GI endoscopy by using pulse oximetry. Hypoxia (SpO2 92% or less of at least 15 s duration) occurred in 17% of sedated patients and in 6% of nonsedated patients, respectively ($p < 0.03$). Mild desaturation (SpO2 94% or less and less than 15 s duration) occurred in 47% of sedated patients compared with 12% of nonsedated patients ($p < 0.001$). In a further Study, the effects of supplementary oxygen therapy and the effects of oxygenation on arterial oxygen saturation (SpO2) in sedated patients were studied using pulse oximetry. Group A received no supplementary oxygen while Group B received supplementary oxygen at 4 1 x min(-1) via nasal cannulae. Hypoxia occurred in 25% Group A and none in groups B ($p < 0.001$). [24]

In patients undergoing upper GI endoscopy, there are some predictive variables who always are associated with increased risk for oxygen desaturation. Alcain, Guillén P, Escolar A, Moreno M, Martín L studied 481 patients to identify factors related to the patient, the examination, and the monitoring data that would predict severe desaturation. Mild desaturation (SaO2 between 90% and 94%) was found in 23.7% of these patients, and severe desaturation (SaO2 < 90%) was found in 6.4%. The variables found to predict severe desaturation were basal SaO2 < 95% (odds ratio 67.7), respiratory disease (odds ratio 30.5), more than one attempt needed for intubation (odds ratio 39.4) and emergency procedure (odds ratio 14.9).The predictive variables analyzed in this study can be used to identify patients who are at increased risk for desaturation and possibility of going into respiratory depression. Such patients require very close monitoring (pulse oximetry monitoring at the minimum). [25]

UPPER GI ENDOSCOPY WITHOUT SEDATION:

Diagnostic upper gastrointestinal endoscopy is a safe procedure and usually does not require sedation. But some degree of hypoxemia occurs even without sedation. MR Banks, PJ Kumar and HE Mulcahy, have studied 330 unsedated patients undergoing diagnostic upper GI endoscopy with the help of pulse oximetry to identify factors associated with oxygen desaturation(SpO2). They also studied a further 154 patients undergoing upper GI endoscopy with sedation as controls. They found out that SpO2 levels were lower in sedated compared to unsedated patients ($p<0.0001$). Six unsedated patients (2%) desaturated to 90% or less during endoscopy as compared to 32 sedated patients (21%) ($p<0.0001$). SpO2 levels in unsedated patients were not related to patient's sex, age, smoking or duration of endoscopy. They concluded that pulse oximetry is not a prerequisite to perform routine unsedated diagnostic endoscopy.[26]

In young patients diagnostic upper gastrointestinal endoscopy can be performed without sedation. Endoscopy without sedation reduces the risks of respiratory depression and reduces procedural recovery time. Assurance to the patient works like a premedication. In a thoughtful editorial, written in 1969, Berry said 'endoscopic premedication' should be regarded as an extension of psychological preparation, just as endoscopy should be regarded as an extension of the physical examination. Non-pharmacological methods, such as patient education and relaxation techniques, have been shown to improve the rate of endoscopy acceptance by the patient. It is commonly noticed that patients presenting for the first endoscopy are relaxed if their anxiety is reduced as a result of increasing their familiarity with the impending procedure. The important psychological preparation for endoscopy begins with the introduction of the

patient to the endoscopist. The establishment of rapport and confidence may be achieved by simple expressions of cordiality and sincere interest in the patient and his problem. There should be at least a brief discussion between the endoscopist and patient. The endoscopist should explain the specific purpose of the procedure and what difficulties or lack of them may be expected by the patient. Obviously anxious individuals may need reassurance of the simple procedure and a promise of gentility. Ability to anticipate varying individual psychological needs in patient's preparation may be the best index of the astuteness of the endoscopist, and may represent the difference between success and failure in demonstrating a lesion in a difficult case.[27]

Arterial hypoxemia, tachycardia and increased systolic blood pressure associated with upper GI endoscopy are due to activation of a classic endocrine stress response with elevated cortisol and catecholamine levels. 50% of endoscopic procedures may be associated with a degree of hypoxemia and this commonly occurs immediately after insertion of endoscope. In non-sedated patients, factors commonly found predisposing to hypoxemia are – basal oxygen saturation of less than 95%, preexisting respiratory disease, multiple attempts at intubation, emergency procedure, operator's inexperience and longer procedural time. In these circumstances, sedation will exacerbate hypoxemia.

Upper gastrointestinal endoscopy has been associated with significant increase of cardiac stress (as measured by the myocardial rate pressure product) even in healthy unsedated volunteers. So it is not surprising that patients with stable coronary disease have been found to experience asymptomatic, silent period of ischemia during endoscopy. In these patients, the incidence of S-T segment depression was found to be reduced by the use of supplemental Oxygen. In some patients having stable coronary

artery disease, an excess of ventricular extrasystoles were noticed during gastroscopy, but these didn't lead to sustained arrhythmias or morbidity. Supplemental Oxygen can certainly correct the hypoxia observed during endoscopy. So in their anesthesia book, Chandra M kumar and Mark bellamy concluded that all patients undergoing upper GI endoscopy should be assessed continuously during the procedure for level of consciousness, hemodynamic status and respiratory status. According to them, in addition to clinical observation, electronic blood pressure monitoring and pulse oximetry are must for patients with sedation, for patients with pre existing cardiac or respiratory disease. Capnography has been suggested to be superior to pulse oximetry in detecting early respiratory depression. [28]

SEDATION AND UPPER GI ENDOSCOPY

Endoscopists should recognize that any drug which depresses CNS has the potential to impair respiration, circulation or both. Most complications of endoscopy with sedation are cardiopulmonary. Sedation should be kept to a minimum required level for patient's comfort and safety particularly in the elderly. A retrospective analysis has identified that cardiopulmonary incidents were noted in the immediate post procedure period. Aspiration pneumonia, embolism and myocardial infarction were noted in the later period. Supplemental oxygen administration has been shown to reduce the magnitude of oxygen desaturation when given during endoscopic procedures. Continuous electrocardiogram (ECG) monitoring is warranted in high risk patients. Patients who may benefit from ECG monitoring include those who have history of significant cardiac or pulmonary disease, elderly patients and those on whom prolonged procedures are anticipated. End tidal Co2 monitoring is useful in cases which take time for the procedure

especially so if associated with a compromised cardio respiratory status. Recovery room observation and monitoring for any adverse effects from the procedure and sedation has to be done. The length of follow up observation is dependent on the perceived risk to the patient.[5]

Sedation given with all necessary precautions is useful. Killic Mehmet et al have observed 200 patients undergoing Upper Gastrointestinal endoscopy to know whether endoscopy procedure itself or the sedation medication was responsible for the oxygen desaturation seen during endoscopy. In the endoscopy unit of Dice hospital, they divided these 200 patients into 2 groups. The first group of 100 patients underwent Upper GI endoscopy without sedation. The second group of 100 patients underwent endoscopy with midazolam sedation. For all these 200 patients, preoperative oxygen saturation, haemoglobin levels and heart rate per minute were recorded. Patients with initial oxygen saturation levels <90% were excluded. At the end of endoscopy, all the 100 patients who received premedication were administered Flumazenil. Oxygen saturation and heart rate monitored. Results showed mean age of all patients is about 45 years. No difference was found between the 2 groups regarding Haemoglobin, basal maximum pulse rate, duration of endoscopy and minimum basal oxygen saturation. Smoking was found making significant contribution to the oxygen desaturation. So the researchers concluded that midazolam premedication for upper gastrointestinal endoscopy is a reliable procedure and does not lead to additional risk. [29]

When deep sedation is planned it is better to monitor the patients for desaturation. Twenty patients posted for upper GI endoscopy who required deep sedation due to prolonged endoscopic procedures were studied by W.Murray et al to assess the

cardiovascular changes during endoscopy and to evaluate suitable monitoring techniques to detect critical events during sedation and endoscopy. In these 20 patients continuous recordings of heart rate, electrocardiograms and arterial oxygen saturation were made and arterial pressure was recorded at 1 min intervals. These patients were studied immediately before administration of sedatives, continued for the duration of procedure and for 1 hour following endoscopy. Oxygen saturation decreased in all patients during the examination to a mean of 82.9% (SD 11.9), and remained below baseline for the duration of the examination and into the recovery period. Statistically significant increases and reductions of systolic arterial pressure and rate-pressure product were found during the procedures compared with baseline values recorded before administration of sedatives. Sixteen of the 20 patients developed tachycardia during the examination. Ten patients developed ectopic foci which were supraventricular, ventricular or both in origin. Electrocardiogram changes resolved during the recovery period. Myocardial ischaemia was assessed by S-T segment depression and a significant correlation was found between S-T segment depression and hypoxaemia, although the magnitude of the S-T depression was small and may not have been detected clinically. No correlation was found between S-T segment depression and arterial pressure, heart rate or rate-pressure product. Regular and frequent assessments of arterial pressure and heart rate are desirable but the results confirm the importance of monitoring arterial oxygen saturation in addition to arterial pressure and the electrocardiogram.[30]

CARDIO RESPIRATORY MONITORING

Monitoring might be necessary in old people and with long procedures. BB Osinaike, A Akere, To Oloajumoke and Eo Oyebamiji have studied in detail 40 patients undergoing Upper Gastrointestinal Endoscopy at Lautech teaching hospital,Osugbo during 2006. None of these had cardiorespiratory diseases. Their Oxygen saturation blood pressure, pulse rate were measured using pulse oximeter and automated BP monitor. The recordings were done from baseline until 5 minutes after the procedure. In these 40 patients 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. So they concluded that mild to moderate hypoxia is common during endoscopic procedures and of no serious consequence; severe hypoxia is less common. So they recommended non-invasive monitoring to be done in patients aged greater than 50 years and with procedures longer than 27 minutes. [18]

When deep sedation is planned it is better to monitor the patients for desaturaion. Statistically significant increases and reductions of systolic arterial pressure and rate-pressure product were found during the procedures compared with baseline values recorded before administration of sedatives. Regular and frequent assessments of arterial

oxygen saturation in addition to arterial pressure and the electrocardiogram are desirable in endoscopic procedures with sedation.[30]

For unsedated upper GI endoscopy routine oxygen monitoring is not necessary according to HY Embu et al. In a study of 54 patients in Nigeria, mild to moderate hypoxia occurred in 18.5% of the patients while severe desaturation occurred in 12.9% of the patients. All these severe hypoxia lasted for less than 30 seconds and no supplementary oxygen was needed. So they concluded that routine oxygen monitoring may not be necessary in patients with unsedated upper GI endoscopy.[31]

BLOOD PRESSURE CHANGES IN UPPER GI ENDOSCOPY

Blood pressure levels are more stable in sedated endoscopy patients than in nonsedated, but oxygen desaturation is also more marked in sedated. In a study out of 252 patients posted for upper GI endoscopy, 1/3 were given Diazepam, 1/3 were given Midazolam and others received placebo. Pulse rate, blood pressure, ECG and peripheral Oxygen saturation (sPo2) were noted at baseline after premedication, during endoscopy and post endoscopy. They found no difference in the baseline record of the three groups. Significant fall in sPo2 was noted in all the age groups, more marked in the sedated group during endoscopy. Blood pressure remained more stable in the sedated group. ECG changes included atrial and ventricular premature contractions in all the three groups. [32]

In a different study Mizuno ju et al observed that blood pressure decreased significantly 2 minutes after midazolam administration, but increased after insertion of endoscope; it was equal to control value. Heart rate increased significantly 1 and 3 minutes after the introduction of endoscope. They concluded that sedation with IV

midazolam during upper GI endoscopy is useful to control the cardiovascular responses and to obtain amnesia. But a decrease in SpO2 should be watched carefully.[33]

In sedated patients,Bhalla V et al observed stable blood pressure, although SpO2 showed significant fall[39]. Others also observed significant increase in blood pressure and heart rate during gastroscopy. These changes occured during intubation time in young patients and later during the procedure in older patients. In a study by Ruth Ross et al observed maximum profound changes in systolic pressure in the sedated group (73 mm Hg) compared to those having Throat spray (43 mm Hg). [34]

ECG CHANGES DURING GASTROSCOPY

Although endoscopy is usually considered to be a safe procedure, arrhythmias are known to occur frequently, especially in the elderly. The frequency of arrhythmias varies between 38.5% and 75% and increases especially in elderly patients with heart disease[35, 36]

Most of the cardiac arrhythmias during upper GI endoscopic procedure are not significant clinically. Sinus tachycardia and sinus bradycardia are commonly noticed.

Cardiac irregularities of rhythm and ECG changes are more commonly seen with elderly patients when they are monitored. So it is stated that elderly patients should have nasal oxygen and cardiopulmonary monitoring during endoscopy.[37]

But another study didn't support routine Oxygen administration. Here 50% of the patients received oxygen at 2 litres/min and the others room air during endoscopy. A wide range of ECG abnormalities were recorded in both oxygen and air groups, of which ventricular and supraventricular ectopic beats were the most common. There were no significant differences in the rate of occurrence of any clinically important cardiac abnormalities either between the oxygen and air groups or between the 3 monitored

periods –before, during and after gastroscopy[38]. Along with tachycardia, atrial and ventricular premature contractions were noticed by others[39]. Electrocardiographic changes usually occur when the endoscope is in the stomach, although introduction of endoscope produced 20% of dysarrhythmias. [40]

To know whether diagnostic endoscopy is safe in very old people, 37 patients above 80 years age who were undergoing upper gastrointestinal endoscopy were monitored for a period of 24 hours with the help of Holter recording and pulse oximetry. It was observed that the number of VES increased during the one hour period after endoscopy. No fatal complications occurred, so they concluded that it is a safe procedure.[41]

Diagnostic upper GI endoscopy can be done even at hill places with no deleterious effects on heart as studied on 120 patients in Simla. Electrocardiographic (ECG) changes were studied. . Increase in heart was seen in most of these patients, maximum in patients with heart disease. ST depression was seen in 14%, T wave inversion in 13%, supraventricular tachycardia in 6% and ventricular ectopics in 1.6%. All these changes reverted to normal within 9 to 10 minutes; so it is a safe procedure.[42]

20 patients posted for upper GI endoscopy who required deep sedation due to prolonged endoscopic procedures were studied to assess the cardiovascular changes during endoscopy and to evaluate suitable monitoring techniques to detect critical events during sedation and endoscopy. Oxygen saturation decreased in all patients during the examination to a mean of 82.9% (SD 11.9), and remained below baseline for the duration of the examination and into the recovery period. Statistically significant increases and reductions of systolic arterial pressure and rate-pressure product were found during the

procedures compared with baseline values recorded before administration of sedatives. Sixteen of the 20 patients developed tachycardia during the examination. Ten patients developed ectopic foci which were supraventricular, ventricular or both in origin. Electrocardiogram changes resolved during the recovery period. Myocardial ischaemia was assessed by S-T segment depression and a significant correlation was found between S-T segment depression and hypoxaemia, although the magnitude of the S-T depression was small and may not have been detected clinically. No correlation was found between S-T segment depression and arterial pressure, heart rate or rate-pressure product. Regular and frequent assessments of arterial pressure and heart rate are desirable but the results confirm the importance of monitoring arterial oxygen saturation in addition to arterial pressure and the electrocardiogram.[30]

Patients suspected of ischemic heart disease should be carefully monitored during upper GI endoscopy. Sixty patients who were posted for endoscopy because of their Dyspepsic symptoms at Dow medical college hospital, Karachi were studied to assess the effects of endoscopy on ischemic heart disease patients with special reference to oxygen saturation, blood pressure ,cardiac rhythm.30 patients were with symptoms of Ischemic heart disease and 30 patients without IHD. Pre endoscopic oxygen saturation, cardiac rhythm and blood pressure were noted and monitored during and after the procedure till the changes that have taken place were returned back. Oxygen saturation dropped in IHD patients (10%) and they developed cardiac rhythm changes-Tachycardia and ventricular premature contractions (6%) and ST segment elevation (3.3%). So cardiac events can occur in IHD patients during endoscopy and these patients should be monitored for oxygen saturation and supplementation.[43]

MYOCARDIAL ISCHEMIA DURING GASTROSCOPY

Myocardial ischemia was assessed by S-T segment depression and a significant correlation was found between S-T segment depression and hypoxaemia, although the magnitude of the S-T depression was small and may not have been detected clinically. No correlation was found between S-T segment depression and arterial pressure, heart rate or rate-pressure product. Regular and frequent assessments of arterial pressure and heart rate are desirable but the results confirm the importance of monitoring arterial oxygen saturation in addition to arterial pressure and the electrocardiogram.[30]

Tachycardia which accompanies upper gastrointestinal endoscopy is known to be an important pathogenic factor in the development of myocardial ischemia. Tachycardia is thought to be due to the endocrine response to endoscopy.

Patients suspected of ischemic heart disease should be carefully monitored during upper GI endoscopy. Sixty patients who were posted for endoscopy because of their dyspepsic symptoms at Dow medical college hospital, Karachi were studied to assess the effects of endoscopy on ischemic heart disease patients with special reference to oxygen saturation, blood pressure ,cardiac rhythm.30 patients were with symptoms of Ischemic heart disease and 30 patients without IHD. Pre endoscopic oxygen saturation, cardiac rhythm and blood pressure were noted and monitored during and after the procedure till the changes that have taken place were returned back. Oxygen saturation dropped in IHD patients (10%) and they developed cardiac rhythm changes-Tachycardia and ventricular premature contractions (6%) and ST segment elevation (3.3%). So cardiac events can occur in IHD patients during endoscopy and these patients should be monitored for oxygen saturation and supplementation.[43]

MATERIALS AND METHODS

SOURCE OF DATA

1 About 140 patients undergoing upper gastrointestinal endoscopic examination in Shri. B. M. Patil Medical College, hospital and research centre between November 2007 and September 2009 were studied. No premedication or anesthesia was given.

2 Thorough cardiac and Respiratory system assessment will be done in all patients

3 A Pentax video gastrointestinal fibreoptic endoscope EPK 150C will be used for upper GI endoscopy.

4 A portable RMS ECG machine was used for recording standard 12 lead ECG with long rhythm strip of lead II at a speed of 25mm/second and 1mV tracing. These tracings were recorded before, during and immediately after endoscopy. Another ECG was taken 10 minutes after withdrawal of the endoscope

5 Along with the ECG recording, blood pressure recording, heart rate recording and Spo_2 monitoring will be done simultaneously before, during and immediately after the procedure and 10 minutes after the procedure.

METHOD OF COLLECTION OF DATA

1 About 140 patients undergoing upper gastrointestinal endoscopic examination in Shri. B.M. Patil Medical College, hospital and research centre between November 2007 and September 2009 were studied.

Inclusion Criteria

1. All patients undergoing upper gastrointestinal endoscopy in Shri. B.M. Patil Medical College, hospital and research centre between November 2007 and September 2009

Exclusion Criteria

1. All patients undergoing emergency endoscopic procedures and
2. Patients with the following conditions are excluded from this study
    a) Acute myocardial Infarction
    b) Heart failure
    c) Cardiogenic shock
    d) Arrhythmias
    e) Respiratory failure
    f) Respiratory distress
    g) Baseline oxygen saturation less than 90% and requiring oxygen therapy before the procedure.

Statistical method:

a) Diagrammatic Representation
b) Statistical analysis using Z test or Chi-Square test

RESULTS / OBSERVATIONS

The present study was undertaken from November 2007 to September 2009 after approval by the Hospital ethics committee. Patients attending endoscopy clinic were thoroughly examined and where ever necessary investigated. Initial 140 consecutive patients, after enforcing the exclusive criteria, were enrolled for this study.

AGE AND SEX:

Of the 140 patients, the youngest patient was 11 years and the oldest patient was aged 80 years. The mean age of the study population was 43.46 years.

TABLE No. 1 Age Distribution of Cases (n=60)

Age group	Number of cases	Percentage
11 – 20	9	6.4
21 – 30	37	26.4
31 – 40	25	17.8
41 – 50	17	12.1
51 – 60	27	19.2
61 – 70	22	15.7
71 – 80	2	1.42

In this study, maximum number of the patients were in the age group of 21 to 30 years (26.4%). Next commonest age is 51 to 60 years(19.2%).

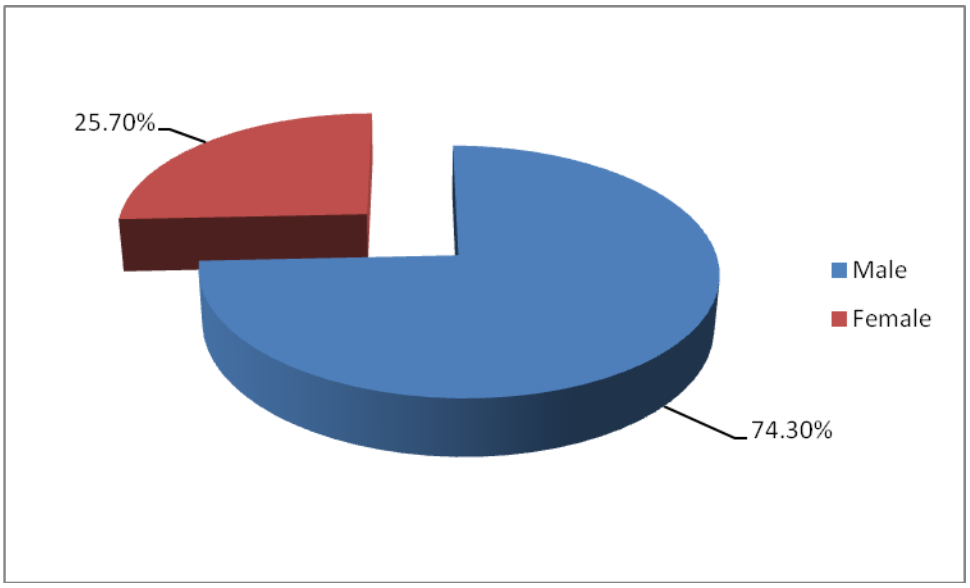
GENDER (SEX)

Of the total 140 patients, there are 104 male patients and 36 female patients.

TABLE NO: 2 Distribution of cases by sex

Gender	Total	Percentage
Male	**104**	**74.3 %**
Female	**36**	**25.7 %**

GRAPH NO: 1 Distribution of cases by sex



In this study, 74.3 % of cases were male and rest of 25.7 % were female. The male preponderance with female is in the ratio of 3: 1

INDICATIONS FOR DIAGNOSTIC UPPER GI ENDOSCOPY:

All patients underwent diagnostic procedures. 82 patients were referred from Inpatient departments of the hospital and 58 were from outpatient departments.

The indications for upper GI endoscopy in these patients were:

TABLE 3: Indications for endoscopy

Indication	No: of Patients	PERCENTAGE
Dysphagia	28	20%
Upper GI bleed	37	27%
Persistent vomiting	7	5%
Dyspepsia	7	5%
Oesophageal varices	5	3%
Iron deficiency anemia	5	3%
Pain Epigastrium	4	3%
Chronic weight loss	4	3%
Anorexia	3	2%
Others	40	29%

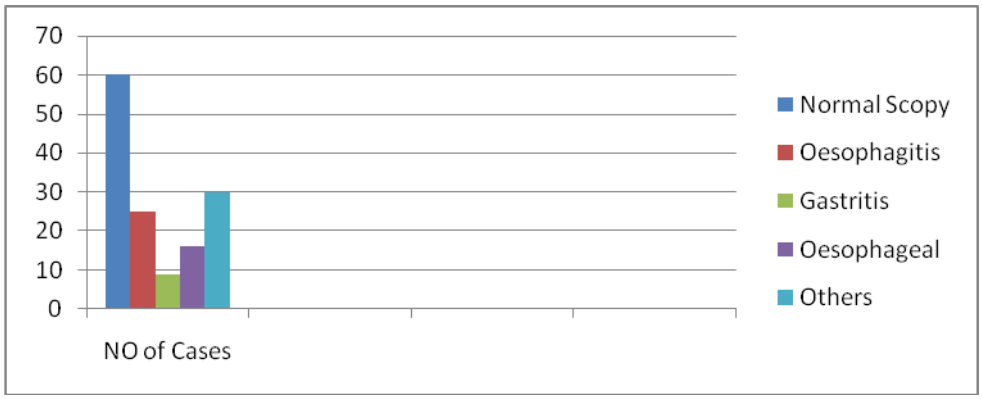
Diagnostic yield of endoscopy in our study group:

In the present study of 140 patients, upper GI scopy was normal in 60(42.8%) patients. The lesions detected were: oesophagitis in 25 (17.85%) patients, Gastritis in 9(6.42%), oesophageal lesions like growths, ulcers and carcinoma in 16(11.42%)patients. Other lesions found include duodenitis, peptic ulcers, NSAID induced gastropathy, oesophageal varices and benign esophageal strictures.

TABLE 4: No of cases by diagnosis

Diagnosis	Male	Female	Total
Normal Scopy	46	14	60
Oesophagitis	20	5	25
Gastritis	7	2	9
Oesophageal growths, ulcers and Ca	11	5	16
Others	**20**	**10**	**30**

GRAPH 2: No of cases by diagnosis



All these 140 patients tolerated and successfully completed the diagnostic upper GI endoscopy. The mean duration of Upper GI scopy was 8.46 minutes (range 6.1 to 12.4 minutes) for all age groups and both sexes.

Although sedation is known to increase the tolerance and reduces anxiety, Sedation was not used for any of these 140 patients. It is a known fact that sedation can't reduce the incidence of tachycardia and myocardial ischemia but can decrease the SPo2 levels.

SPO2 (SATURATION OF PERIPHERAL OXYGEN) LEVELS

Pulse oximetry is a reliable non invasive method in assessing arterial oxygen saturation and was used in monitoring these patients.

TABLE 5: Statistical measures at before, during and after endoscopy on spo2 by male, female and together

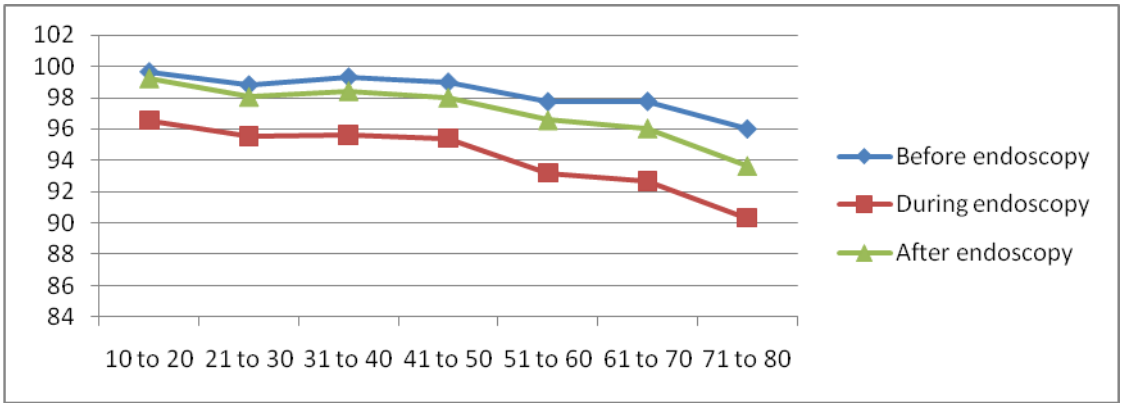
	Spo2(%)		
	Before Endoscopy	During Endoscopy	After Endoscopy
	Mean± SD	Mean±SD	Mean± SD
Male	98.54± 1.52	94.57± 2.99	97.32± 2.42
Female	98.6± 2.1	94.64± 2.67	97.94± 2.19
Together	98.54± 1.68	94.6± 2.91	97.5± 2.37

Normal levels of SPo2 reported for pulse oximetry are 95% to 100% for adult population. In our study group, before starting Upper GI endoscopy, baseline Spo2 levels were found to be around 98.5%.

TABLE 6: Spo2 levels before, during and after endoscopy by age

Age Group	Spo2(%)		
	Before Endoscopy	During Endoscopy	After Endoscopy
	Mean±SD	Mean± SD	Mean±SD
10 to 20	99.67± 0.71	96.56±2.92	99.22±1.3
21 to 30	98.82±1.74	95.55±2.63	98.05±2
31 to 40	99.33±0.87	95.63±1.76	98.42±0.88
41 to 50	99±0.89	95.44±1.5	98±1.32
51 to 60	97.75±1.53	93.21±3.22	96.57±2.74
61 to 70	97.77±2.14	92.68±2.73	96.05±2.95
71 to 80	96±2	90.33±2.52	93.67±2.52

GRAPH 3: Spo2 level at before, during and after endoscopy by age



Conclusion: The chart indicates the drastic decline of Spo2 during Upper GI scopy

Oxygen desaturation between 94-90% was taken as moderate desaturation and <90% as severe desaturation. In our study, the average baseline mean oxygen saturation was 98 %. It decreased to 94 % during insertion of the endoscopy probe. Mild to moderate hypoxia was found in 32% of patients. Severe hypoxia was found in 5% of the patients, mostly in those people who are above 50 years age. Oxygen saturation improved after the procedure to 97.5% in all these people. There were 6 episodes of severe hypoxia; 4 of these occurred during insertion of the endoscope and 2 during procedure. 5 episodes of severe hypoxia occurred in patients above 50 years age group and 2 of these patients received supplemental Oxygen.

SPO2 LEVELS BY AGE AND GENDER

SPo2 levels decreased by about 4% in both sexes during introduction of endoscopy tube and continued at the lower levels during the diagnostic endoscopy procedure in both male and female; the oxygen desaturation was slightly more in male patients. Patients aged more than 60 years, having underlying chronic airway disease, history of smoking and severe anemic patients were related significantly to oxygen desaturation. Similarly the recovery of SPo2 was observed (by about 3%) immediately

after the procedure in both the sexes. Base line levels were regained nearly 10 minutes after the procedure in all the patients. Two of the patients in the study group required supplemental Oxygen administration during the procedure.

Oxygen saturation was satisfactorily maintained above 95.5 in the younger age groups during the procedure. In the 10 to 20 age group it was about 96.56±2.92; In the 21 to 30 age group it remained at 95.55± 2.63 during the procedure. Even in the 31 to 40 age group and 41 to 50 age groups it stayed at 95.63± 1.76 and 95.44± 1.5 during the procedures. But in the 51 to 60 age group, it has fallen to 93.21± 3.22 and in the 61 to 70 age group it fell more to 92.68 ± 2.73; In the oldest group of 71 to 80 years age group, it has fallen drastically to 90.33± 2.52.In this age group even the baseline SPo2 was 96± 2 and it remained at 93.67± 2.52 even after the procedure.

The female patients in general showed slightly better SPo2 levels even at baseline. Before endoscopy, they maintained SPo2 levels of 98.6±23.1 as against 98.54±1.52 maintained my male group. During and post the procedures, they maintained 94.64±2.67 and 97.94±2.19 as against 94.57±2.99 and 97.32±2.42 seen in male patients.

Heart rate (Pulse)

The following heart rate recordings were noted from pulse oximetry of our 140 patients during various stages of upper GI endoscopy.

Table 7: Statistical measure at before, during and after the procedure on heart rate by male, female and combined

	HR		
	Before Endoscopy	During Endoscopy	After Endoscopy
	Mean±SD	Mean±SD	Mean±SD
Male	76.77±14.28	94.14±18.01	79.81±14.93
Female	86.7±16	101±16.5	88.66±15.3
Together	79±15	96±18	82±15

Table 8: Test of significance between heart rate level (Before and during Endoscopy) [male and female together]

Statistical Measures	Before Endoscopy	During Endoscopy	t – value	p – value
Mean	79	96	8.62	P<0.00001
SD	15	18		
N	140	140		

Table 9: Test of Significance between heart rate level (Before and after Endoscopy) [Male and female together]

Statistical Measures	Before Endoscopy	After Endoscopy	t – value	p – value
Mean	79	82	1.68	P=0.13
SD	15	15		
N	140	140		

Table 10: Statistical measures on heart rate by age

Age Group (in years)	HR		
	Before Endoscopy	During Endoscopy	After Endoscopy
	Mean±SD	Mean±SD	Mean±SD
10 to 20	85.89±17.57	105.33±17.87	91.67±16.72
21 to 30	82.05±19.05	96.66±22.32	84.39±20.03
31 to 40	76.25±13.49	95.96±16.3	78.08±12.34
41 to 50	78.5±15.31	95.25±18.77	80±15.16
51 to 60	76.75±10.67	91.82±12.78	81±9.75
61 to 70	77.05±13.28	94.64±16.11	79.27±13.81
71 to 80	94.33±12.74	108.67±9.29	98±9.64

Significant asymptomatic tachycardia was noted in 88% of the study group patients. It occurred in all the stages of the procedure but predominantly during blade insertion. Our study showed that sinus tachycardia starts with the introduction of endoscope into pharynx. Heart rate returned to normal within few minutes at the end of the procedure. The rise in heart rate was observed during all phases of Upper GI scopy in all age groups of patients and of both the sexes of the study group. A heart rate (pulse rate) of above 100 beats per minute was taken as tachycardia and a rate of less than 60 beats per minute was taken as bradycardia. None of the patients developed bradycardia.

Changes in heart rate vs age of the patient

The average baseline pulse rate of the study group was 85.89, 82.05, 76.25 and 78.5 in the 10 to20, 21 to 30, 31 to 40 and 41 to 50 age groups. In the older age groups, the baseline heart rate was 76.75and 77.05 in the 51 to 60 and 61 to 70 age groups. In the oldest age group of 71 to 80 years, the baseline pulse rate was high at 94.33.

During the upper gastrointestinal endoscopy procedure, heart rate increased considerably in all age groups. In the 10 to 20 age group it raised to 105.33 from a mean of 85.89. In the 21 to 30, 31 to 40 and 41 to 50 age groups also, heart rate increased from mean of 82.05, 76.25 and 78.5 to 96.66, 95.96 and 95.25 during the procedure.

After completion of upper GI endoscopy, the heart rates remained slightly high. In the age group of 10 to 20 years, post procedure, mean heart rate was at 91.67 where as baseline level was 85.89. In the 21 to30, 31 to 40 and 41 to 50 age groups also, post endoscopy the pulse rates remained high for some more time; they were at 84.39, 78.08 and 80. Similarly in the older age groups, they remained high at 81, 79.27 and 98 in the age groups of 51 to 60, 61 to 70 and 71 to 80 years.

Table 11 : Distribution of cases by age and increase in HR by (1-10 , 11-20 , 21-30 , 31 and above)

AGE Group (in years)	Increase in HR - n (%)				
	1 to 10	11 to 20	21 to 30	31 and above	Total
10 to 20	0 (0%)	5 (55.56%)	4 (44.44%)	0 (0%)	9
21 to 30	10 (26.32%)	15 (39.47%)	11 (28.95%)	2 (5.26%)	38
31 to 40	5 (20.83%)	8 (33.33%)	6 (25%)	5 (20.83%)	24
41 to 50	5 (31.25%)	6 (37.5%)	1 (6.25%)	4 (25%)	16
51 to 60	7 (25%)	15 (53.57%)	6 (21.43%)	0 (0%)	28
61 to 70	7 (31.82%)	8 (36.36%)	5 (22.73%)	2 (9.09%)	22
71 to 80	1 (33.33%)	2 (66.67%)	0 (0%)	0 (0%)	3
					140

Table 12 : Test of Significance between HR level (Before & during Endoscopy) [Male]

Statistical Measures	Before Endoscopy	During Endoscopy	t-value	p-value
Mean	76.77	94.14	9.23	p < 0.00001
SD	14.28	18.01		
N	104	104		

Table 13 : Test of Significance between HR level (During & after Endoscopy) [Male]

Statistical Measures	During Endoscopy	After Endoscopy	t-value	p-value
Mean	94.14	79.81	7.8	p < 0.00001
SD	18.01	14.06		
N	104	104		

Table 14 : Test of Significance between HR level (Before and during Endoscopy) [Female]

Statistical Measures	Before Endoscopy	During Endoscopy	t-value	p-value
Mean	86.7	101.2	7.92	p < 0.00001
SD	16	16.5		
N	36	36		

Table 15 : Test of Significance between HR level (During and after Endoscopy) [Female]

Statistical Measures	During Endoscopy	After Endoscopy	t-value	p-value
Mean	101.2	88.66	3.858	p < 0.00001
SD	16.5	15.3		
N	36	36		

Table 16 : Tachycardia (HR more than 100 during Endoscopy)

AGE Group	Tachycardia		
	Male	Female	Total
10 to 20	3 (50%)	3 (50%)	6 (100%)
21 to 30	12 (63%)	7 (37%)	19 (100%)
31 to 40	8 (66%)	4 (34%)	12 (100%)
41 to 50	6 (86%)	1 (14%)	7 (100%)
51 to 60	10 (100%)	0 (0%)	10 (100%)
61 to 70	5 (84%)	1 (16%)	6 (100%)
71 to 80	3 (100%)	0 (0%)	3 (100%)

BLOOD PRESSURE:

Out of these 140 patients, blood pressure increased to hypertension levels in 22 patients (15.7 %). (Hypertension is systolic BP more than 160 mm of hg; Hypotension is systolic BP less than 90 mm hg). None of these patients developed any cardiac symptoms during this hypertensive phase. In all these patients, blood pressure returned to normal within few minutes after the procedure. Systolic blood pressure didn't change significantly.

CHANGES IN BLOOD PRESSURE VS PATIENT'S GENDER:

TABLE 17: Statistical measure at before, during and after the process on blood pressure by male, female and combined

SEX	BP (mm of Hg)			
		Before Endoscopy	During Endoscopy	After Endoscopy
		Mean±SD	Mean±SD	Mean±SD
Male	Systolic	119.6±9.8	136.4±12.42	127±10.65
	Diastolic	76.65±7.35	85.75±8.53	81±7.52
Female	Systolic	118.33±8.30	131.33±10.65	123.39±8.77
	Diastolic	76.22±5.43	83.55±7.04	78.66±6.12
Together	Systolic	119.3±9.43	135.1±12.16	126±10.29
	Diastolic	76.54±6.89	85.19±8.20	80.4±7.24

In the present study, the base line mean systolic pressure for all patients was 119.3±9.43 before the procedure. For male, the baseline systolic pressure was 119.6±9.8 mm of Hg and in female it was 118.33±8.30. During endoscopy, it increased to 136.4±12.42 in males and to 131.33±10.65 in females. Immediately after completion of endoscopy, it came down to 127±10.65 in males and to 123.39±8.77 in women.

The baseline diastolic blood pressure of the total study group was 76.54±6.89 mm of hg. For male patients, the mean baseline diastolic pressure levels were 76.65±7.35 mm oh hg. It rose to 85.75±8.53 during endoscopy and has fallen back to 81±7.52 after the procedure. In female patients, the mean diastolic pressure levels before endoscopy were76.22±5.43. They rose to 83.55±7.04 during the procedure and fallen back to 78.66±6.12 after endoscopy.

CHANGES IN BLOOD PRESSURE VS PATIENT'S AGE:

TABLE 18: Statistical measure at before, during and after the process on blood pressure by patient's age

Age Group	BP(mm of Hg)			
		Before Endoscopy	During Endoscopy	After Endoscopy
		Mean±SD	Mean±SD	Mean±SD
10 to 20	Systolic	116.44 ±10.57	126.22±6.44	117.33±6.48
	Diastolic	76±5.57	82±6.16	77.56±5.98
21 to 30	Systolic	116.05±6.53	130.74±10.68	123.32±8.65
	Diastolic	75.16±5.25	83.68±6.3	79.74±6.5
31 to 40	Systolic	120.17±9.19	137.33±11.03	126.5±9.55
	Diastolic	77.17±7.08	84.75±9.02	80.17±6.01
41 to 50	Systolic	121.88±9.22	140.88±11.73	131.13±9.15
	Diastolic	77.63±8.77	88.25±8.51	82.25±7.76
51 to 60	Systolic	120±11.1	134.79±12.69	125.86±11.51
	Diastolic	76.71±7.84	85.36±9.81	80.21±9.02
61 to 70	Systolic	119.91±9.39	136.18±10.56	127.09±8.59
	Diastolic	76.73±7.16	85.45±7.28	80.27±6.39
71 to 80	Systolic	136±3.46	162.67±4.62	150±0
	Diastolic	82±7.21	97.33±8.33	92±6.93

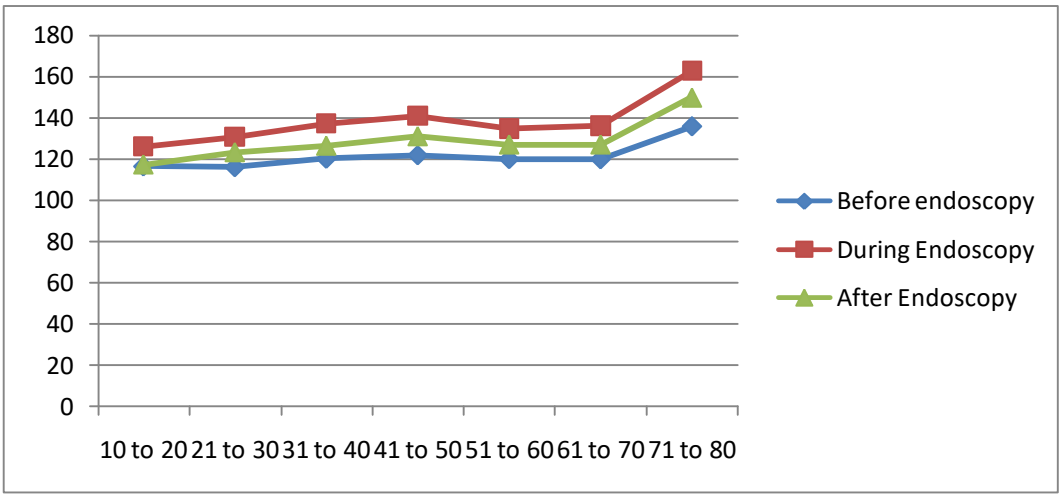
Both systolic and diastolic blood pressures of all age groups raised during the procedure. Even though the baseline blood pressures were high in older age groups, they showed a dramatic rise immediately after the insertion of endoscope blade.

The mean baseline systolic blood pressures were around 116 mm of Hg in the age groups of both 10 to 20 years and 21 to 30 years. In the age groups of 31 to 40, 41 to 50 and 51 to 60 the baseline systolic pressures were 120,121.8 and 120 mm of hg. In the older age groups of 61 to 70 and 71 to 80, the baseline systolic pressures were 120 and 136.

Immediately after the insertion of endoscopic blade, systolic blood pressure rose and remained at higher levels throughout endoscopy. In the 10 to 20 age group it rose from 116 to 126, and in the age groups of 21 to 30, 31 to 40, 41 to 50 it rose from 116 to 130, 120 to 137 and 121 to140 mm of hg. In the old patients, systolic BP rose from 120 to 136 and 136 to 162 mm in the 61 to 70 and 71 to 80 years age groups.

In the youngest age group of 10 to 20 years, systolic BP returned to baseline immediately after completion of the procedure. In other groups, although BP decreased, it remained slightly higher than baseline levels. In age group 21 to 30, it remained at 123 (baseline 116), 31 to 40 group at 126 (120), 41 to 50 age group 131 (121), 51 to 60 group at 125 (120), 61 to 70 group 127 (119) and 71 to 80 age group 150 (136) mm of Hg.

GRAPH 4: Systolic BP level at before, during and after Endoscopy



Conclusion: The chart indicates that there is rise in systolic BP during endoscopy in all age groups and is more at older age.

Table 19: Test of Significance between BP level (Before and During Endoscopy)

[Male]

Statistical Measures	Before Endoscopy	During Endoscopy	t-value	p-value	Before Endoscopy	During Endoscopy	t-value	p-value
	Systolic	Systolic			Diastolic	Diastolic		
Mean	119.6	136.4	10.91	p < 0.00001	76.65	85.75	8.34	p < 0.00001
SD	9.8	12.42			7.35	8.53		
N	104	104			104	104		

Table 20: Test of Significance between BP level (During and after Endoscopy) [Male]

Statistical Measures	During Endoscopy	After Endoscopy	t-value	p-value	During Endoscopy	After Endoscopy	t-value	p-value
	Systolic	Systolic			Diastolic	Diastolic		
Mean	136.4	127	5.58	p < 0.01	85.75	81	4.56	p < 0.00001
SD	12.42	10.65			8.53	7.52		
N	104	104			104	104		

Table 21: Test of Significance between BP level (Before and During Endoscopy) [Female]

Statistical Measures	Before Endoscopy	During Endoscopy	t-value	p-value	Before Endoscopy	During Endoscopy	t-value	p-value
	Systolic	Systolic			Diastolic	Diastolic		
Mean	118.33	131.33	5.8	p < 0.00001	76.22	83.55	5.72	p < 0.00001
SD	8.3	10.65			5.43	7.04		
N	36	36			36	36		

Table 22: Test of Significance between BP level (During and after Endoscopy) [Female]

Statistical Measures	During Endoscopy	After Endoscopy	t-value	p-value	During Endoscopy	After Endoscopy	t-value	p-value
	Systolic	Systolic			Diastolic	Diastolic		
Mean	131.33	123.39	3.46	p < 0.0001	83.55	78.66	3.214	p < 0.00001
SD	10.65	8.77			7.04	6.12		
N	36	36			36	36		

ECG CHANGES:

In the present study, sinus tachycardia was observed in 88 % of the total patients and S-T depression noticed in 4% of these patients during Upper GI scopy. T wave inversion was observed in 3% of the patients. All these changes disappeared in the ECG's taken 10 minutes after endoscopy

The following ECG changes were observed in our 140 patients during various stages of endoscopy:

Sinus Tachycardia 88% of patients

ST depression 0%

T wave inversion 3%

Supra ventricular tachycardia 0%

These electrocardiographic changes were observed mostly in patients aged above 50 years. T wave inversion was more frequent in women patients. All these changes reverted to normal within few minutes after the endoscopic procedure.

Table 23: ECG changes observed during Endoscopy

ECG changes	**Baseline**	**Probe insertion**	**During Endoscopy**	**Post Endoscopy**
Sinus tachycardia	**18%**	**82%**	**66%**	**34%**
ST depression	**0**	**7%**	**3%**	**0**
T inversion	**0**	**8%**	**2%**	**0**
SV tachycardia	**0**	**4%**	**1%**	**0**

CHANGES IN ELECTROCARDIOGRAM VS AGE & GENDER OF PATIENT:

Most of these electrocardiographic changes occurred in patients showing arterial oxygen desaturation. There were no major differences between male and female patients regarding electrocardiographic changes and occurrence of arrhythmias. Only T wave inversion was slightly more in women patients.

Heart rate increased in 88%% of patients resulting in sinus arrhythmia and the maximum rise occurred in older patients and in those with history of cardiac disease.

Other ECG abnormalities occurred in 12% of present study and were more frequently appeared in elderly people (68%), in persons with chronic lung disease (42%) and in persons with previous heart disease (28%). S-T depression occurred only in patients with previous cardiac disease. All these changes reverted to near normal ranges within half an hour.

DISCUSSION

Upper gastrointestinal endoscopy is a commonly performed procedure and has evolved into an essential diagnostic and therapeutic tool. The assurance that high quality endoscopic procedures are performed has taken increased importance. A high quality endoscopy ensures that the patient receives an indicated procedure, that correct and clinically relevant diagnosis are made or excluded, upper GI scopy and therapeutic procedures are performed properly with minimal complications to the patient.[15]

Diagnostic upper GI endoscopy is an invasive procedure and has many adverse effects like cardiopulmonary complications, complications related to sedation, infectious complications, bleeding and perforation. 50% of the complications and 60% of deaths during upper GI endoscopy were attributed to cardiopulmonary complications.[44]

So this study was undertaken to evaluate important variables like age of the patient, gender, duration of the procedure in relation to the cardiopulmonary changes during diagnostic endoscopy. For this purpose oxygen saturation, blood pressure, heart rate (pulse) and ECG recordings were monitored using pulse oximeter. A total number of 140 patients were studied and their ages ranged from 10 to 80 years. Of these 140 patients, 104 are male and 36 female. In a similar study in Saudi Arabia, of the 6386 patients followed, the male female ratio was 5.2:1.[45]

The common cardio pulmonary changes noticed in our patients during upper GI endoscopy study were

1. Blood oxygen desaturation
2. Tachycardia
3. Hypertension

4. Tachypnoea
5. ECG changes like sinus tachycardia, ST depression and T wave inversion.

SPo2

It has been reported that oxygen desaturation occurs in 15-50% of non sedated patients during gastroscopy;[18] in our study 34%developed mild desaturaion and 5 % developed severe oxygen desaturation. Factors leading to oxygen desaturation are patient's age, history of cardio vascular and respiratory diseases and difficulty with intubation procedure. The occurrence of lowest oxygen saturation and increased systolic pressure during introduction of endoscope is suggestive of sympathetic overstimulation during this phase.

In a study of 126 patients who underwent non sedated gastroscopy, Javid G Khan et al found in Srinagar study, that baseline SPo2 was 97.8% and it remained >95% in 60% of patients during the procedure ; mild oxygen desaturation occurred in 24% and severe desaturation in 16% of their patients. Desaturation was severe in therauptic endoscopies than diagnostic upper GI endoscopies. They observed that oxygen desaturation was significantly related to patients aged more than 60 years ($p<0.001$), hemoglobin<10gm/dl ($p<0.001$) and history of smoking ($p<0.001$).[46]

In our study of 140 patients, during endoscopy we found very mild oxygen desaturation (SPo2< 95%) in 34% of the patients, mild oxygen desaturation (SPo2 90-95%) in 10 % of the patients and severe desaturation (SPo2 <90%) in none of the patients. Similar findings were reported by Sun young et al.[47]

In our study sedation was not used as it increases chances of oxygen desaturation. Rozario et al in a prospective study of 389 patients compared 2 groups of patients who underwent Gastroscopy under sedation; one group received supplemental oxygen during gastroscopy while the other similar group didn't. They observed that patients receiving supplemental oxygen were 98% less likely to experience dasaturation and recommended routine use of 2 l /minute of supplemental O2 during sedated endoscopic procedures.[48]

B B Osinaike et al studied 40 healthy patients to find out risk factors for cardiopulmonary changes during endoscopy. They concluded that mild to moderate hypoxia is common during endoscopic procedures and is of no serious consequence. Severe hypoxia is rare. They recommended non invasive monitoring in older patients and in endoscopic procedures longer than 27 minutes.[49]

Blood pressure

Out of these 140 patients, blood pressure increased to hypertension levels in 22 patients (15.7 %). Both systolic and diastolic blood pressures increased, mostly during the insertion of endoscopic tube. Ruthross et al had similar findings in their study of 37 patients. They found that during upper GI endoscopy there is large increase in blood pressure with maximum changes occurring during intubation in the youngert age group. In the older patients, they observed that blood pressure increased later in the procedure and was sustained for a long period. Systolic pressure was greater in sedated patients.[50] In the present study, for the youngest age group of 10 to 20 years, systolic BP returned to baseline immediately after completion of the procedure. In other age groups, although BP came down, it remained slightly higher than baseline levels.

In a similar study by B B Osinaike et al, they didn't find significant changes in systolic blood pressure throughout the procedure except transient hypertension in 14% of their patients. They also observed slower return of blood pressure to normal levels in older patients.[49]

Stress inducing procedures are supposed to cause an increase in blood pressure by catecholamine release. Tetsuya saijyo et al measured blood pressure by tonometry in 30 patients to determine the rationale behind the cardiac events during upper GI endoscopy. They calculated CVbp and HFbp which are indicators of parasympathetic tone, and found that they increased in the early parts endoscopy but decreased significantly in the middle and late phases compared with the pre endoscopy values. Their conclusion was that GI endoscopy induced an autonomic nervous abnormality which has contributed to these cardiac events.[51] In sedated patients, blood pressure remained stable although they were more prone to hypoxia.[39] As we didn't use sedation , all our patients showed some rise in systolic blood pressure.

Heart rate

Upper GI endoscopy is thought to cause stress response (endocrine response) leading to tachycardia, and there by leading to myocardial ischemia.[52]

Tachycardia occured in 88% of the total patients during upper GI endoscopy. It was seen during all stages of the procedure but was higher during endoscope insertion. Introduction of endoscope into pharynx triggered severe tachycardia. In the present study, the rise in heart rate was more pronounced in women than men during the endoscopy procedure.

Rise in heart rate during endoscopy has been reported by many workers. Tachycardia occurred in 89% of upper GI endoscopy patients during a study by Mistry FP et al and disappeared in all of them after endoscopy.[53] The present study too demonstrated similar result during all phases of the procedure. In all these cases, the tachycardia disappeared spontaneously in the post-endoscopic phase within 30 minutes. None of our patients developed bradycardia, although a few studies have reported bradycardia.[18]

In an Indian study, tachycardia during upper GI endoscopy has been studied by Malhotra HS et al, in 120 patients in Shimla and found increased heart rate in 96.6% of their study group. Maximum rise in heart rate was found in cardiac patients. All these changes reverted to normal with in 10 minutes.[42]

The frequency of tachyarrythmia during gastroscopy studies were reported between 38.5% to 75%. So Mehmet yet al, used Holter monitor to verify this and found that 15% of their patients suffered with severe tachyarrythmias and attributed this to fear, anxiety and catecholamine secretion.[54] In the present study also 10 to 20 age group showed sudden rise of mean heart rate from 85 to 105 and this can also be attributed to fear and anxiety.

ECG & CARDIAC CHANGES

Mehmet S et al studied 40 non cardiac patients of above 50 years age undergoing gastroscopy to know the safety of upper GI endoscopy in the elderly candidates. They observed supraventricular tachycardia in 15% of patients without causing any symptoms. Two patients aged above 60 years had episodes of silent ischemia during endoscopy but

their coronary angiograms at a later date showed normal coronary arteries. They concluded that gastroscopy does not cause serious cardiac complications in aged patients if they are properly screened to rule out cardiac disease.[54]

In our study, increase in heart rate was found in 88 % of the patients and S-T depression noticed in 4% of the patients. T wave inversion observed in 8% of the patients. All these changes lasted for a few minutes after endoscopy and disappeared. In a study by Malhotra HS et al at Simla, 96.6% patients showed tachycardia, 14.2% had ST depression, 13.3% had T wave inversion, and 5.8% had supraventricular tachycardia.[42]

. A W Murray et al studied the effects of gastroscopy in sedated patients and found that 16 of the 20 patients developed tachycardia and 10 patients developed supraventricular and ventricular ectopic foci. They assessed myocardial ischemia by ST segment depression and found that there is a significant correlation between ST segment depression and hypoxemia. They concluded that measuring arterial oxygen saturation is important to detect myocardial ischemia in addition to measuring BP and ECG recording [30]

Lauri Seinelaa et al in a 24 hour Holter study of very old patients found that the number of Ventricular ectopics were increased during the one hour period after upper GI endoscopy, that too more commonly in known cardiac patients., although no fatalities occurred.[55]

Toru Hayashi et al ii a study to determine the effect of autonomic imbalance on arrhythmia generation during endoscopy procedure found that high frequency spectral power,which reflect parasympathetic activity decreased during gastroscopy and advised

measurement of this prior to endoscopy can identify those with reduced power so that cardiovascular complications related to premedication and endoscopy can be prevented.[56]

Possible predictive factors for patients undergoing upper GI endoscopy are- Basal SPo2 of <95%, pre existing respiratory disease, more than one attempt at intubation and emergency Gastroscopy. So these groups of patients require very close monitoring with pulse oximetry and endoscopist should be alert to the possibility of respiratory depression in these patients.[57]

Arrythmias:

Other than sinus tachycardia, the present study group did not show significant arrhythmias.ST depression (4%), T wave inversion (8%) and supra ventricular tachycardia was noted in few patients.

Mathew et al noticed high incidence of cardiac arrhythmias in their study of 52 patients undergoing gastroscopy, including ventricular premature contractions in 19% of their study.[58]

Malhotra et al studied 120 patients undergoing gastroscopy at shimla and found tachycardia in 96.6%, S-T depression in 14.2%, T wave inversion in 13.3% anmd supraventricular tachycardia in 5.8% of patients. All these arrhythmias disappeared after endoscopy.[42]

Effects of age and gender on cardiopulmonary changes

Blood pressure in the old people increased during later part of the procedure and lasted for a long period. In the younger age group, it occurred during entry of the endoscope. Heart rate changes were less significant in those who received throat spray. Similar findings were observed by Ruth Ross et al.[50]

NEED FOR NON INVASIVE MONITORING IN THE ABOVE 50 YEARS AGE GROUP:

In upper GI endoscopy, the risk for cardiovascular and pulmonary complications is related to both the patients underlying condition and the endoscopic procedure being performed. Elderly patients with cardiac, pulmonary, renal or other problems are at increased risk, that too if sedation has to be used. Emergency therapeutic endoscopy is associated with more risk and in all these patients appropriate cardio respiratory monitoring will help to minimize complications. Continuous electrocardiographic monitoring is reasonable in elderly, in patients with significant cardiac or pulmonary disease and in whom prolonged procedure is anticipated. In these patients pulse oximetry measures oxygen saturation and helps to find out when patient needs supplemental oxygen administration. So in cardiovascular high risk patients and in long standing upper GI therapeutic procedures, using pulse oximeter and monitoring the heart rhythm is indicated and administration of supplemental Oxygen can prevent many of the ventilation problems. Although electronic monitoring equipment facilitates assessment of patient's status, still it does not replace a well trained and vigilant assistant.[59]

Cardiopulmonary changes found in this study group include:

Our study confirms that although upper GI Endoscopy (Gastroscopy) is a safe procedure, cardiopulmonary changes occur frequently. Elderly people need to be carefully monitored as they have higher chances of developing hypoxia and cardiac arrhythmias during the procedure.

Cardiopulmonary complications are due to vasovagal episodes, hypoventilation, aspiration, airway obstruction and oversedation. Risk factors for developing

complications during upper GI endoscopy include old age, obesity, severe anemia, pre-exisisting cardiopulmonary disorders and smoking. These risk factors should be identified before endoscopy. When these patients present for Upper GI scopy, pulse oximetry monitoring along with ECG and blood pressure monitoring should be used.

CONCLUSION

During Upper gastrointestinal endoscopy, transient cardio respiratory changes occur frequently. Our study of 140 patients revealed mild to moderate hypoxia, tachycardia, hypertension are common during Gastroscopy. Most of these changes are transient in nature and did not lead to significant pathology. Still in elderly patients and in those with pre existing cardiac/pulmonary diseases, it will be useful to monitor patients pulse rate, blood pressure and oxygen saturation. In selected cases, ECG monitoring is useful.

SUMMARY

Diagnostic upper gastrointestinal endoscopy is a commonly performed procedure and is safe. Although serious complications are rare, cardiopulmonary changes are frequently observed and can lead to problems in aged.

In the present study group,

1. Maximum number of patients were in the age group of 21 to30 and 51 to 60 years with mean age of 43.45+-17.02
2. Male to female ratio was 3:1
3. Common indications for Upper GI scopy were dysphagia and upper gastrointestinal bleeding.
4. Common pathologies identified were esophagitis and gastritis. In 60 patients, endoscopy was normal.
5. The common risk factors identified were old age, previous cardiopulmonary diseases, smoking and duration of the procedure.
6. Maximum changes in SPO2, heart rate and blood pressure occurred immediately after the introduction of endoscope.
7. Tachycardia was noted in 88% of the study group patients. It was seen during all the stages of the endoscopic procedure, predominantly during blade insertion and was asymptomatic. Although increase in heart rate was universal in all age groups of both sexes, it was slightly more in younger male patients and older female patients.
8. These cardiopulmonary changes didn’t translate into any identifiable clinical symptoms.
9. The rate of recovery was faster in younger age groups and women.

10. In those aged above 50 years and in people with risk factors like existing cardio vascular diseases, it is ideal to monitor with pulse oximeter and electrocardiogram.

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CARDIO PULMONARY CHANGES DURING UPPER GASTROINTESTINAL ENDOSCOPY

PROFORMA

NAME:

AGE:

SEX:

OCCUPATION:

IP.NO/ HOSPITAL NO:

ADDRESS:

DATE OF ADMISSION:

DATE OF DISCHARGE:

STATUS AT DISCHARGE:

PRESENTING COMPLAINTS

Chest pain	Vomiting
Dyspnea	Burning sensation in the chest
Fatigue	Malena
Anemia	Breathlessness
Hematemesis	Abdominal pain
Dyspepsia	Other Symptoms
Ascitis	Constipation/Diarrhea

HISTORY OF PRESENT ILLNESS

PAST HISTORY:

DIABETES MELLITUS ALCOHOLIC LIVER DISEASE

HYPERTENSION

DRUG HISTORY

ANY OTHER SYSTEMIC ILLNESS IN THE PAST

PERSONAL HISTORY

SLEEP

DIET

APPETITE

BOWEL

BLADDER

HABITS

SMOKING

TOBACCO CHEWING

ALCOHOL

FAMILY HISTORY

DIABETES

HYPERTENSION

ISCHAEMIC HEART DISEASE

CEREBROVASCULAR ACCIDENTS

ALCOHOLISM

OBESITY

GENERAL PHYSICAL EXAMINATION

PALLOR	OEDEMA: PEDAL/FACIAL/GENERALIZED
ICTERUS	LYMPHADENOPATHY
CYANOSIS	HEIGHT
CLUBBING	WEIGHT
KOILONYCHIA	

VITALS SIGNS

PULSE

BP

RESPIRATORY RATE

TEMPERATURE

CARDIOVASCULAR SYSTEM

RESPIRATORY SYSTEM

GASTROINTESTINAL SYSTEM

CENTRAL NERVOUS SYSTEM

PROVISIONAL DIAGNOSIS

INVESTIGATIONS

I. HAEMATOLOGY

HAEMOGLOBIN	Gm/dl
TC	Cells/mm^3
DC	
NEUTROPHILS	%
LYMPHOCYTES	%
EOSINOPHILS	%
MONOCYTES	%
ESR	mm/1hr
COMPLETE BLOOD COUNT	

II. URINE

ALBUMIN	
SUGAR	
MICROSCOPY	

III. BIOCHEMISTRY

B.UREA	
S. CREATININE	
S. SODIUM	
S. POTASSIUM	
BLOOD SUGAR	

IV CHEST X-RAY

V**. ENDOSCOPY**

Indication for endoscopy:

Endoscopy Report:

Biopsy done: Yes/ no

Biopsy report (If Biopsy done):

VI. **Spo_2, BP, HR**

	Before Endoscopy	During Endoscopy	After Endoscopy	10 min after Endoscopy
Spo_2 (%)				
Blood Pressure (mm of hg)				
Heart rate (beats per min)				

VII. **ELECTROCARDIOGRAPH**

	Before Endoscopy	**During Endoscopy**	**After Endoscopy**	**10 min after Endoscopy**
Standardization				
Rate				
Rhythm				
P wave				
PR interval				
QRS Complex				
Mean QRS Axis				
ST Segment				
T wave				
QT interval QTc				
Others				
Impression				

SHRI B.M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE, BIJAPUR – 586103.

RESEARCH INFORMED CONSENT FORM

TITLE OF RESEARCH : CARDIOPULMONARY CHANGES DURING UPPER GASTROINTESTINAL ENDOSCOPY

GUIDE : DR. BADIGER SHARANABASAWAPPA

P.G. STUDENT : DR. AMITH KUMAR PENDURTHI

PURPOSE OF RESEARCH:

I have been informed that the purpose of this study is to study the cardiopulmonary changes during upper gastrointestinal endoscopy

PROCEDURE:

I understand that I will undergo detailed history and clinical examination will be done along with Spo_2 monitoring and electrocardiography before, during and after the procedure.

RISKS AND DISCOMFORTS:

I understand that there is no risk involved and I may experience insignificant mild pain during the above-mentioned procedures.

BENEFITS:

I understand that my participation in this study will help me in recognizing the importance of early detection of cardiopulmonary problems occurring during upper gastrointestinal endoscopy.

CONFIDENTIALITY:

I understand that the medical information produced by the study will become a part of hospital record and will be subjected to confidentiality and privacy regulations of hospital. If the data is used for publications the identity of the patient will not be revealed.

REQUEST FOR MORE INFORMATION:

I understand that I may ask for more information about the study at any time.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I understand that my participation is voluntary and I may refuse to participate or withdraw from study at any time.

INJURY STATEMENT:

I understand in the unlikely event of injury to me during the study I will get medical treatment but no further compensations.

(Signature of Guardian) (Signature of Patient)

KEY TO MASTER CHART

AE	-	After Endoscopy
BE	-	Before Endoscopy
DE	-	During Endoscopy
F	-	Female
M	-	Male
N	-	Normal
10 AE	-	10 min after Endoscopy

UPPER GASTROINTESTINAL ENDOSCOPY IMAGES

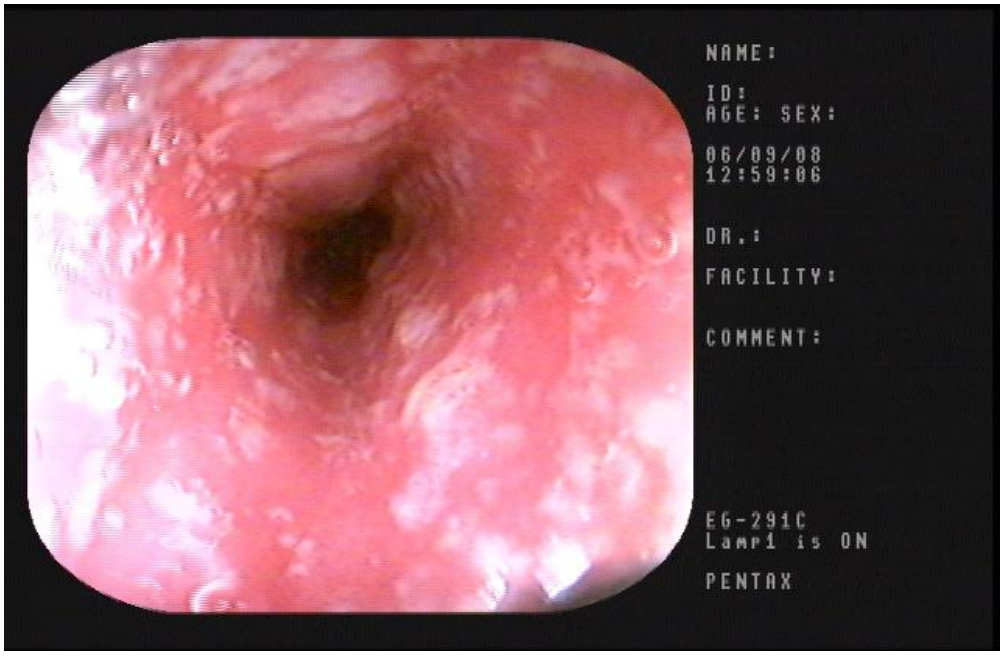


Image 1: Oesophageal Candidiasis

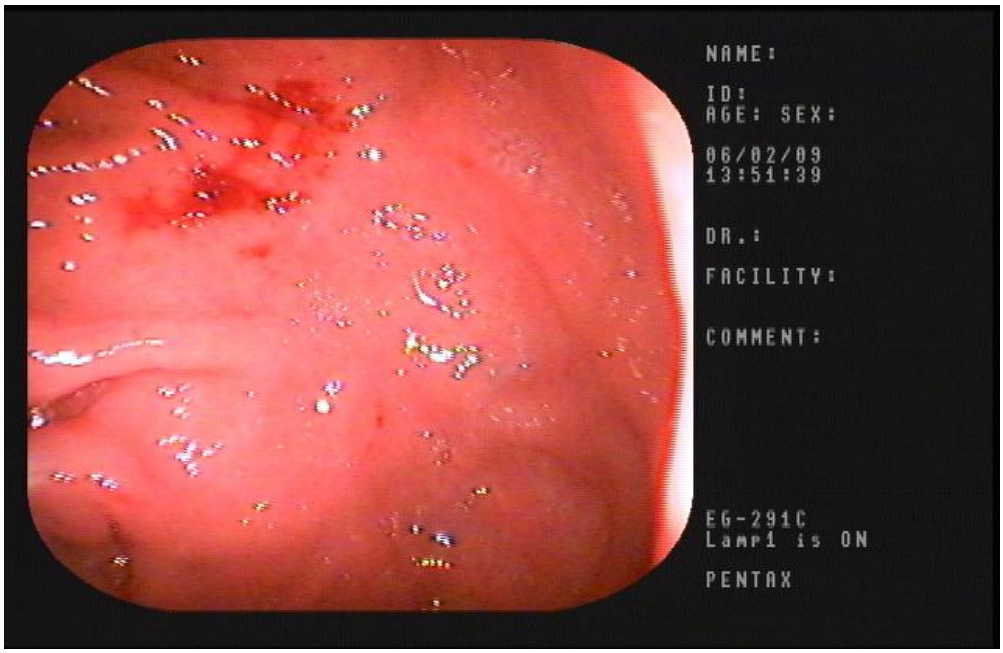


Image 2: Ulcer in the Stomach

UPPER GASTROINTESTINAL ENDOSCOPY IMAGES

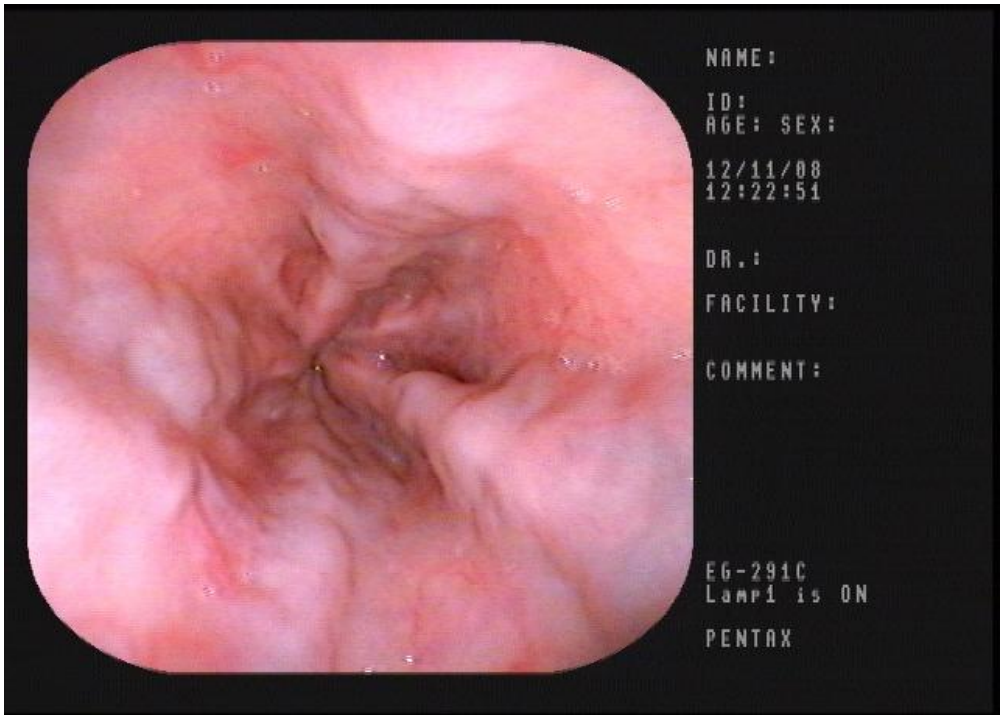


Image 3: Oesophageal Varices

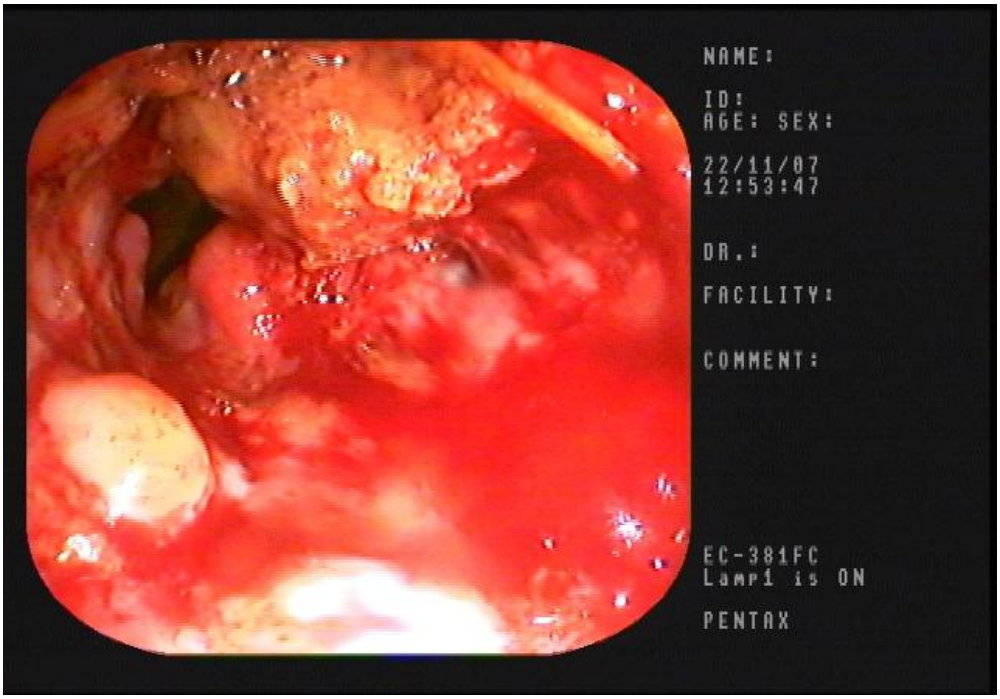
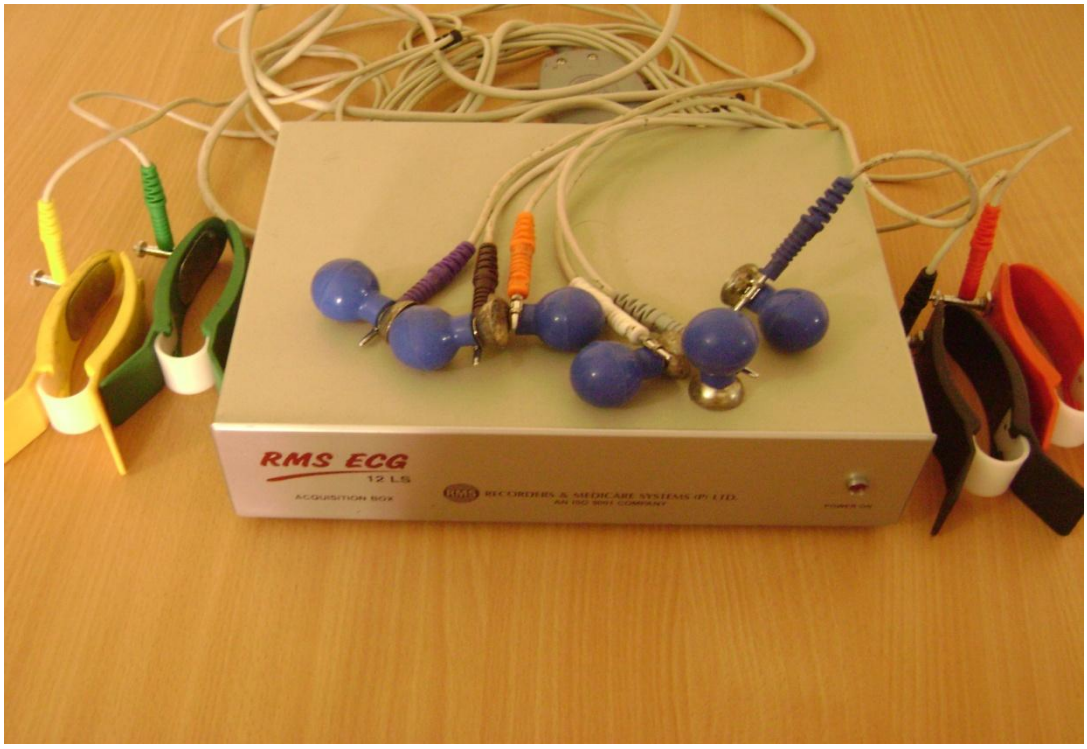
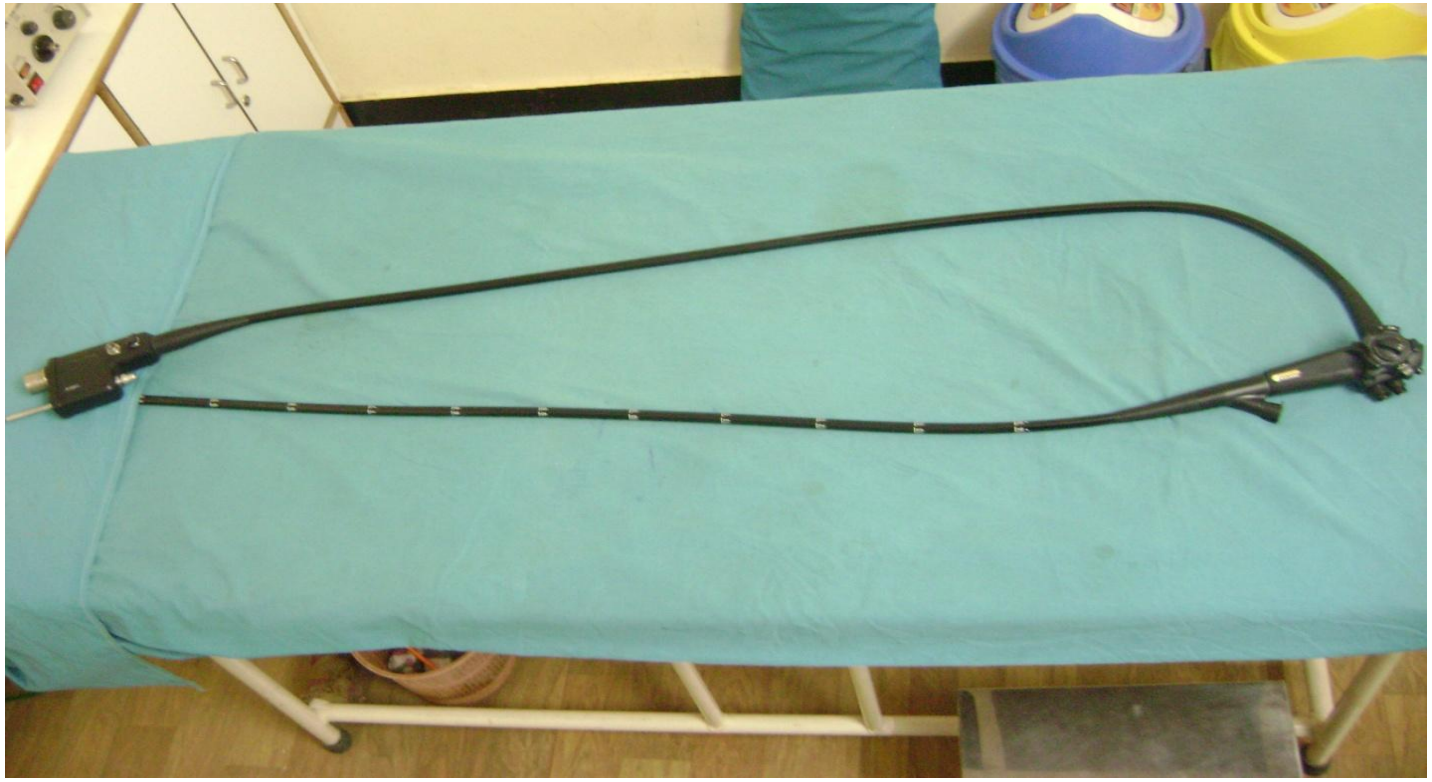


Image 4: Oesophageal Growth

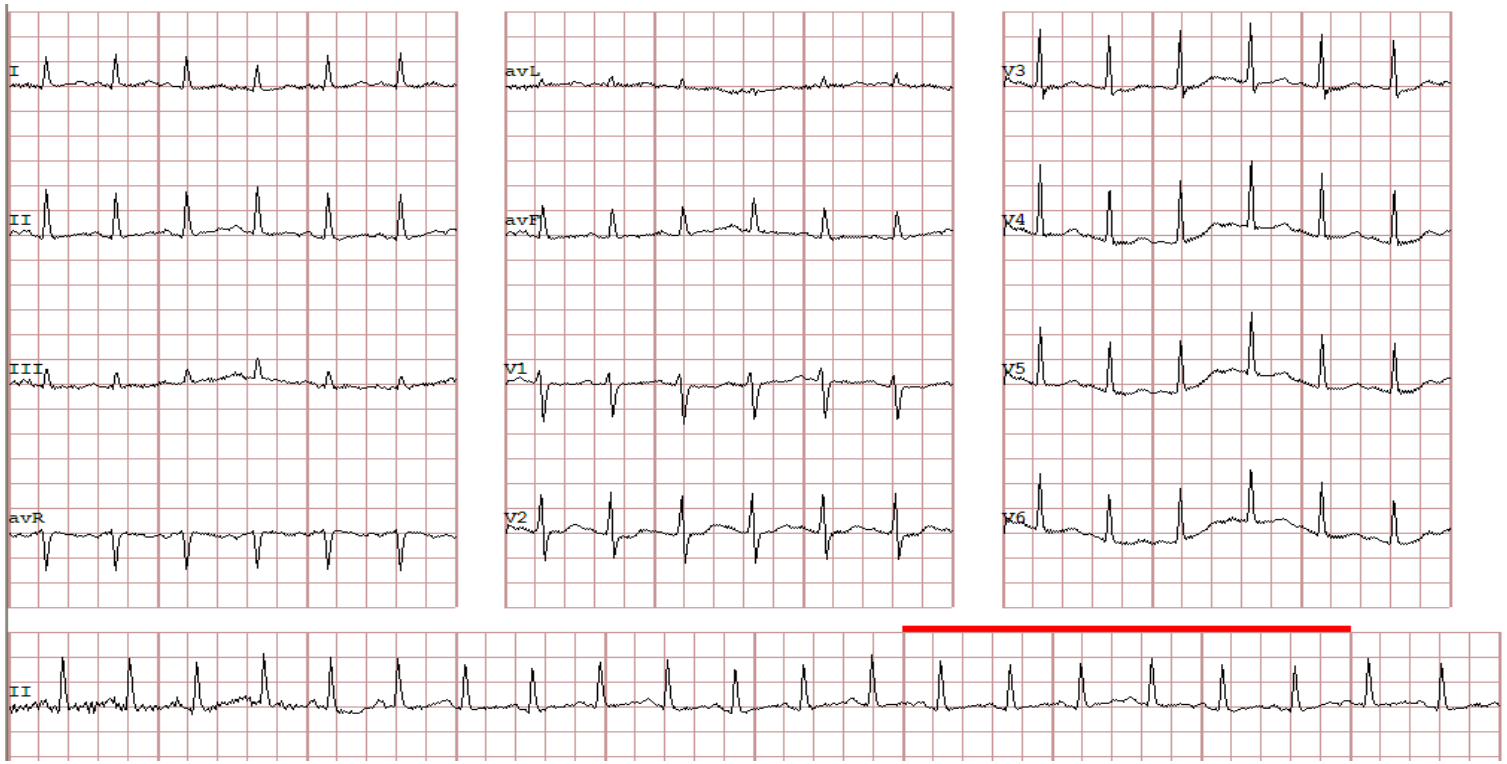


RMS PORTABLE ECG MACHINE

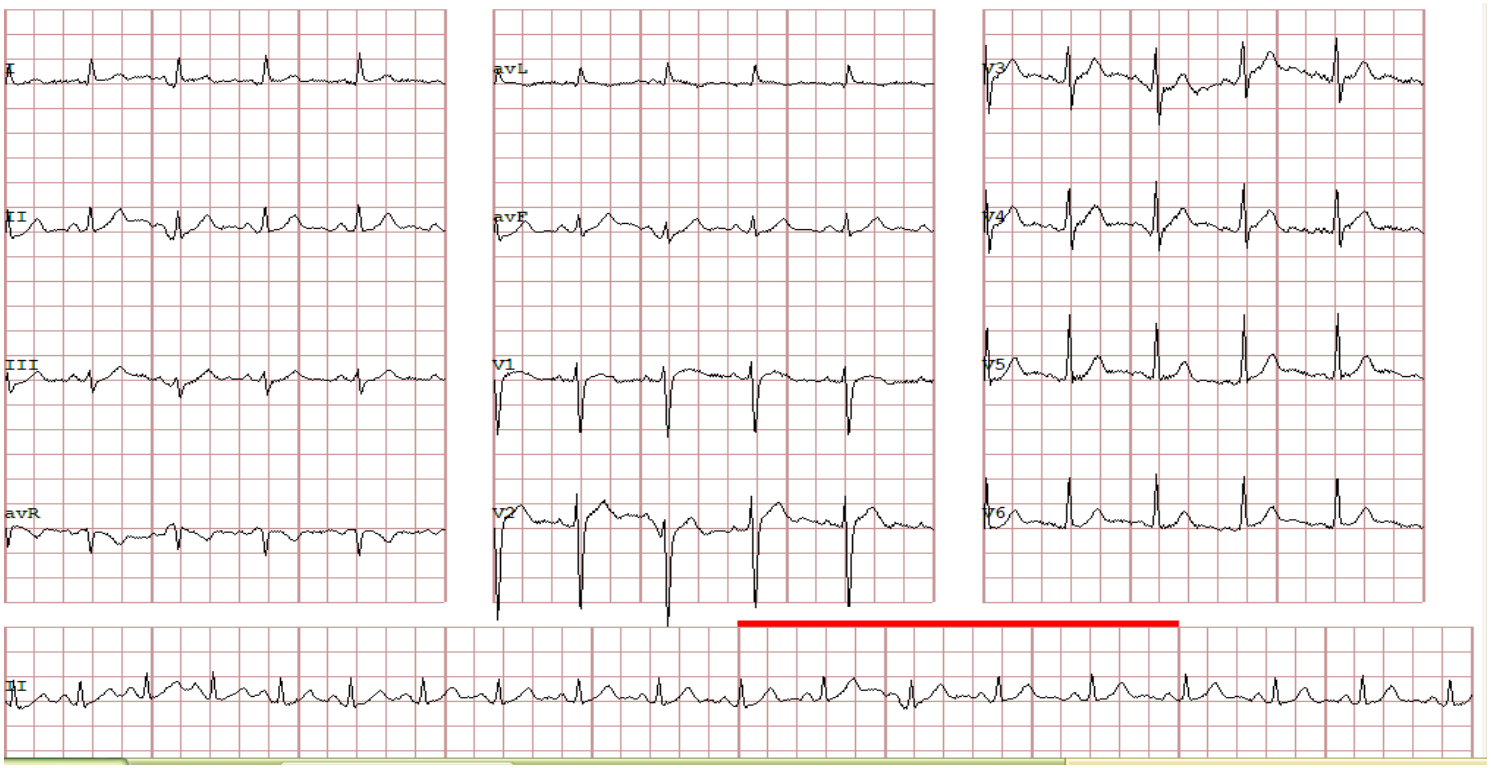
PULSE OXIMETER



PENTAX VIDEO GI FIBREOPTIC ENDOSCOPE EPK 150C



SAMPLE ECG RECORDING 1 SHOWING SINUS TACHYCARDIA



SAMPLE ECG RECORDING 2

Sl. No	Name	Age (Years)	Sex	Diagnosis	Spo2(%)				Blood Pressure(mmhg)				Heart Rate (beats/min)				ECG Changes observed during endoscopy
					BE	DE	AE	10 AE	BE	DE	AE	10AE	BE	DE	AE	10AE	
1	LS	55	M	Duodenal Ulcer	98	94	97	98	130/70	140/78	136/74	132/72	87	91	88	86	N
2	NG	24	M	Gastritis, Duodenitis	99	96	96	96	124/70	136/76	130/72	128/74	69	104	70	73	Sinus Tachycardia
3	HK	25	M	Normal Scopy	96	88	92	94	110/70	120/76	120/70	116/70	66	72	67	68	N
4	PB	53	M	Normal scopy	96	90	92	95	116/80	130/90	122/84	120/80	73	99	81	80	N
5	Mg	56	M	Oesophagitis	96	86	98	99	130/80	144/94	140/90	140/90	65	80	70	65	N
6	S	30	M	Gastritis	99	96	98	99	120/80	128/86	124/80	124/80	65	66	65	65	N
7	SD	30	M	Oesoph, Gastritis	99	97	98	98	120/70	124/78	124/74	120/70	56	56	57	57	N
8	Y	55	M	Oesoph Varices	94	88	90	92	100/70	108/78	104/76	104/70	86	96	87	84	N
9	K	19	F	Oesophagitis	100	96	99	100	110/70	120/74	114/70	110/70	100	121	99	95	Sinus Tachycardia
10	SS	45	M	Normal scopy	99	93	96	96	130/76	138/78	134/76	128/74	59	68	61	60	N
11	AM	20	F	Oesophagitis	99	90	96	99	114/70	120/76	120/80	110/76	104	116	100	103	Sinus Tachycardia
12	TT	70	F	Oesophgitis	96	92	98	96	116/84	124/80	124/80	120/80	86	98	87	79	N
13	P	65	M	Gastritis	96	90	91	91	136/90	150/100	146/96	146/94	100	110	101	97	Sinus Tachycardia
14	RN	42	M	Normal scopy	98	95	98	99	110/78	120/84	116/80	114/78	60	69	60	57	N
15	A	28	M	Normal scopy	98	94	99	98	134/80	148/90	140/90	136/86	110	123	112	104	Sinus Tachycardia
16	B	25	F	Oesoph, gastritis	99	92	95	99	106/70	110/74	110/70	100/66	63	88	68	69	N
17	HH	70	M	Oesophagitis	94	89	92	93	110/70	120/76	116/74	114/72	80	94	88	87	N
18	M	30	F	Normal scopy	100	96	99	100	110/80	124/90	120/86	110/80	109	129	114	111	Sinus Tachycardia
19	A	25	F	Oesphagitis	100	96	99	99	114/76	120/80	114/80	114/76	104	99	100	103	N
20	M	68	M	Normal scopy	99	93	99	99	136/80	150/86	142/82	140/80	91	99	94	98	N
21	C	60	M	Oesoph candidiasis	97	91	93	96	120/86	126/90	116/88	120/84	86	96	87	87	N
22	P	30	F	Normal scopy	97	94	96	96	124/76	130/80	130/80	124/74	65	66	65	65	N
23	M	48	M	Gastritis	99	95	96	98	110/64	116/70	114/66	114/66	74	80	70	70	N
24	S	40	M	Normal scopy	99	95	98	97	116/86	124/90	120/86	120/84	78	100	78	76	Sinus Tachycardia
25	P	22	M	Oesoph varices	96	89	94	94	100/70	114/74	104/70	98/66	60	73	59	63	N
26	R	32	M	Gastritis	98	96	99	100	110/70	124/72	110/70	110/70	93	101	89	87	Sinus Tachycardia
27	M	38	F	Normal scopy	100	94	99	98	110/86	120/90	116/80	116/84	98	102	94	94	Sinus Tachycardia
28	C	56	M	Normal scopy	96	90	98	99	130/90	144/100	126/86	134/90	61	76	64	64	N
29	N	70	F	Normal scopy	99	94	98	99	130/80	142/86	134/76	130/80	72	87	78	78	T wave inversion
30	M	30	F	Normal scopy	98	96	99	100	106/70	116/74	110/70	110/70	78	85	80	83	N
31	K	27	F	Oesophagitis	100	96	99	99	114/70	120/76	110/70	110/70	104	128	110	104	Sinus Tachycardia
32	D	57	F	Normal scopy	95	88	96	99	126/80	134/90	116/78	120/80	79	88	76	80	N
33	S	48	F	Oesophagitis	100	96	99	99	120/80	134/90	130/86	130/86	102	124	99	96	Sinus Tachycardia

Sl. No	Name	Age (Years)	Sex	Diagnosis	Spo2(%)				Blood Pressure(mmhg)				Heart Rate (beats/min)				ECG Changes observed during endoscopy
					BE	DE	AE	10 AE	BE	DE	AE	10AE	BE	DE	AE	10AE	
34	A	40	F	Oesophagitis	100	96	99	99	110/70	130/78	116/70	116/70	70	89	75	75	N
35	S	25	F	Normal scopy	98	96	99	99	120/80	124/80	124/84	116/80	100	104	101	103	Sinus Tachycardia
36	SP	65	F	Normal scopy	100	96	99	99	120/74	132/80	128/76	124/76	88	94	89	89	N
37	GK	60	F	Oes Varices, P Ulcer	100	92	99	98	136/90	148/100	140/96	140/90	60	86	70	64	N
38	MB	65	M	Oes Ulcer, candidiasis	99	96	98	98	110/70	120/78	112/74	112/70	78	84	80	80	N
39	B	40	M	Gastritis	100	96	98	99	140/80	154/92	146/86	144/80	74	82	77	70	N
40	V	65	M	Gastritis	100	96	96	99	126/80	130/84	126/84	126/84	78	81	80	80	N
41	P	25	F	Gastritis	98	94	99	99	114/76	122/80	116/80	116/80	70	89	75	73	N
42	S	26	M	Normal scopy	99	96	99	100	116/80	130/84	120/86	116/70	68	73	69	64	N
43	S	65	M	Gastritis	100	97	99	99	130/80	136/80	130/80	130/80	79	89	78	77	N
44	I	52	M	Duodenal Ulcer	97	90	95	96	130/80	134/72	126/76	130/74	65	72	66	65	N
45	R	50	M	Oesophagitis, gastritis	98	94	96	97	136/90	140/94	136/94	136/90	89	95	89	84	N
46	J	57	M	Duodenal Ulcer	99	96	99	99	100/70	114/76	110/70	106/70	94	100	96	94	Sinus Tachycardia, ST depression
47	I	28	F	Normal scopy	99	94	98	99	120/80	134/86	126/80	126/80	78	86	80	82	N
48	M	30	F	Oesophagitis	96	93	96	98	116/70	124/80	120/80	116/70	62	75	70	67	N
49	B	30	M	prepyloric ulcers	95	88	92	94	116/86	124/90	126/90	120/90	56	70	58	57	N
50	Sk	60	M	Gastritis, Duodenitis	99	96	97	100	120/70	126/74	116/70	120/70	60	72	65	64	N
51	C	60	M	Oesoph Candidiasis	97	94	92	95	100/60	106/64	110/60	106/60	80	94	87	88	N
52	B	34	M	Ca Oesophagus	99	94	98	98	120/80	134/90	126/84	124/80	77	84	74	69	N
53	H	69	M	Oesophagitis	98	90	96	97	116/86	134/90	126/88	120/84	73	116	74	68	Sinus Tachycardia, T wave inversion
54	RY	34	M	Oesophagitis,Gastritis	99	94	98	99	120/84	140/88	126/80	124/82	77	114	73	70	Sinus Tachycardia
55	S	40	M	Oesophageal Varices	99	96	98	99	134/80	158/74	146/86	138/84	70	106	68	68	Sinus Tachycardia
56	RH	56	M	Normal Scopy	99	97	99	100	114/80	148/96	136/90	120/84	78	107	82	72	Sinus Tachycardia
57	BD	45	M	Ca Oesophagus	98	93	96	98	110/70	140/84	126/80	120/76	80	104	74	74	Sinus Tachycardia
58	MP	21	M	Oesophagitis, Gastritis	100	99	98	100	130/86	150/94	138/90	132/88	68	106	78	75	Sinus Tachycardia
59	MN	58	M	Oesophagitis, Gastritis	99	96	98	99	140/86	160/98	150/94	144/90	70	100	84	70	Sinus Tachycardia
60	M	48	M	Normal Scopy	99	96	99	100	110/69	134/80	120/68	116/66	72	101	83	66	Sinus Tachycardia
61	KR	55	M	Normal Scopy	98	95	97	99	124/86	150/96	140/90	136/84	66	80	74	74	N
62	P	70	M	Normal Scopy	96	89	92	94	120/70	144/86	130/80	124/76	65	80	67	72	N
63	VM	30	M	Normal Scopy	100	96	98	99	120/76	150/100	144/96	130/80	77	100	69	74	Sinus Tachycardia
64	S	42	M	Normal Scopy	97	95	98	98	124/76	156/98	140/80	130/80	91	101	86	98	Sinus Tachycardia

Sl. No	Name	Age (Years)	Sex	Diagnosis	Spo2(%)				Blood Pressure(mmhg)				Heart Rate (beats/min)				ECG Changes observed during endoscopy
					BE	DE	AE	10 AE	BE	DE	AE	10AE	BE	DE	AE	10AE	
65	B	80	M	Normal Scopy	94	88	91	92	134/80	160/100	150/96	144/90	88	101	91	86	Sinus Tachycardia
66	P	60	M	Pyloric Ulcer	96	91	94	93	110/76	138/88	120/80	120/80	75	100	84	81	Sinus Tachycardia
67	S	20	M	Oesophagitis, Gastritis	100	97	99	100	114/76	130/84	120/78	120/80	84	102	98	96	Sinus Tachycardia
68	GB	75	M	Normal Scopy	96	90	94	97	140/90	168/104	150/96	146/90	109	119	106	95	Sinus Tachycardia
69	GC	22	F	Oesoph Ulcer	98	94	97	96	110/76	140/88	134/80	120/80	90	104	96	94	Sinus Tachycardia
70	S`	70	F	Normal Scopy	93	89	91	92	104/68	136/80	120/76	110/70	100	112	104	102	Sinus Tachycardia
71	S	40	F	Normal Scopy	99	96	98	99	116/70	140/84	134/80	120/74	107	121	103	98	Sinus Tachycardia
72	S	80	M	Normal Scopy	98	93	96	97	134/76	160/88	150/84	140/80	86	106	94	81	Sinus Tachycardia, ST depression, T wave inversion
73	B	25	F	Oesophagitis	100	97	99	100	116/78	140/84	130/80	124/80	97	120	105	94	Sinus Tachycardia
74	HP	42	M	Oesophagitis	100	96	99	100	110/70	144/80	136/80	124/74	70	90	82	73	N
75	M	60	M	Oesoph ulcer	96	92	92	94	120/74	134/86	130/80	120/70	84	96	86	82	N
76	B	3	M	Normal Scopy	100	97	98	99	124/80	148/90	130/84	126/78	56	85	69	63	N
77	S	21	M	Normal Scopy	100	98	100	100	120/80	140/90	132/86	124/84	93	120	94	94	Sinus Tachycardia
78	A	25	M	Normal Scopy	100	97	99	99	116/70	140/86	130/80	120/74	100	124	102	98	Sinus Tachycardia
79	H	24	M	Gastritis	100	97	99	100	120/84	150/96	130/86	126/80	98	122	110	94	Sinus Tachycardia
80	LB	59	M	Oesophagitis	99	97	99	100	140/90	154/100	148/94	144/90	98	120	100	90	Sinus Tachycardia
81	VD	18	M	Oesophagitis	100	98	100	100	110/70	128/84	120/78	114/76	98	128	100	100	Sinus Tachycardia
82	M	70	M	Oesophagitis	99	95	98	99	120/80	146/90	132/86	124/80	88	116	100	94	Sinus Tachycardia
83	RU	35	M	Normal Scopy	97	93	98	98	124/72	140/78	130/76	130/72	75	120	80	76	Sinus Tachycardia
84	S	16	F	Oesophagitis	98	94	99	99	120/80	126/84	118/76	120/76	75	90	68	74	N
85	BS	70	M	Oesoph Strictures	99	92	97	98	110/70	134/90	124/80	116/76	76	130	75	75	Sinus Tachycardia, ST Depression
86	KG	28	M	Gastritis	100	96	99	100	116/78	124/84	120/80	114/80	75	100	96	78	Sinus Tachycardia
87	A	36	M	Normal Scopy	99	96	98	99	110/70	124/78	120/76	116/72	75	106	75	75	Sinus Tachycardia
88	V	48	M	Gastritis	100	94	98	99	126/74	154/96	136/84	130/78	75	116	74	88	Sinus Tachycardia
89	B	35	M	Normal Scopy	98	92	96	98	120/70	134/72	126/70	116/70	76	110	80	78	Sinus Tachycardia
90	A	40	M	Oesoph varices	100	94	98	98	104/60	118/70	110/70	106/64	80	100	88	82	Sinus Tachycardia
91	B	24	M	Normal Scopy	99	96	98	99	116/80	124/86	120/82	120/80	76	88	80	72	N
92	S	40	M	Normal Scopy	100	98	99	99	130/84	150/100	130/86	124/78	57	70	62	58	N
93	K	24	M	Normal Scopy	100	97	99	100	116/70	134/84	120/78	120/76	60	77	63	57	N
94	S	65	M	Gastritis	99	94	98	98	110/70	128/80	120/74	114/70	69	78	64	60	N
95	S	48	M	Normal Scopy	99	98	99	100	130/90	144/98	136/92	130/94	84	96	86	80	N

Sl. No	Name	Age (Years)	Sex	Diagnosis	Spo2(%)				Blood Pressure(mmhg)				Heart Rate (beats/min)				ECG Changes observed during endoscopy
					BE	DE	AE	10 AE	BE	DE	AE	10AE	BE	DE	AE	10AE	
96	M	30	M	Normal Scopy	100	97	99	99	110/70	128/84	120/80	116/74`	66	78	65	65	N
97	G	35	M	Normal scopy	99	97	99	99	130/90	144/96	130/90	130/90	63	80	70	68	N
98	S	70	M	Normal scopy	100	94	98	99	120/76	128/84	126/78	120/78	56	72	66	60	N
99	PN	48	M	Normal scopy	100	98	100	100	128/84	146/96	134/90	130/86	60	78	66	64	N
100	R	65	M	Normal Scopy	98	90	96	98	110/70	134/84	120/76	114/74	63	86	70	70	N
101	I	35	M	Normal Scopy	100	98	100	100	120/76	134/84	126/78	124/78	60	74	64	64	N
102	I	65	M	Normal Scopy	99	95	98	99	124/86	142/94	130/86	126/84	70	88	84	74	N
103	GS	40	M	Normal scopy	99	95	98	99	120/74	142/88	130/80	124/78	60	83	73	63	N
104	GR	25	M	Normal scopy	100	97	99	99	116/74	140/86	124/80	120/76	100	127	101	97	Sinus Tachycardia
105	A	36	M	Gastritis	100	97	98	99	130/84	150/100	136/88	130/80	63	84	70	74	N
106	BS	40	M	Normal scopy	100	97	100	100	110/70	130/80	124/76	120/70	74	92	80	70	N
107	C	50	M	Normal Scopy	99	97	99	99	130/80	160/96	150/84	136/80	63	78	70	66	N
108	SK	35	M	Normal scopy	98	92	97	96	116/78	138/76	120/80	120/78	86	96	87	79	N
109	S	64	M	Oesophagitis	96	92	94	95	120/74	134/86	126/80	124/80	65	92	70	69	N
110	K	65	F	Oesoph growth	94	88	90	92	130/80	160/100	138/84	136/84	70	98	82	78	ST depression
111	J	26	F	Normal Scopy	100	98	99	99	120/70	144/86	130/78	124/70	100	120	99	97	Sinus Tachycardia
112	RB	28	M	Normal Scopy	98	96	98	98	110/70	124/78	116/70	110/70	73	99	81	80	N
113	RK	25	M	Normal Scopy	100	98	100	100	120/80	140/90	128/84	124/80	58	78	64	64	N
114	T	51	M	Oesophagitis	99	96	98	99	116/70	128/80	120/76	120/72	82	100	88	84	Sinus Tachycardia
115	H	26	M	Normal Scopy	98	96	98	98	110/70	134/86	120/80	116/74	110	130	122	100	Sinus Tachycardia
116	G	32	F	Duodenitis, Pyl spasm	100	98	99	99	120/80	140/88	124/82	120/80	94	109	98	95	Sinus Tachycardia
117	J	37	F	Oesophagitis	100	97	99	99	134/80	150/94	140/86	136/80	97	120	104	99	Sinus Tachycardia
118	N	54	F	Normal scopy	100	96	99	99	120/70	134/76	126/70	120/70	76	89	78	77	N
119	BP	58	F	Ca Oesophagus	98	95	99	99	124/80	138/96	130/90	126/84	72	90	78	77	N
120	SB	55	F	Oesoph varices	99	96	97	99	120/70	134/78	126/72	118/70	78	94	84	80	N
121	P	28	M	Normal scopy	100	98	99	100	110/70	124/76	114/74	110/70	100	130	114	110	Sinus Tachycardia
122	S	42	F	Gastritis	99	96	98	99	124/80	140/86	130/82	126/80	79	90	80	78	N
123	D	40	F	Normal scopy	100	96	99	100	116/78	130/86	120/80	116/70	70	94	78	74	N
124	P	16	F	Oeoph varices	100	97	100	100	116/74	124/78	110/70	110/70	88	111	104	100	Sinus Tachycardia
125	N	50	M	Oesophagitis	100	96	99	99	120/80	136/86	126/84	120/80	104	128	110	106	Sinus Tachycardia
126	D	28	M	Gastritis`	100	98	100	100	120/80	136/84	126/84	120/78	84	102	85	85	Sinus Tachycardia
127	M	13	M	Oesoph varices	100	99	100	100	116/80	128/86	120/84	114/78	60	80	68	59	N
128	N	60	M	Normal scopy	98	92	97	98	110/70	130/78	116/72	112/70	70	88	72	68	N

Sl. No	Name	Age (Years)	Sex	Diagnosis	Spo2(%)				Blood Pressure(mmhg)				Heart Rate (beats/min)				ECG Changes observed during endoscopy
					BE	DE	AE	10 AE	BE	DE	AE	10 AE	BE	DE	AE	10 AE	
129	R	12	M	Oesoph ulcer	100	98	100	100	100/70	120/78	106/74	104/70	104	120	110	106	Sinus Tachycardia
130	M	26	M	Oesoph candidiasis	100	99	100	100	110/70	126/78	116/72	110/70	85	104	86	82	Sinus Tachycardia
131	A	55	M	Gastric ulcer	99	97	99	99	130/80	148/84	136/80	130/70	94	104	95	90	Sinus Tachycardia
132	S	52	M	Ca oesoph	98	89	94	97	110/70	130/76	120/72	114/70	83	101	86	86	Sinus Tachycardia
133	V	19	M	Oesophagitis	100	98	100	100	124/86	140/94	128/88	120/84	60	81	74	64	N
134	T	65	M	Oesophagitis	98	94	97	98	110/64	124/72	114/66	108/60	82	106	88	86	Sinus Tachycardia
135	M	66	M	Oesophagitis	99	94	98	98	130/86	148/94	134/88	130/82	67	84	63	58	N
136	VS	49	M	Oesophagitis	99	95	98	99	132/90	150/96	134/90	126/86	93	112	89	87	Sinus Tachycardia
137	S	52	M	Oesoph growth	98	95	99	99	120/80	134/88	124/84	120/80	83	101	86	86	Sinus Tachycardia
138	S	60	M	Normal Scopy	98	95	96	97	110/70	124/80	120/80	116/74	65	78	68	63	N
139	BN	29	M	Oesophagitis	100	97	99	99	120/70	134/84	126/78	124/74	80	88	75	73`	N
140	N	55	M	Normal Scopy	99	96	99	99	114/70	136/84	120/74	118/74	87	104	88	86	Sinus Tachycardia