CHAPTER IV
Oral and Oral Related Cancers

Biochemical Parameters in Oral and Oral Related Cancers

Introduction:

In this chapter of oral and oral related cancers various types of cancers were studied. They included the cancers of cervical nodes, pyriform fossa, maxilla, parotid tumour, larynx and oesophagus.

Oral cancer has emerged as an alarming public health problem with increasing incidence and mortality rates all over the world. Therefore, the implementation of newer screening and early detection approaches are of utmost importance which could reduce the morbidity and mortality associated with this disease. Sensitive and specific biomarkers for oral cancer are likely to be most effective for screening, diagnosis, staging and follow-up for this dreaded malignancy (295).

Oral cancer is the 15th most prevalent cancer with the age standardized incidence rate of 3.9 per 100,000 population worldwide (296). This dreaded malignancy stems as the major health concern due to rising trendy in younger population. The Indian subcontinent accounts for one-third of the world burden of this malignancy (297). In India, the age standardized incidence rate of oral cancer is 12.6 per 100,000 population and a sharp increase in the incidence rate of this cancer has been reported in recent years (298). It is the most common form of cancer and accounts for increasing number of cancer related deaths among men in India (297). According to the rural and urban registry reports of the Gujarat Cancer and Research Institute, Ahmedabad, the estimated age standardized incidence rate of oral cancer is 24 and 33.3 per 100,000 population, respectively (296). A recent pooled analysis from the International Head and Neck Cancer Epidemiology consortium based on over 10,000 cases and 13,000 controls support significant role of tobacco and alcohol use in etiology of oral cancer (299). The high incidence of oral cancer in India has also been linked
with habits of tobacco chewing and smoking \(^{300}\). The repeated exposures of carcinogenic insults (e.g. tobacco chewing) to oral mucosal cells increase the risk for development of multiple independent premalignant and malignant lesions from the accumulations of genetic alterations of oncogenes and tumour suppressor genes supporting the “field cancerization model, multiple oral cancers develop from separate, independent cell clones \(^{301}\).

Malignant neoplasms are major causes of fear, morbidity and mortality all over the world. Globally oral cancer is the sixth most common cause of cancer-related death \(^{302}\). Oral cancer accounts for approximately 30-40% of all cancers in India \(^{303}\). Despite the recent advances in tumour surgery and multimodal treatment regimes, the prognosis of oral squamous cell carcinoma is still relatively poor. This may be because symptoms that indicate the presence of the carcinoma often appear when the tumour is in an advanced stage \(^{304}\).

In the light of such problem, it will be very useful to find biochemical markers that allow suspecting the presence of the carcinoma at early stages. During the course of tumour development, quantitative changes have been shown to occur in a variety of substances in serum. These substances are collectively referred to as biochemical markers or tumour markers. \(^{305,306}\)

Oral cancer is more common in men than women. It is thought this is because men are more likely than women to use tobacco and alcohol in heavy amounts. The incidence of oral cancer increases with age and is greatest after 40 years. Some studies show that low socioeconomic status, lack of education and low income are associated with a higher incidence of oral cancer.

An estimated 2,63,900 new cases and 1,28,000 deaths from oral cavity cancer (including lip cancer) occurred in 2008 worldwide. The highest oral cavity cancer rates are found in Melanesia, South Central Asia and Central and Eastern Europe and the lowest in Africa, Central America
and Eastern Asia for both males and females. Smoking, alcohol use, smokeless tobacco products and HPV infections are the major risk factors for oral cavity cancer, with smoking and alcohol having synergistic effects (307-308). The contribution of each of these risk factors to the burden varies across regions (307,309-312). Worldwide smoking accounts for 42% of deaths from cancers of the oral cavity (including the pharynx) and heavy alcohol consumption for 16% of the deaths (313). Smokeless tobacco products and betel quid with or without tobacco are the major risk factors for oral cavity cancer in Taiwan, India and other neighboring countries (309,314,315). Incidence rates for oral cancer sites related to HPV infections, such as the oropharynx, tonsil and base of the tongue are increasing in young adults. (316-320)

**Anatomy and Physiology:**
The mouth (oral cavity) is enclosed by the lips, cheeks, palate (roof of the mouth) and tongue. It is lined by a mucous membrane that protects the inside of the mouth. All of the structures in the oral cavity play an important role in the first steps of digestion.

**Figure 4.1**

![Head and Neck Diagram](image-url)
Structure

The oral cavity can be divided into specific areas, including:

- lips
- commissure of lips – where the upper and lower lips meet at the corner of the mouth
- tongue (front two-thirds)
- floor of the mouth
- buccal mucosa (the lining of the lips and cheeks)
- gingiva (gums)
- retromolar trigone (firm area just behind the back molars in the lower jaw)
- hard palate (bony part of the roof of the mouth)
- soft palate (soft, muscular part of the roof of the mouth)
- teeth
- lower jaw (mandible) and upper jaw (maxilla)
Signs and Symptoms:

The signs and symptoms of oral cancer can also be caused by other health conditions.

Signs and symptoms of oral cancer are:

- ulcer or sore in the mouth that doesn't heal
- lump in the lip, mouth, gums, tongue, roof of mouth or tonsil
- thickening in the cheek
- bleeding in the mouth
- pain in the mouth that doesn't go away
- loose teeth
- dentures that no longer fit
- slurred speech
- swollen saliva glands
- swollen lymph nodes in the neck

White patches (leukoplakia) or red patches (erythroplakia) on the lips or in the mouth are precancerous conditions that may become cancerous.

Late signs and symptoms:

Late signs and symptoms occur as the cancer grows larger or spreads to other parts of the body, including other organs (Metastases).

- swelling in the neck
- difficulty in swallowing or chewing
- difficulty in moving the tongue or jaw
- loss of appetite (anorexia)
- weight loss
Rare signs and symptoms:

A rare sign of oral cancer is an orocutaneous fistula. This is an opening to the surface of the skin from the inside of the mouth. Advanced cancers may wear through the fat layer of the mouth to the outer skin, creating an opening on the surface.

Biochemical Parameters:

- Biochemical Parameters measure many different chemicals in the blood. They show how well certain organs are functioning and can also be used to detect abnormalities.

- Increased alkaline phosphatase (ALP) may indicate that cancer has spread to the liver or bone.

- Increased alanine transaminase (ALT) and aspartate transaminase (AST) may indicate that the cancer has spread to the liver.

- Lactate dehydrogenase (LDH) measures liver and kidney function and when increased may indicate advanced cancer.

- Bilirubin levels measure the function of the liver and when increased may indicate tumours in the liver.
Malathi M et al\textsuperscript{(321)} aimed to assess the oxidant-antioxidant status in head and neck cancer patients before and after radiotherapy. The plasma levels of malondialdehyde (MDA), the marker of lipid peroxidation, and the antioxidants, superoxide dismutase (SOD), vitamin A, vitamin C and ceruloplasmin, were assayed before and after radiotherapy, in comparison to the healthy controls.

Their results showed that the plasma levels of MDA were higher and the levels of SOD, vitamin A, vitamin C and ceruloplasmin were lower in the head and neck cancer patients as compared to those in the healthy controls. These parameters showed significant changes after radiotherapy, as indicated by a lower level of MDA and higher levels of SOD, vitamin A,
vitamin C and ceruloplasmin in the plasma of the cancer patients after radiotherapy, as compared to the plasma levels before radiotherapy. All the results were statistically significant (P<0.001). They concluded that radiotherapy caused a reduction in the lipid peroxidation and an improvement in the antioxidant status of the head and neck cancer patients (321).

Free radicals are implicated in the pathogenesis of a multistage process of carcinogenesis. They are proposed to cause DNA base alterations, strand breaks, damage to the tumour suppressor genes and an enhanced expression of the proto-oncogenes (322-325). The burst of the reactive oxygen species (ROS) and the reactive nitrogen species (RNS) has been implicated in the development of cancer. Increased levels of lipid hydroperoxide, MDA and nitric oxide and decreased levels of the antioxidants, catalase, SOD, glutathione peroxidase, vitamin C and vitamin E, in blood and tissues, have been reported in head and neck cancer patients (326-332).

The present study revealed increased lipid peroxidation and lowered levels of antioxidants in the head and neck cancer patients. The levels of MDA, the marker of lipid peroxidation, were higher almost by 4-fold in the cancer patients as compared to the controls. The levels of the antioxidants, SOD, vitamin C, vitamin A and ceruloplasmin, were decreased in the head and neck cancer patients. This suggests an increased oxidative stress being involved in the pathogenesis of head and neck cancer. This study results correlate with our present study results showing elevated values of serum alkaline phosphatase, serum proteins and MDA/TBARS significantly. Also there was significant decrease in the vitamin A and reduced glutathione mean values. This suggested an increased oxidative stress being involved in pathogenesis of head and neck cancer.

Previous studies have reported increased blood levels of lipid peroxides and MDA, and decreased blood levels of antioxidants in head
and neck cancers\textsuperscript{(325-332)}. Red blood cell membranes are more prone to lipid peroxidation because of their high polyunsaturated fatty acid content and their direct exposure to molecular oxygen and haemoglobin. The compensatory mechanism to counter the ROS results in reduced levels or activities of enzymatic and non-enzymatic antioxidants in blood.

The authors advocating increased oxidative stress in radiotherapy have shown from their studies, that supplementation with antioxidants such as alpha-tocopherol ameliorates the oxidative damage caused by radiotherapy. Chitra and Shyamaladevi\textsuperscript{(333)} observed a significant decrease in the malondialdehyde levels and an increase in the activities of antioxidant enzymes in oral cancer patients who were supplemented with alpha-tocopherol during radiotherapy, as compared to radiation-treated oral cancer patients without alpha-tocopherol supplementation.

The study concluded that the involvement of oxidative stress in head and neck cancer is evident from increased lipid peroxidation and decreased levels of antioxidants in plasma.
Results and Discussion

The results are depicted in Table No. I, II, III and Graph No. 1,2 and 3.

Table No. I shows levels of kidney function test parameters in the patients with cervical nodes cancer. On an average the blood urea levels in test patients was (23.3±6.537mg/dl) against (20.6±3.411 mg/dl) in control patients.

The second parameter in this table is serum creatinine. Its mean levels in the test group were towards upper limits as compared to the control group. The mean levels were (1.01±0.009 mg/dl) and (0.77±0.009 mg/dl) respectively. The serum uric acid mean level in the test group (5.61±1.033mg/dl) were higher than the control group (4.47±0.0655 mg/dl). All the three parameters were significantly increased in the test group as compared to the control group.

Liver function test parameters mean levels are shown in Table No. II. Mean levels of the serum alkaline phosphatase were (118.0±74.737IU/L) against the control group mean level being (106.8±21.221IU/L). The value was highly significant. The serum proteins and the serum albumin were also towards the higher side. The average mean levels were (7.73±0.286gm/dl) and (3.45±0.186gm/dl) for serum proteins and serum albumin respectively in the test group against (7.01±0.165 gm/dl) and (3.14±0.006 gm/dl) in the control groups.

Table No. III shows the results of antioxidant levels studied in the cervical node cancer patients. The vitamin A mean levels were (33.6±2.147µg/dl) in the test group as compared to (37.1±3.674µg/dl) in the control group. There was less difference between the two mean values but still it was significantly low in the test patients. Reduced glutathione was also decreased in the test group (15.713±2.086mg/dl) as compared to the control group (30.161±0.493mg/dl). The oxidative stress indicator, Thiobarbituric Acid Reactive Substance (TBARS) or malondialdehyde
(MDA) mean levels in the patients with cervical node cancer were (19.97±45.95nmol/ml) against the control group mean level (5.405±7.603nmol/ml). The TBARS mean value was highly significant statistically. (321)

Second parameter studied for oxidative stress was SEPH i.e. Sensitivity of Erythrocytes to Peroxide Haemolysis also showed elevated mean values for test (7.95±1.59%) as compared to the control mean value (5.2±1.0). These results indicated the role of oxidative stress in the malignancy.
VARIOUS PARAMETERS IN CERVICAL NODES CANCER

TABLE NO I

Kidney Function Test in Cervical Nodes

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood urea (mg/dl)</td>
<td>23.3±6.537*</td>
<td>20.06±3.411</td>
</tr>
<tr>
<td>Serum creatinine (mg/dl)</td>
<td>1.01±0.009*</td>
<td>0.77±0.009</td>
</tr>
<tr>
<td>Serum uric acid (mg/dl)</td>
<td>5.61±61.033*</td>
<td>4.47±0.655</td>
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</table>

TABLE NO II

Liver Function Test in Cervical Nodes

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaline phosphatase (IU/L)</td>
<td>118.0±74.737*</td>
<td>106.8±21.221</td>
</tr>
<tr>
<td>Serum proteins (gm/dl)</td>
<td>7.73±0.286*</td>
<td>7.01±0.165</td>
</tr>
<tr>
<td>Serum albumin (gm/dl)</td>
<td>3.45±0.186**</td>
<td>3.17±0.006</td>
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TABLE NO III

Serum Antioxidants and Oxidative Stress Levels in Cervical Nodes

<table>
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<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
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</thead>
<tbody>
<tr>
<td>Vitamin A (µg/dl)</td>
<td>33.6±2.147*</td>
<td>37.1±3.674</td>
</tr>
<tr>
<td>Reduced Glutathione (mg/dl)</td>
<td>15.713±2.087*</td>
<td>30.161±0.493</td>
</tr>
<tr>
<td>TBARS (nmol/ml)</td>
<td>19.97±45.950*</td>
<td>5.405±7.603</td>
</tr>
<tr>
<td>SEPH (%)</td>
<td>7.951±1.599*</td>
<td>5.2±1.0</td>
</tr>
</tbody>
</table>

All values are mean with ± standard deviation  **P<0.05  * P<0.01
Graph No. 1
Kidney Function Test in Cervical Nodes

Graph No. 2 (A)
Serum Alkaline Phosphatase Levels in Cervical Nodes
Graph No. 2 (B)
Serum Proteins and Serum Albumin Levels in Cervical Nodes

Graph No. 3 (A)
Antioxidant Vitamin A Levels in Cervical Nodes
Graph No. 3 (B)
Serum Antioxidant Reduced Glutathione in Cervical Nodes

Graph No. 3 (C)
Oxidative Stress parameter- Serum TBARS Levels in Cervical Nodes
Graph No. 3 (D)
Oxidative Stress Parameter SEPH in Cervical Nodes

![Bar chart showing SEPH (%) in Cervical Nodes and Control categories.]

- **SEPH (%)**
  - **Cervical Nodes**: 7.9%
  - **Control**: 5.5%
Biochemical Parameters in Pyriform fossa Cancer:

Carcinoma of the pyriform fossa carries one of the worst prognoses of all head and neck cancers. A prospective trial was set up by Conlon BJ et al to study the efficacy of hyperfractionated radiotherapy as a primary treatment modality in the management of these patients. Seventeen patients entered the trial and were followed for up to 3 years. Results for local control, regional control and survival compare favourably with patients treated primarily with surgery with or without radiotherapy. Hyperfractionated radiotherapy offers a logical and standardized approach to the management of this tumour and reduces the significant morbidity associated with the use of surgery as a primary treatment (334).

Head and neck cancers make up 4% of all malignancies in the UK, with 90% being squamous cell carcinoma (SCC) (335). Of these, pyriform fossa SCC is common, particularly amongst smokers. Head and neck cancers represent a significant proportion of all malignancies; comparatively few occur in the nasal sinuses, and fewer still of these are metastatic in origin. This case describes the presentation and management of a sphenoid sinus metastasis from a primary squamous cell carcinoma of the pyriform fossa. Laryngeal carcinomas have been reported to metastasize most frequently to the lungs, ribs and thoracolumbar vertebrae (336,337).

Sinonasal tumours represent 1% of all cancers (338), and of these very few are metastatic. One study (339) found that renal primary tumours were most often responsible for secondary spread to the paranasal sinuses, and of these, the maxillary sinus is involved in 42%, the nasal cavity in 42% and the sphenoid sinus less frequently (340).
Results and Discussion

The results are shown in Table No. IV, V, VI and Graph No. 4,5 and 6.

**Table No. IV** shows the renal profile of patients with cancer of *pyriform fossa*. The blood urea mean levels were (22.6±2.789mg/dl) in test group and (20.6±3.411mg/dl) in the control group the value was *statistically highly significant*. Serum creatinine and the serum uric acid mean levels were (1.010±0.009mg/dl) and (6.440±0.565mg/dl) respectively of the test group. The control group mean levels were (0.770±0.009mg/dl) and (4.470±0.655mg/dl) respectively. Here the serum uric acid mean level was *highly significant*.

**Table No. V** shows the liver profile of patients with cancer of pyriform fossa. Serum alkaline phosphatase and serum glutamate oxaloacetate transaminase (SGOT) enzyme activities were estimated along with serum total proteins. The mean value estimated for serum alkaline phosphatase in the test group was (147.3±101.32 IU/L) against the control mean level being (106.8±21.22 IU/L). The SGOT enzyme activity also showed elevated mean levels with (10.75±0.450 IU/L) for test group and (8.95±0.257 IU/L) for the control group. The serum total proteins mean levels were (7.64±0.381 gm/dl) and (7.010±0.165 gm/dl) for the test and the control group respectively.

Antioxidant status and oxidative stress indicator levels were noted in **Table No. VI**. The parameters studied for the antioxidant status were vitamin A and reduced glutathione and Thiobarbituric Acid Reactive Substance (TBARS) or malondialdehyde (MDA) as *an oxidative stress indicator*. Vitamin A mean levels (35.6±6.147 µg/dl) in the patient group were towards decreased level as compared to the control mean level value being (37.1±3.674 µg/dl). The reduced glutathione mean levels were
(14.986±3.560 mg/dl) which showed high decreased value compared to the control being (30.161±0.493 mg/dl). These values were significant.

The TBARS mean level values were elevated (16.30±81.973nmol/ml) in test group against the mean level (5.405±7.603 nmol/ml) in the control group. \(^{(321,326)}\)
VARIous parameters in pyriform fossa cancer

Table no. IV
Kidney function tests in pyriform fossa

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
</tr>
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<tbody>
<tr>
<td>Blood urea (mg/dl)</td>
<td>22.6±2.789*</td>
<td>20.6±3.411</td>
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<tr>
<td>Serum creatinine (mg/dl)</td>
<td>1.010±0.009*</td>
<td>0.770±0.009</td>
</tr>
<tr>
<td>Serum uric acid (mg/dl)</td>
<td>6.440±0.565*</td>
<td>4.470±0.655</td>
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</table>

Table no. V
Liver function tests in pyriform fossa

<table>
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<tr>
<th>Parameter</th>
<th>Tests</th>
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<tr>
<td>Alkaline phosphatase (IU/L)</td>
<td>147.3±100.32*</td>
<td>106.8±21.22</td>
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<tr>
<td>SGOT (IU/L)</td>
<td>10.75±0.450*</td>
<td>8.95±0.257</td>
</tr>
<tr>
<td>Serum proteins (gm/dl)</td>
<td>7.64±0.381*</td>
<td>7.010±0.165</td>
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Table no. VI
Antioxidants and oxidative stress levels in pyriform fossa

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<th>Parameter</th>
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<th>Control</th>
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<td>Vitamin A (µg/dl)</td>
<td>35.6±6.147</td>
<td>37.1±3.674</td>
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<tr>
<td>Reduced Glutathione (mg/dl)</td>
<td>14.986±3.560*</td>
<td>30.161±0.493</td>
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<tr>
<td>TBARS (nmol/ml)</td>
<td>16.30±81.973 *</td>
<td>5.405±7.603</td>
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All values are mean with ± standard deviation  **P<0.05   * P<0.01
CHAPTER IV - ORAL AND ORAL RELATED CANCER

Graph No. 4

Kidney Function Test in Pyriform fossa

Graph No. 5 (A)

Serum Alkaline Phosphatase Levels in Pyriform Fossa
Graph No. 5 (B)
SGOT Levels in Pyriform fossa

Graph No. 5 (C)
Serum Protein Levels in Pyriform fossa
Graph No. 6 (A)
Antioxidant Serum Vitamin A Levels in Pyriform fossa

Graph No. 6 (B)
Antioxidant Serum Reduced Glutathione Levels in Pyriform fossa
Graph No. 6 (C)

Oxidative Stress Parameter Serum TBARS Levels in Pyriform fossa

<table>
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<th>Parameters</th>
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<tr>
<td>Pyriform fossa</td>
<td>16.3</td>
</tr>
<tr>
<td>Control</td>
<td>5.4</td>
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Biochemical Parameters in Cancer of Maxilla:

Anatomy:

The maxilla is a fusion of two bones along the palatal fissure that form the upper jaw. This is similar to the mandible (lower jaw), which is also a fusion of two halves at the mandibular symphysis. Sometimes (e.g. in bony fish), the maxilla is called "upper maxilla," with the mandible being the “lower maxilla”.

Epidemiology:

Oral cancer is an increasingly prevalent disease in the United States that accounts for the demise and deformity of many patients. Most oral cancer are epithelial squamous cell carcinomas (OSCCA) because most of the risk factors injure the most superficial layers of the mucous and gingiva. These areas experience a constant turnover and prolonged exposure to risk factors, including tobacco, alcohol, viruses, drugs and betelnut (alone or in combination), which cause genetic mutations that
ultimately result in an increase in incidence and prevalence of the disease (341).

OSCCA accounts for 3% of all malignancies in men and 2 % in women (342). More than 90% of oral cancer occurs in patients over the age of 45 years. The incidence increases steadily, with the age until 65 and then levels off. A common presenting symptom in oral cancer is the presence of a painful lesion in the mouth. Other common symptoms are bleeding, nonhealing also and presence of a mass in the oral cavity. Late-stage symptoms include cranial nerve deficits, loose teeth, ill fitting dentures, weight loss and hoarseness.(343)

Metastatic Evaluation:

Oral cancer is generally considered a regional diseased, however, the possibility of symptomic metastasis should not be overlooked (343). The most common sites of distant metastasis include the lungs (66%), bone (22%) and the liver (9.5%) (344). Advanced disease stage and lymphatic or vascular invasion by the primary tumour are associated with an increased rate of distant mestasis (344,345).

Adequate evaluation and staging are paramount in providing patients with the best chance of cure and survival. During diagnosis and treatment, it is recommended that a multidisciplinary team discusses each particular case to integrate the opinion and expertise of each specialty involve. These opinions help to find the best possible solution regarding a patients needs given what is available at the time. Modern medical technology gives us valuable means for this purpose and will continue to evolve and provide even more possibilities to help our patients. It is important to continue stress prevention, screening and adequate diagnosis and treatment modalities for cancer.

These biomarkers have good sensitivity, specificity and efficiency values for oral cancer.
Findings of the study suggest that the evaluation of these markers would be useful in assessing early malignant change, increasing accuracy of clinical diagnosis and also in assessing the spread and invasiveness of the cancer of the oral cavity.

Not a single marker but rather, a combination of different markers will be more effective in cancer diagnostic and prognostic.
Results and Discussion

The next cancer studied in the oral and oral related cancer was the maxilla. The kidney function tests, liver function tests, the antioxidants status and the oxidative stress indicators were evaluated in these clinically confirmed cases of cancer of maxilla. The results are shown in Table No. VII, VIII, IX and Graph No. 7, 8 and 9.

Table No. VII shows the mean values of the kidney function tests. Blood urea mean level was (28.30±0.842 mg/dl) increased against the control mean value (26.20±1.702 mg/dl). The serum creatinine mean level (0.885±0.005 mg/dl) was increased in the test group as compared to the control mean level (0.725±0.002 mg/dl). The serum uric acid mean level was not affected (4.165±0.040 mg/dl) in test.

The serum alkaline phosphatase and serum total protein levels are shown in Table No. VIII. Serum alkaline phosphatase in the test group were highly elevated, being (306.2±529.339 IU/L) as compared to the control group (187.2±8.719 IU/L). The elevated values of serum alkaline phosphatase indicate the involvement of bone because of the diseased condition. The serum protein mean values were towards upper level (7.545±0.114 gm/dl) against the control values (6.655±0.174 gm/dl).

The antioxidant status and oxidative stress indicator levels in patients with cancer of maxilla are shown in Table No. IX. The vitamin A parameter showed relatively low mean level values (13.70±3.591 µg/dl) as compared to the control mean level (35.350±3.620 µg/dl); the reduced glutathione also showed lowered values compared to the mean control. The values were (14.904±0.291mg/dl) and (28.711±0.441 mg/dl) of test and control group respectively.

The oxidative stress indicator -TBARS values were highly elevated (10.355±35.482 nmol/ml) against (5.305±7.347 nmol/ml) control mean value. The second oxidative stress indicator studied, SEPH mean value for test group was (5.9±1.396 %) against the control group (5.2±1.0 %).
## VARIOUS PARAMETERS IN CANCER OF MAXILLA

### TABLE NO VII
**Kidney Function Tests in Maxilla**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
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<tbody>
<tr>
<td>Blood urea (mg/dl)</td>
<td>28.30±0.842*</td>
<td>26.20±1.702</td>
</tr>
<tr>
<td>Serum creatinine (mg/dl)</td>
<td>0.885±0.005*</td>
<td>0.725±0.002</td>
</tr>
<tr>
<td>Serum uric acid (mg/dl)</td>
<td>4.165±0.040</td>
<td>4.180±0.588</td>
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### TABLE NO VIII
**Liver Function Tests in Maxilla**

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<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
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<tbody>
<tr>
<td>Alkaline phosphatase (IU/dl)</td>
<td>306.2±529.339*</td>
<td>187.2±8.719</td>
</tr>
<tr>
<td>Serum proteins (gm/dl)</td>
<td>7.545±0.114*</td>
<td>6.655±0.174</td>
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### TABLE NO IX
**Antioxidants and oxidative stress levels in Maxilla**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
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<tr>
<td>Vitamin A (µg/dl)</td>
<td>13.70±3.591*</td>
<td>35.350±3.620</td>
</tr>
<tr>
<td>Reduced Glutathione (mg/dl)</td>
<td>14.904±0.291*</td>
<td>28.711±0.441</td>
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<tr>
<td>TBARS (nmol/ml)</td>
<td>10.355±35.482*</td>
<td>5.305±7.347</td>
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<tr>
<td>SEPH (%)</td>
<td>5.9±1.396</td>
<td>5.2±1.0</td>
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All values are mean with ± standard deviation  **P<0.05  * P<0.01
Graph No. 7
Kidney Function Test in *Maxilla*

![Kidney Function Test Graph]

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Maxilla</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Urea (mg/dl)</td>
<td>28.3</td>
<td>0.88</td>
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<tr>
<td>Serum Creatinine (mg/dl)</td>
<td>26.2</td>
<td>0.72</td>
</tr>
<tr>
<td>Serum Uric Acid (mg/dl)</td>
<td>4.16</td>
<td>4.18</td>
</tr>
</tbody>
</table>

Graph No. 8 (A)
Serum Alkaline Phosphatase Levels in Maxilla

![Serum Alkaline Phosphatase Graph]

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Maxilla</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaline Phosphatase (IU/L)</td>
<td>306.2</td>
<td>187.2</td>
</tr>
</tbody>
</table>
Graph No. 8 (B)
Serum Protein Levels in Maxilla

Graph No. 9 (A)
Antioxidant Serum Vitamin A Levels in Maxilla
Graph No. 9 (B)
Antioxidant Serum Reduced Glutathione Levels in Maxilla

Graph No. 9 (C)
Oxidative Stress Indicator Serum TBARS Levels in Maxilla
Graph No. 9 (D)
Oxidative Stress Indicator SEPH Levels in Cancer of Maxilla.

![Graph showing SEPH levels in Maxilla and Control samples.](image-url)
PART -IVD : PAROTID TUMOURS

Biochemical Parameters in Parotid Tumours:

Anatomy:

Figure 4 (D) 1: Parotid Gland

The paired parotid glands are the largest of the salivary glands. They are each found wrapped around the mandibular ramus, and secrete saliva through Stensen's ducts into the oral cavity, to facilitate mastication and swallowing and to begin the digestion of starches.

Oral cancer arises through a series of histopathologic stages from benign hyperplasia to dysplasia to carcinoma in situ followed by invasive squamous cell carcinoma. The malignancy is usually preceded by premalignant lesions like leukoplakia, erythroplakia and oral submucous fibrosis with a transformation rate raging from 0 to 20% in 1-30 years, according to the type of lesion. In India, oral leukoplakia is considered to be potentially malignant.
Globally, the 5 year mortality rate of oral cancer is about 50% and has not changed significantly in recent years despite of the advances in surgery, radiotherapy and chemotherapy. This is attributed mainly to late diagnosis, poor response of tumour to chemotherapy and radiotherapy as well as insufficient biomarkers for early diagnosis and post therapeutic monitoring.\(^{347, 348}\) The main reason for late stage presentation of the disease is the ignorance of lesions either by patients or clinicians. This is also accounted due to lack of awareness of malignant potential of small lesions of oral cancer. Health education programs aimed at motivating patients for early diagnosis have also been largely unsuccessful because of incomplete understanding of the disease \(^{349}\). Further, detection of an oral cancer at stage I carries a prognosis of 80% survival, while the same lesion at stage III carries a 20% survival. This difference could affect not only the quality of life for the patients but also the cost of the medical treatments of a stage I versus stage III oral cancer patients. In addition, early detection of cancer would also lead to fewer side effects from cancer treatments such as chemotherapy and radiotherapy and to a better prognosis. Moreover, oral cancer has a very high recurrence rate. Patients who survive a first encounter with this disease have up to a 20 fold increased risk of
developing a second cancer \(^{(350,351)}\) Thus, early identification of recurrence or a second primary tumour remains important challenge. Therefore, implementation of an early detection scheme would have a positive impact on prognosis of the disease.
Results and Discussion

The results are represented in Table No. X, XI and Graph No. 10 and 11. Parotid tumours patients showed the kidney function tests within normal limits. Serum alkaline phosphatase and serum protein parameters were studied under the liver function tests. Table No. X shows the results of serum alkaline phosphatase and serum total proteins in the parotid tumour patients. The mean values of both the parameters were significantly higher as compared to the control. Serum alkaline phosphatase mean values were (244.5±21.246 IU/L) and (180.95±1.041 IU/L) in test group and control group respectively. The results suggested involvement of bone with the progression of the disease because of the advanced stage. The serum total proteins were elevated: mean value being (7.275±0.034 gm/dl) as compared to control mean value of (6.655±0.174 gm/dl). (341)

Table No. XI shows the results of antioxidants and oxidative stress status in the parotid tumour patients. The mean values of vitamin A and reduced glutathione were decreased significantly. The mean levels in test group for vitamin A were (27.050±3.152 µg/dl) and (35.350±3.620 µg/dl) in control group. Mean values for the reduced glutathione were (14.290±0.246 mg/dl) and (28.711±0.441 mg/dl) in test and control groups respectively. The Oxidative stress parameter, TBARS showed elevated mean values (9.655±29.198 nmol/ml) in test group against control mean value (5.305±7.347 nmol/ml). The results suggested that the carcinogenesis has increased free radicals which affected the antioxidant defense system. (326)

The overall results of the study of biochemical parameters in partid tumour indicated that serum alkaline phosphatase and antioxidant status were affected.
VARIOUS PARAMETERS IN PAROTID TUMOUR

**TABLE X**
Liver Function Tests in Parotid Tumour

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaline phosphatase (IU/L)</td>
<td>244.5±21.246</td>
<td>180.95±1.041</td>
</tr>
<tr>
<td>Serum proteins (gm/dl)</td>
<td>7.275±0.034</td>
<td>6.655±0.174</td>
</tr>
</tbody>
</table>

**TABLE XI**
Serum Antioxidants and Oxidative Stress Levels in Parotid Tumour

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A (µg/dl)</td>
<td>27.050±3.152</td>
<td>35.350±3.620</td>
</tr>
<tr>
<td>Reduced Glutathione (mg/dl)</td>
<td>14.290±0.246</td>
<td>28.711±0.441</td>
</tr>
<tr>
<td>TBARS (nmol/ml)</td>
<td>9.655±29.198</td>
<td>5.305±7.347</td>
</tr>
</tbody>
</table>

All values are mean with ± standard deviation  **P<0.05    * P<0.01
Graph No. 10 (A)
Serum Alkaline Phosphatase Levels in Parotid Tumour

Graph No. 10 (B)
Serum Protein Levels in Parotid Tumour
**Graph No. 11 (A)**

Serum Vitamin A Levels in Parotid Tumour

![Graph showing Vitamin A levels](image)

**Graph No. 11 (B)**

Serum Reduced Glutathione Levels in Parotid Tumour

![Graph showing Glutathione levels](image)
Graph No. 11 (C)

Oxidative Stress parameter Serum TBARS Levels in Parotid Tumour

![Graph showing TBARS levels in Parotid Tumour and Control]

- Parotid Tumour: 9.655 nmol/ml
- Control: 5.305 nmol/ml
PART -IV (E) : CANCER OF LARYNX

Biochemical Parameters in Cancer of Larynx:

Anatomy of the larynx:

The larynx is located in the anterior part of the neck, anterior to the bodies of the fourth to sixth cervical vertebrae and the laryngopharynx. On each side of the larynx are the carotid sheath and a lobe of the thyroid gland. The latter are joined anteriorly by the thyroid isthmus that overlies the second to fourth tracheal rings. Further anteriorly lies the superficial and deep fascia and platysma muscle.

The larynx is made up of 9 cartilages forming the laryngeal skeleton, these are joined by various ligaments and membranes (Figs 1). It has three unpaired cartilages (thyroid, cricoid, epiglottis) and three paired cartilages (arytenoid, corniculate, cuneiform).

Figure : 4(E) 1: Larynx
**Functions:**

The larynx acts as a protective sphincter of the respiratory tract, separating the trachea from the upper gastrointestinal tract, preventing aspiration during swallowing. It contains the vocal apparatus, and so is important in communication, but it is also required for an effective cough and to perform a valsalva manoeuvre.

Dwivedi R C *et al* (352) aimed to assess the role of oxidative stress in the laryngeal cancer patients in Indian population. Level of malondialdehyde (MDA) as a marker of oxidative stress was examined in large cohort of control [50] and laryngeal carcinoma patients (155) from North India. Both the controls and laryngeal carcinoma patients were smokers. The study results showed that in control healthy subjects MDA levels were $0.102\pm0.07$ (0.080-0.303, 95% CI) n mol/ml, as compared to $0.329\pm0.16$ (0.124-0.354, 95% CI) nmol/ml in the cases of laryngeal carcinoma patients. Three times higher serum MDA levels indicated that there was significant oxidative stress in the subjects having laryngeal carcinoma lesions. Their findings suggested that in case of laryngeal carcinoma patients, there is increase in the level of oxidative enzyme MDA. The oxidative stress might be due to the modulation of pro-oxidant or anti-oxidant systems in laryngeal carcinoma.
Results and Discussion

The results are summarized in Table No. XII, XIII, XIV and Graph No. 12,13 and 14.

Table No. XII shows the kidney function test parameters in the patients with cancer of larynx. The blood urea mean levels were (20.66±2.094 mg/dl) and 19.60±3.579 mg/dl) in test and control groups respectively. The serum creatinine and serum uric acid mean levels were in the normal limits suggesting that the metastases towards kidney did not take place.

Table No. XIII shows the results of liver function tests in the patients with cancer of larynx. The serum alkaline phosphatase mean value was (187.0±115.585 IU/L) in test group and (172.8±10.988 IU/L) in the control group, indicating an increase (p<0.01). The serum protein mean value in test group were increased than the control group (p<0.05). The mean values of this parameter was (6.95±0.004 gm/dl) and (6.655±0.174 gm/dl) in the test and control group respectively.

Table No XIV. shows the values for oxidative stress parameters, TBARS and Sensitivity of Erythrocytes to Lipid Peroxide Heamolysis (SEPH). There was a significant increase in levels of TBARS in test group (16.3±35.48 nmol/ml) against control mean level (5.305±7.347 nmol/ml) The second parameter for oxidative stress, SEPH also showed a significant increase in the mean value for test group (20.325±15.699%) against the control group mean value (5.2±1.0%). These findings co-relate with the study of Dwivedi R C et al\textsuperscript{(352)}. 

\textsuperscript{(352)}
## VARIOUS PARAMETERS IN CANCER OF LARYNX

### TABLE NO XII

Kidney Function Tests in cancer of Larynx

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood urea (mg/dl)</td>
<td>20.65±2.094</td>
<td>19.60±3.579</td>
</tr>
<tr>
<td>Serum uric acid (mg/dl)</td>
<td>5.28±2.4</td>
<td>4.18±0.58</td>
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### TABLE NO XIII

Liver Function Tests in cancer of Larynx

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaline phosphatase (IU/L)</td>
<td>187.0±115.585*</td>
<td>172.8±10.988</td>
</tr>
<tr>
<td>Serum proteins (gm/dl)</td>
<td>6.95±0.004**</td>
<td>6.655±0.174</td>
</tr>
</tbody>
</table>

### TABLE NO XIV

Oxidative Stress Indicator SEPH Levels in Cancer of larynx

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBARS (nmol/ml)</td>
<td>16.3±35.48*</td>
<td>5.305±7.347</td>
</tr>
<tr>
<td>SEPH (%)</td>
<td>20.325 ± 15.699 *</td>
<td>5.2±1.0</td>
</tr>
</tbody>
</table>

All values are mean with ± standard deviation  **P<0.05   * P<0.01
Graph No. 12
Kidney Function Test in Cancer of Larynx

![Kidney Function Graph]

Graph No. 13 (A)
Serum Alkaline Phosphatase Test in Cancer of Larynx

![Serum Alkaline Phosphatase Graph]
Graph No. 13 (B)
Serum Protein Levels in Cancer of Larynx

Graph No. 14 (A)
Serum TBARS Levels in Cancer of Larynx
Graph No. 14 (B)

Oxidative Stress Parameter SEPH in Cancer of Larynx

![Bar graph showing SEPH (%) for Larynx and Control groups. SEPH for Larynx is 20.32, and for Control is 5.2.]
PART- IV (F) : CANCER OF OESOPHAGUS

Biochemical Parameters in Cancer of Oesophagus :

Morphology :

The normal oesophagus is a hollow highly distensible muscular tube that extends from the pharynx to the gastroesophageal junction at the level of the T11 or T12 vertebra. Measuring between 10 and 11cms in the newborn. It grows to a length of about 23 to 25 cms in the adult. Several points of luminal narrowing can be indentified along its course - proximally at the cricoids cartilage, midway in its course alongside the aortic arch and at the anterior crossing of the left main branches and left atrium, and distally where it pierces the diaphragm. A 3cm segment in the proximal oesophagus at the level of the cricopharyngeus muscle is referred to as the upper oesophageal sphincter. The 2 to 4 cms. segment just proximal to the anatomic oesophagogastric junction, at the level of the diaphragm is referred to as the lower oesophageal sphincter (LES). The wall of the oesophagus consists of a mucosa, submucosa, muscularis propia and adventitia, reflecting the general structural organization of the gastrointestinal tract.

The functions of the oesophagus are to conduct food and fluids from the pharynx to the stomach and to prevent reflux of gastric contents into the oesophagus.
Benign Tumour: Benign tumour of the oesophagus are mostly mesenchymal in origin and within the oesophageal wall. Most common are benign tumours of smooth muscle origin traditionally called leiomyomas and considered the benign end of a spectrum of gastrointestinal stromal tumours.

Malignant Tumours: In the United States, carcinomas of the oesophagus represent about 6% of all cancers of the gastrointestinal tract but cause a disproportionate number of cancer deaths. They remain asymptomatic during much of their development and are often discovered too late to permit cure. With rare exception malignant oesophageal tumours
arise from the epithelial layer. Worldwide squamous cell cancers constitute 90% of the oesophageal cancers, but in the United States, squamous cell carcinoma and adenocarcinoma exhibit comparable incidence rates.

**Squamous Cell Carcinoma:**

Most squamous cell carcinomas occur in adults over age 50. The male to female ratio falls in the range of 2:1 to as high as 20:1. While squamous cell carcinoma of the oesophagus occurs throughout the world, its incidence varies widely among countries and within regions of the same country. Blacks throughout the world are at higher risk than are whites reaching a four-fold incidence in the United States.

**Etiology and Pathogenesis:**

The marked differences in epidemiology strongly implicate dietary and environmental factors as shown in following table with an ill-defined contribution from genetic predisposition. The majority of cancers in Europe and the United States are attributable to alcohol and tobacco usage. Some alcoholic drinks contain significant amounts of such carcinogens as polycyclic hydrocarbons, fusal oils and nitrosamines along with other mutagenic compounds. Nutritional deficiencies associated with alcoholism may contribute to the process of carcinogenesis. It is estimated that 1750 new cases of oesophageal cancer will be diagnosed in Canada in 2011.

**Table : Factors associated with the Development of Squamous cell carcinoma of the oesophagus**

- **Dietary**
  - Deficiency of Vitamins (A,C, riboflavin, thiamine, pyridoxine)
  - Deficiency of trace metals (zinc, molybdenum)
  - Fungal contamination of food stuffs.
  - High content of nitrates/nitrosamines.
  - Betel Chewing
- **Lifestyle**
  - Alcohol consumption
  - Tobacco Use
  - Urban environment

- **Oesophageal Disorders**
  - Long Standing Oesophagitic
  - Achalasia
  - Plummer – vision Syndrome

- **Genetic Predisposition**
  - Long standing ciliac disease
  - Ectodermal dysplasia, epidermolysis bullosa
  - Tylosis/nalmaries at plantaries
  - Rocual disportion

Human Papilloma Virus DNA is found frequently in oesophageal squamous cell carcinomas from high incidence regions. Its presence is infrequent, however, in cancer-bearing patients of North America. Based on the aforementioned considerations, dietary and environmental factor have been proposed to increase risks with nutritional deficiencies acting as promoters or protentiators of the tumorigenic effects of environmental carcinogens. For eg. methylating nitroso compounds in the diet and in tobacco smoke may be the reason for the broad spectrum of $p^{53}$ point mutations, which are present in more than half of oesophageal cancer.

**Clinical Features:**

Oesophageal carcinoma is insidious in onset and produces dysphasia and obstruction gradually and late. Patients subconsciously adjust to their increasing difficulty in swallowing by progressively altering their diet from solid to liquid foods. Extreme weight loss and debilitation result from both the impaired nutrition and the effects of the tumour itself. Hemorrhage and sepsis may accompany ulceration of the tumours. Occasionally the first
The alarming symptom is aspiration food via a cancerous tracheoesophageal fistula.

Five year survival rates of patients with superficial oesophageal carcinoma are about 75% compared with 25% in patients undergoing curative surgery for more advanced disease and 5% for all patients with oesophageal carcinoma. Local and distant recurrence after surgery is common. The presence of lymph node metastases at the time of resection significantly reduces the 5-year survived.

**Adenocarcinoma:**

Because of confusion with gastric cancer arising at gastro-esophageal junction, true oesophageal adenocarcinomas were thought to be unusual. With increasing recognition of Burrett mucosa, it is apparent that most adenocarcinoma in the lower third of the oesophagus is the true oesophageal cancers, rather than gastric cancers, straddling the oesophagogastric junction. Accordingly, adenocarcinoma now represents up to half of all ospeophagal cancers reported in the United States.

**Etiology and Pathogenesis:**

Although the pathogenesis of Barrett oesophagus is unclear, genetic alterations in this disease are well documented. Over expression of p53 protein and increased proportion of cells with a G1/S DNA content are occasionally observed in metaplastic Barrett epithelium, presumably the result of chronic cell and DNA damage induced by gastric reflux. Allelic losses in 17p or point mutations in p53 are evident only in dysplastic foci, resulting in functional inactivation of the p53 gene and abrogation of cell cycle control at the G1/S transition. Clonal progression of dysplastic foci to frank adenocarcinoma then occurs, with accumulation of further chromosomal abnormalities.

Oesophageal carcinoma has a poor prognosis because of rapid spread and growth. Because most patients have advanced disease at the
time of diagnosis\(^{(353)}\), the recurrence rate after surgery is extremely high. Suitable early biomarkers for esophageal carcinoma are therefore urgently required. Such tumour markers might facilitate an early diagnosis of cancer, provide data for adequate staging relative to tumour burden and a method for evaluating the effects of therapy, and facilitate diagnoses of metastases or local recurrences. Squamous cell carcinoma (SCC) antigen (CEA) have been used as markers for esophageal carcinoma; however, their sensitivity has not been satisfactory.\(^{(354,355)}\)

\*\*\*\*\*\*

\*\*\*\*\*\*
Results and Discussion

The results are represented in Table No. XV, XVI, XVII and Graph No. 15,16 and 17.

**Table No XV** shows the renal profile results of the patients clinically confirmed for cancer of oesophagus. The blood urea mean value was within normal limits (17.8±5.891 mg/dl) and (21.0±2.55 mg/dl) of the test and control group respectively. The serum creatinine mean value was increased (1.0±0.1 mg/dl) in test compared to (0.82±0.045 mg/dl) in the control group (p<001). The serum uric acid level mean value in test group was (4.76±0.709 mg/dl) and (4.54±0.963 mg/dl) in control group.

**Table No. XVI** shows the liver profile results in the patients with cancer of oesophagus. The serum ALP and total serum proteins mean values were significantly higher (344,345). The mean values were (168.6±47.92 IU/L) and (106.6±2.302 IU/L) for serum alkaline phophatase and (7.76±0.594 gm/dl) and (6.84±0.55 gm/dl) for serum total proteins in test and control groups respectively. The mean value for serum albumin was (3.08±0.455 gm/dl) in test and (3.16±0.089 gm/dl) in control.

**Table No. XVII** shows the antioxidant status in the cancer patients of oesophagus. The vitamin A and reduced glutathione showed comparatively low mean values (25.0±5.568 mg/dl) and (24.6±0.894 mg/dl) for vitamin A whereas (16.748±1.743 mg/dl) and (28.400±1.14 mg/dl) for the reduced glutathione parameter in test and control group respectively. The oxidative stress parameter -TBARS was significantly elevated as compared to the control groups. The mean value for test group was (17.56±0.981 nmol/ml) against (4.81±2.678 nmol/ml) for the control group (321-325).

The second parameter for oxidative stress, Sensitivity of Erythrocytes to Lipid Peroxide Haemolysis (SEPH) level was significantly increased as compared to the control levels. The mean value for test group was (11.221±3.625%) and (5.2±1.0%) for control group.
VARIOUS PARAMETERS IN CANCER OF OESOPHAGUS

**TABLE NO XV**

Kidney Function Tests in Cancer of Oesophagus

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood urea (mg/dl)</td>
<td>17.8±5.891</td>
<td>21.0±2.55</td>
</tr>
<tr>
<td>Serum creatinine (mg/dl)</td>
<td>1.0±0.1*</td>
<td>0.82±0.045</td>
</tr>
<tr>
<td>Serum uric acid (mg/dl)</td>
<td>4.76±0.709</td>
<td>4.54±0.963</td>
</tr>
</tbody>
</table>

**TABLE NO XVI**

Liver Function Tests in Cancer of Oesophagus

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaline phosphatase (IU/L)</td>
<td>168.6±47.92*</td>
<td>106.6±2.302</td>
</tr>
<tr>
<td>Serum proteins (gm/dl)</td>
<td>7.76±0.594*</td>
<td>6.84±0.55</td>
</tr>
<tr>
<td>Serum albumin (gm/dl)</td>
<td>3.08±0.455</td>
<td>3.16±0.089</td>
</tr>
</tbody>
</table>

**TABLE NO XVII**

Antioxidants and Oxidative Stress Levels in Cancer of Oesophagus

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tests</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A (µg/dl)</td>
<td>25.0±5.568</td>
<td>24.6±0.894</td>
</tr>
<tr>
<td>Reduced Glutathione (mg/dl)</td>
<td>16.748±1.743**</td>
<td>28.400±1.14</td>
</tr>
<tr>
<td>TBARS (nmol/ml)</td>
<td>17.56±0.981*</td>
<td>4.81±2.678</td>
</tr>
<tr>
<td>SEPH (%)</td>
<td>11.221±3.625*</td>
<td>5.2±1.0</td>
</tr>
</tbody>
</table>

All values are mean with ± standard deviation  **p<0.05   *p<0.01
Graph No. 15
Kidney Function Test in Cancer of Oesophagus

Graph No. 16 (A)
Serum Alkaline Phosphatase Levels in Cancer of Oesophagus
Graph No. 16 (B)
Serum Protein Levels in Cancer of Oesophagus

Graph No. 16 (C)
Serum Albumin Levels in Cancer of Oesophagus
Graph No. 17 (A)
Serum Vitamin A Levels in Cancer of Oesophagus

Graph No. 17 (B)
Serum Reduced Glutathione Levels in Cancer of Oesophagus
Graph No. 17 (C)
Serum TBARS Levels in Cancer of Oesophagus

Graph No. 17 (D)
Percent Sensitivity of Erythrocytes to Lipid Peroxide Hemolysis (SEPH) in Cancer of Oesophagus