A REVIEW ON EARLY DETECTION AND DIAGNOSTIC ADVANCEMENT IN ORAL CANCER

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ABSTRACT

Clinical studies reveal that in India among the cancer patients majority of them are diagnosed and having oral cancer. Practitioners in their study suggest that patients should come forward to diagnose the cancer and start treatment in early stage to avoid complication. The present review aimed to describe the essentials of early diagnosis, pathophysiology, and various conventional and advanced diagnostic techniques available. Past literatures published in journals was reviewed with a focus on oral cancer diagnosis and also critically examined the different tests. Moreover, this paper assessed the value of each test in spotting oral squamous cell carcinoma and also its precursor lesions. It is evident that despite consequent innovation in diagnostic techniques, the burden of oral cancer remains constant. From this study it was found that frequent conduct of awareness programmes about oral cancer and providing low cost screening of oral cancer will help the people to cure cancer.

INTRODUCTION

Among the various types of cancer oral cancer finds sixth place in the world (Shpitzer , Subramanian) India ranks third place. Predominantly oral cancer in localized to the tongue, however it also occur lip, palate, gingiva and floor of the mouth (Shpitzer 2007) OSCC (Oral Squamous cell carcinoma) Occurs in all the oral cancer cases and it causes malignant disorders, it can be detachable in the pre-clinical phase of oral cancer(Borse 2020) some of the risk factors in the oral cancer associated with the occurrence of chewing betel-quid, more consumption of alcohol , consumption of Tobacco, intake of insufficient diet and frequent viral infection[HPV]. In India around 77000new cases and 52000 deaths are reported per year (Subramanian 2009).

Through the timely treatment of oral cancer, mortality and morbidity with associated severe loss of function, disfigurement, depression and poor quality of life can be minimized to a greater extent (Borse 2020). In order to achieve this early diagnosis of oral cancer becomes obligatory. Various conventional clinical techniques such as histopathological/physical examination, staining, biopsy and spectroscopic/radiological techniques are being used regularly to detect oral cancer. The present review aimed to describe the essentials of early diagnosis, pathophysiology, and various conventional and advanced diagnostic techniques available.

METHODS

Past published literatures have been reviewed using Google scholar and PubMed, focusing on the diagnosis of oral cancer. This search includes trials, meta-analyses, reviews, government publications, guidelines, and journal articles published with the keywords‘ oral cancer’ in the title and ‘screening’ or ‘diagnosis’ in the title or abstract. Also, we reviewed studies pertaining to epidemiology, aetiopathogenesis, pre-malignancy, novel diagnostic techniques, and screening.

DISCUSSION

Need of oral cancer screening and early diagnosis

It is inevitable to detect oral cancer in the initial stage to enhance the life span of a patient. If oral cancer is diagnosed in advanced stage then the treatment will not cure the disease instead it will lead to death of patients. Subramanian (2009) conducted a cost-effective screening of oral cancer study in India over a period of eight years in which he has collected data from 1.92 lakhs people. From this study he has found that “there was a significant reduction in mortality in the intervention arm (29.9 cases per 100,000) versus the control arm (45.4 cases per 100,000), due to detection of oral cancer at an early stage”. The main aim of oral cancer screening is early detection and awareness of local oral health that subsequently results in the discovery of other oral mucosal diseases, early treatment of oral cancer, maintenance, and improvement of quality of life. Both countermeasure screening and opportunistic screening for oral cancer have a greater impact on the early diagnosis of oral cancer. This was proved in a previous study where the oral cancer detection rates of countermeasure and opportunistic screening systems were equivalent (Borse 2020). Furthermore, general physicians play a vital role in choosing correct decisions about lesions and are thus significant in avoiding unnecessary or delayed referrals.

Oral cancer and risk factors

It includes cigarettes smoking tobacco chewing and alcohol drinking are the high risk factors both men and women. Some other factors are

- Exposure to sun light
- Human papillomavirus (HPV) infection
- Nutrition deficiency
- Genetic factor

Men are likely to get more than the women (Subramanian, Coelho)] many studies concluded that nonsmoker’s alcohol is the only risk factor (Kruse, Böcking) over all, the life time risk of developing cancer is about 1 in 60 (1.7%) for men and 1 in 140 (0.71%) for women (Kruse 2010) more over the nonsmokers remains, unclear and this possess a need for intensive screening the population irrespective of the presence of risk factors.

Pathophysiology of oral cancer

Accurate diagnosis is dependent on various factors in the pathological domain, like types of slides used and features scrutinized (Shpitzer 2007). Though lesions of squamous cell carcinomas being the most common, this may be divided into different entities based on-site, etiology, and prognosis**.** Speight (2018) states that “The defining criterion for a diagnosis of carcinoma is an invasion of epithelial cells through the basement membrane into the superficial connective tissues”. According to Speight (2018) “the invasion starts as a little breach by a few cells or small epithelial islands and progresses to gross infiltration of the underlying sub mucosa or bone by sheets and islands of malignant cells. This process of invasion gives rise to the two most classical clinical signs of cancer – the lesion is hard (induration) and is fixed to the underlying tissues (fixation)” (Speight 2018). Variants of squamous cell carcinoma that may be encountered within the oral cavity are verrucous carcinoma, basaloid squamous cell carcinoma, spindle cell carcinoma, adenosquamous carcinoma, and papillary squamous cell carcinoma. Whenever a pathologist examines a carcinoma, grading of the lesion is done, which is directly associated with the prognosis of cancer and also helps the physician to sketch appropriate management.

Pre-malignant lesion

Remmerbach (2009) reveal that In human being "oral carcinogenesis proceeds through a stepwise accumulation of (cyto) genetic changes over time". Significant advances have been made both in relation to the screening and evaluation of precursor lesions. As patients tolerate the noninvasive procedures, more lesions may be screened, and thus more oral cancers may be found in early, curable stages. In contrast to the oral premalignant conditions, oral premalignant lesions are morphologically abnormal solitary or multiple areas of mucosa that are typically white, red, speckled, or verrucous in appearance(Bocking,2010). Despite easy access to the oral cavity for cancer screening, the main limitations to successful treatment are uncertain prognostic criteria for (pre-) malignant lesions (Remmerbach, 2009).

Various Diagnostic Techniques

1. Salivary analysis Techniques

This analysis is evaluated through comprehensive salivary analysis to find out the immunological and biochemical parameters (Shiptzer 2007). Salivary testing, noninvasive alternative modality for diagnosis of oral cancer. (Nagler etal 2006) so the salivary biomarkers are more practical to be used because parts of oral cancer cells are immersed in salivary milieu and saliva specimens, so biomarkers may be used for OSCC diagnosis.

2. Brush Biopsy Techniques

In this technique to collect the cytology sample a tiny nylon brush will be used. The samples will be scanned and analyzed by computer software to find out the individual cells are cancerous or not (Velleuer 2020) microscopic images to be used to assess the presence and target antigen in the tissues. The presence and the status of the disease may be studied only through the highly – resolution microscope (Bocking 2010).

3. Scalpel Biopsy Techniques

Scalpel biopsy is where a small piece of tissues is taken for histopathological evaluation by surgical means (Morikawa 2021) this is one of the best method for diagnosis of oral cancer.

4. Diagnosis by Mechanical Phenotyping

Detecting a functional cellular marker represents a significant development for the diagnosis and treatment of oral cancer. Toward this aim, mechanical phenotyping of individual cells is a novel approach to detect cytoskeletal changes, which are diagnostic for malignant change. In a study, the compliance of cells from cell lines and primary samples of healthy donors and cancer patients was measured using a microfluidic optical stretcher. These diagnosis results of the patient samples were confirmed by standard histopathology and cancer cells were on average 3.5 times more compliant than those of healthy donors (Remmerbach 2009).

5. Tumor-derived Exosomal (TEX) biomarkers Technique

TEX is usually obtained from a liquid biopsy. Apart from biopsy and mucosal scraping examinations, exosomes from saliva and blood are emerging as an accessible source for diagnosis and providing additional information about the tumor's characteristics (Sahu 2021). This gives rise to the study of tumor-derived exosomal (TEX) biomarkers as a promising diagnostic tool. In addition, TEX biomarkers can also forecast resistance to recurrence, chemotherapeutic agents, and metastasis.

6. Light-based oral cancer screening aids Technique

Light-based oral cancers screening aids used to visualize lesions and are considered to be utilized as adjuncts to the conventional oral cavity examination. Vizilite Plus with TBlue system and VELscope use visible light in the 430 nm wavelength in order to cause fluorescent excitation of certain compounds in the tissues(Mehrotra 2011). In Microlux/DL and Orascoptic DK screening, the oral cavity first rinse with acetic acid and then examined with a battery-powered fiberoptic visible light source instead of a chemiluminescent visible light source (based upon the assumption that abnormal metabolic or structural changes have different absorbance and reflectance properties) (Mehrotra 2011).

7. Laser Capture Micro dissection Technique

This is one of the best methods (LCM) for isolation specific cells of interest from microscopic regions of tissue (Mehrotra 2011) with the help of the laser .This technique can produce accurate and meaningful results.

8. DNA-Analysis Technique

Sensitivity of DNA in oral cancer cells are 96.4% specificity 100% positive predictive value 100% and negative 99.0%. The combination of both techniques increased the sensitivity to 98.2% specificity to 100% positive predictive value to 100% and negative to 99.5% (Maraki 2004). At present review has updated DNA methylation saliva based biomarkers for the diagnosis of oral Cancer.

9. Oral cancer screening through artificial intelligence Technique

Although traditional oral cavity screening appears viable in LMIC, in particular the high incidence countries, disproportionate accessibility of health care of high-risk groups within these countries forces us to identify alternative screening methods, in order to improve the reach and therefore the success of screening (Mehrotra 2011). Modern technology like artificial intelligence (AI) provides the prospective to perform the medical activity at a remote distance, circumventing issues related to physical presence requirements, which promises to improve the expedited reach of screening, specifically into the remote lower SES regions around the world where screening is deemed most successful. Kanniyappan (n.d) reveals that Artificial intelligence has also been applied extensively in the molecular analysis of oral cancer biopsy specimens, also automates the screening process to detect oral cavity cancer using deep convolutional neural network (DCNN) models with a small dataset of clinically annotated photographic images. A deep learning algorithm has been developed based on a partitioned convolution neural network (CNN) for automatic oral cancer specimen diagnosis by investigating hyper spectral images from patient biopsy specimens (Kanniyappan)

CONCLUSION

From the previous studies taken into consideration for this study it was found that poverty, illiteracy and lack of access to health care are the barriers for the cause of oral cancer. Cancer disease is curable if found at the earlier stage. Hence the practitioners especially the cancer curing doctors should formulate a policy to overcome all the above mentioned barriers and should give a solution for earlier deduction to prevent the patients from death. Further researches on the pathology of oral cancer are the need of the hour.

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