

Cancer Prevention Strategies

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INTRODUCTION

Cancer is one of the leading public health problems in developed nations of Europe and America. In Africa and tropical countries it is an emerging health problem¹. In America and Europe cancer is the second most important cause of death only after cardiovascular cause.^{2,4}

The increase in the incidence of cancer worldwide is attributable to increasing life span; improvement in health care delivery and the rising rate of cigarette smoking.^{5,6}

An overview of the epidemiological pattern of cancer shows striking disparity between the incidences of cancer in developed countries and developing tropical countries. The cancer types most frequent in America, Europe and other developed nations include, lung, breast, colorectal, prostate and genital cancers.³ The types commonly prevalent in the tropics include prostate, cervix, hepatocellular, lymphoid and connective tissue malignancies.^{4,6}

In the India subcontinent, oral and oropharyngeal cancers are prevalent, while in China and the Far East, nasopharyngeal, hepatocellular and penile cancers are the most common.⁸

Several forms of cancers have exhibited a time-trend over several decades. Lung cancer has shown a rising trend since the 1930s. The trend is maintained by increase in the incidence of lung cancer in women smokers.^{8,9} The developed world has in the past 30 years experienced a rise in major cancers and a reduction in stomach, oesophageal, uterus and colorectal cancers.⁴ While breast cancer shows an increasing trend with socio-economic progress and improvement in the quality of life, cervical cancer is characteristically prevalent in areas with poor socio-economic development and inferior quality of life.⁵ Personal attributes like age, sex, occupation, habits and culture also influence the distribution of cancers. Generally increase in age is associated with increase in the incidence of cancer.⁹

The causes of cancers are a combination of environmental carcinogens and hereditary risk factors. Though detailed causes are not the subject of discussion in this article, the purpose of this article is to review strategies for cancer risk reduction, prevention and early detection.

WHAT ARE THE CHARACTERISTICS OF CANCER?

- Excessive growth in all directions causing local invasion and destruction.
- Ability to spread to distant sites from the primary site. (metastasis)
- Weight loss. All cancers cause weight loss. This happens when nutrients meant for normal tissue are used to support the cancer cells.
- Fever and loss of appetite which also contribute to weight loss.
- Severe pains when cancer cells spread to local or distant areas and cause compression of the various peripheral nerves causing excruciating pains at the site of destruction.
- Loss of blood. Cancer cells invade bone marrow and blood streams to cause rapid blood cells destruction leading to anaemia, and bleeding disorders.
- Unexplained bone pains; and fractures. Cancer cells destroys bones causing pain, and fracture of bone with minimal force.
- Bleeding after sexual contact, bloody diarrhoea, haematuria and haemoptysis are all signs and symptoms of abnormal growth of tissue.

GENERAL PRINCIPLES FOR CANCER PREVENTION

Most common cancers are preventable. There are three levels of prevention. Primary prevention: It is possible with existing knowledge to prevent a third of all cases of cancers, when resources are available current knowledge also allows early detection and effective treatment. This is the principle applied in secondary prevention. In tertiary prevention, intervention is aimed at pain relief and improvement in the quality of life.

- It has been demonstrated that consumption of a minimum of five servings of fruits and vegetable daily and a variety of whole grain and cereals, is associated with 20-30% reduction of cancer in general.
Reason: - these fruits/vegetables contain variety of vitamins, minerals and Anti oxidant with low calorie, help to eliminate toxic waste from the body.⁹
- **Consumption of a low-fat diet:-** The role of dietary fat in cancer risk is controversial. However, the relationship between diet high in fat especially saturated fat and cardiovascular disease is well established. It is speculated that diet, rich in saturated fat is associated with risk of the following cancers; breast, colon, pancreas endometrium and prostate. However, the reduction in fat should be achieved through the consumption of fruits,

vegetables and whole grains.

- **Role of meat consumption:** - Consumption of red meat, meat at a high temperature grilled and charred may lead to the formation of chemical carcinogens and should be avoided. Choosing a Variety of meats including fresh chicken, fish, turkey are better alternatives. However, these should be consumed with vegetables and fruits.¹⁰
- **Maintain a healthy weight:** - Consuming a plant based diet with appropriate protein will help to control total calorie consumption. Weight loss of just 5-10% is associated with improved health and can reduce the incidence or severity of many diseases including cancer. Regardless of adult weight, minimizing weight gain-during adulthood is an important way to reduce cancer risk.
- **Participation in physical activity:** A daily, moderate-to-vigorous intensity of exercise several days each week is critical to healthy living. The energy expenditure associated with physical activity is a critical component of maintaining healthy body weight and prevent adult weight gain associated with risk of several types of cancers.
- **Alcohol:-** if consumed at all should be limited. Chronic alcohol consumption is strongly associated with the risk of the following cancers, oral pharynx, larynx, and oesophagus, together with tobacco smoking increase the risk of gastric, liver and colon cancers.
- **Tobacco control:-** Legislation on tobacco consumption and effective control programme will reduce tobacco related cancers. Target population should be school pupils, victims of tobacco-related cancer patients and use of pharmacological treatments for addicts.
- **Reduced Occupational and Environmental Exposures:-** The prevention of cancer attributed to occupations or environmental factors, primarily requires regulatory actions.⁷ Screening of occupationally exposed workers, replacement of carcinogens by alternate chemicals, improved ventilation, re-engineered manufacturing processes, protective clothing and equipment can prevent cancer risk.
- **Immunization:-** Hepatitis B. Vaccine is the first cancer prevention vaccine. Recently, vaccine against strains of HPV16 and 18 have been developed and it is hoped it will reduce significantly genital cancers caused by HPV.

10. REDUCTION OF EXPOSURE TO ULTRAVIOLET RADIATION

UV radiation is established as a cause of skin cancer and may account for 80-90% of skin diseases. Public health programs to reduce skin cancer should aim at measures to reduce sun exposure. This could be achieved by educating people to adopt sun protecting behaviour and

avoid intentional exposure.^{7,8}

- **Chemoprevention:-** chemoprevention is defined as the reduction of risk of cancer development through the use of pharmaceuticals or micronutrients. There is conclusive evidence that in women with a previous diagnosis of breast cancer, tamoxifen reduces the risk of contra lateral breast cancer. Similarly observation studies indicate a moderate reductive of colorectal carcinoma in people using non-steroidal anti inflammatory drugs regularly. Uses of aspirin for up to six months have been found to reverse squamous metaplasia of lungs of heavy cigarette smokers. Micronutrients which appear to protect against cancer include beta carotene, alphanatocopherol and ascorbic acid. Vegetable and fruits also partially act through micronutrients.¹²⁻¹⁵

SECONDARY PREVENTION

This programme is aim at early detection of cancer at the stages that treatment is curable. This is achieved through regular and thorough medical checkup of individual or through population based screening.

CANCER SCREENING

Cancer screening and early detection have major influence to the survival of patients with many cancers. All the common cancers in our environment such as breast, cervix, prostate, colorectal, urinary bladder, have one thing in common, the prognosis is better and treatment more successful if the disease is detected at an early stage, when the cancer is still localized.

CRITERIA IN THE DECISION FOR CANCER SCREENING

- The disease should be an important public health problem.
- The disease should have a detectable preclinical phase.
- Treatment of disease detected before the onset of clinical symptoms, should offer benefits compared with treatment after the onset of symptoms.
- The screening test should meet acceptable levels of accuracy and cost.
- The screening test and follow up requirement should be acceptable to individuals at risk and their health care providers.
- Facilities are available for diagnosis and treatment of the disease.

METHODOLOGICAL ISSUES IN THE EVALUATION OF EARLY CANCER DETECTION PROGRAMME

A number of factors affect the outcome of screening and early detection of cancer. The effectiveness of screening programmes depend to a large extent on whether the person screened, will live long enough for confirmation of trustworthiness of the programme. The fact that a symptomatic screening programme can detect cancer is

not a fool proof indication of cancer detection. Evaluation of screening tests done outside the context of a rigorous research design are subject to many biases, that may and usually do invalidate the conclusion being drawn. Included in these complicated factors are; lead time and length of bias, subjective self-selection and over diagnosis.^{8,9}

LEAD-TIME BIAS

The interval between the moment an occult cancer can be detected and the moment that condition would have become known to the patient by sign and symptoms is called lead-time. Until lead time is accounted for, comparison of survival rates in screened and unscreened populations will be misleading. There is always a bias toward better survival rate in the screened group because the length of the lead time moves the point at which survival begins to be measured forward. If lead time bias is present, screen-detected cancers appear to have better survival but in fact death occurs at the same point it would have without screening.

LENGTH BIAS

The time required to detect non life threatening cancer is called length Bias. This occurs when a tumour has a long preclinical phase. Because of variation with tumour growth rate and other biological characteristics, more of the cancers with long preclinical phase will be detected when a population is screened. This form of potential bias complicates the interpretation of outcome difference between cancers detected by screening and those found outside the screening programme, because the cancer likely to escape detection may be the very cancers that have the greatest likelihood of causing death.

OVERDIAGNOSIS

Over diagnosis is an extreme example of length bias. Because screening is more likely than symptom recognition to yield lesions that might never become clinically significant, cancers survival statistics for screening detected cancer may be inflated. Over diagnosis may be suspected, if an imbalance in a cohort persists after an extended period of follow-up between the incidence rate in a screening programme and the expected incidence rate in the absence of screening.

PATIENT SELF-SELECTION

Individuals who elect to receive early detection test may be different from those who do not in ways that could affect their survival or recovery from disease, for example users of early-detection services may be more health conscious, more likely to control risk factors such as smoking or diet, more alert to the signs and symptoms of disease, more adherent to treatment or generally healthier.⁹⁻¹⁰

RESEARCH DESIGN FOR SCREENING EVALUATION

Researchers use several different approaches to study cancer screening effectively.

These include the following:-

- Descriptive studies;
- Case-control studies;
- Randomised controlled trials'

Each of these has certain strengths and weaknesses. Some methods are more powerful than others but no single approach can provide all the answers needed for the screening efficiency. Assembling the effectiveness of a screening intervention almost always requires combining evidence from multiple sources based on different research methodologies:-

- **Descriptive Studies:** -The cancer is described in terms of three variables who is affected? And what time? Where is it affected? The answer to these questions together with knowledge of the clinical and pathological features of the disease and information about the population and its environment assist in developing hypotheses about the determinants of the disease.

- **Case-Control Studies:** - These can be prospective or retrospective. The retrospective case-study can provide additional evidence on screening effectiveness. The advantage of this approach is that it is a low-cost strategy that may provide evidence more quickly than prospective studies, when the screening procedure is already in clinical use. Although mortality reduction can be an end point measured in these studies, case-control studies are subject to bias and confounding from uncontrolled tactics.

- **Randomised Clinical Trials:-**

The most vigorous assessment of screening is by randomized clinical trials that measure cancer specific mortality reduction as the primary end point. It eliminates selection, lead time and length biases. A randomized clinical trial of screening rather than screening per se, that is, end results are based on comparison between invited and uninvited groups, rather than screened and unscreened groups. The distinction is important since non compliance to the invitation to screening in the experimental group, and contamination in the control group (i.e. participation in screening), has an effect on the magnitude of the observed outcome. Although randomized clinical trials are the most desirable study, designed from methodological perspective, the large sample size required, their expenses and their long duration have tended to limit the number of randomized controlled trials that have been conducted.

PREVENTION STRATEGY FOR SOME SPECIFIC CANCERS

BREAST

Breast cancer still remains the commonest cancer in women in America, excluding skin cancers.

In Africa and Nigeria breast cancer also ranks number one in most centres. However data generated in Nigeria are hospital based and may not truly reflect incidence in the population. In some centres in Nigeria, breast cancer comes after cancer of the cervix. Among women in the United States of America, death from breast cancer is also a leading cause of premature mortality from cancer.^{10,11}

On the average, a woman dying of breast cancer has lost 18.5 years of life she might have had if she had not died of this disease. In developed countries of Europe and America 5 year survival rate for breast cancer cases is about 85%. This figure increases if the disease is diagnosed early.¹²

SCREENING AND DIAGNOSTIC METHOD

There are three basic methods for breast cancer screening.

- Mammography
- Breast self-examination (BSE)
- Clinical breast examination (CBE)

After 40 years of age, the principal role of breast self examination are to identify breast lumps not detected by mammography or due to test limitation, rapid tumors growth or human error.

Mammography:- mammography screening was introduced in the 1980s as a means to detect small non-palpable asymptomatic breast cancer. The sensitivity and specificity increases with age after 40 years.

Mammography is an X-Ray examination of the breast to detect abnormalities that may be breast cancer. Modern mammography is done on dedicated imaging equipment designed to produce high quality image of the breast at a minimum x-ray dose.

A screening examination involves two views of each breast; - a craniocaudal view and a mediolateral oblique view. Prior to taking the x-ray, a radiology technologist positions a woman's breast in a compression device, pictures are taken at various angles. The principal mammographic features are density and calcification which appear linear and branching.¹⁶⁻²⁰

EVALUATION OF BREAST CANCER IN A COMMUNITY

There has been increasing interest in evaluating the impact of screening in the community setting which is also referred to as service screening.

Although randomized clinical trials of the breast cancer screening had clearly demonstrated the benefit of early breast cancer detection, the establishment of routine screening with mammography as health policy posed new challenge. Does mammography reduce mortality rate?

PHYSICAL EXAMINATION: CLINICAL BREAST EXAMINATION (CBE) AND BREAST SELF EXAMINATION (BSE)

CBE involves physical palpation of the breast by a trained physician. Its role in prevention of breast cancer is complemented by breast self examination. Clinical breast examination is done between the ages of 20-40 years and is recommended every 3 years.

However, women about 40 years of age, Clinical breast examination are recommended to be done annually prior to the time of mammography. A negative finding on mammography in the presence of palpable mass does not rule out breast cancer.¹³

Breast self examination should begin at age of 20 and should be performed monthly. There are various techniques for breast self examination that women may follow, but the choice of any one technique probably can be done on the basis of personal preference.

ADVANTAGES OF BREAST SELF EXAMINATION

- It is more appealing and convenient;
- it has no financial cost to the participant;
- it is non-invasive
- it has advantage of creating awareness of early breast cancer;

DISADVANTAGES OF BREAST SELF EXAMINATION

- BSE, may be distractive to the use of mammography
- There may be false assurance
- It may cause heightened anxiety about the possibility of breast cancer
- False positivity may be higher

Some studies have shown improvements in breast cancer survival among women who practice breast self examination, whereas others have not.

BSE and BCE potentially offer some advantage for the detection of palpable masses in women who have not reach an age when mammography is recommended or to detect cancers missed by mammography or fast growing tumour among women in an age group in which mammography is recommended.¹⁸⁻²⁰

PREVENTION OF COLORECTAL CANCER:-

Colorectal cancer is the third most common cancer diagnosed among men and women in USA and Europe. In Nigeria it ranks after prostate, breast in women, liver, cervical carcinoma and lymphomas.²¹⁻²³

The incidence and mortality rates increase with increasing age and are higher in African American than the Caucasians. Among men and women diagnosed with colorectal cancer, survival is highly dependent on the stage at diagnosis. Five year survival is 90% if diagnosed while localized, the percentage decreases

with advancing stage of the disease.^{13,14}

SCREENING AND DIAGNOSTIC METHODS

The goal of screening for colorectal cancer is for both the detection of early stage adenocarcinomas and the detection and removal of anomalous polyp which are accepted as being potential precursors for colorectal cancer.

BENEFITS

Reduces mortality and morbidity by allowing the diagnosis of occult cancer at a more favorable stage and preventing the disease through the removal of precursor lesions

EPIDEMIOLOGICAL RISK FACTORS

Adenomatous polyp which represent about one third to two third of all colorectal polyps are associated with the greatest risk of colorectal cancer.

There are three common screening tests for colorectal cancer.

1. Faecal occult blood testing
2. Endoscopy (flexible sigmoidoscopy and colonoscopy);
3. Barium enema;

These test may be used alone or in combination to improve sensitivity or in some instances, to reinforce a complete examination.

FOECAL OCCULT BLOOD TESTING

This aims at discovering the presence of blood in stool, which may be derived from colorectal cancer or large polyps greater than 2cm. Bleeding from lesion tends to be intermittent leading to the need for serial specimens examination during annual test. The most common foecal occult blood testing in use today are guavas-base test (Haemocult 11 and Haemocult SENSA).²⁴⁻²⁷

FLEXIBLE SIGMOIDOSCOPY

This is examination of sigmoid and Rectum. Sigmoidoscope is an instrument used in screening. This may be rigid or flexible. The procedure requires minimal preparation. It is usually combined with Direct rectal examination .if the test is positive, the patient is generally referred for colonoscopy.

Combined Foecal occult blood testing and Flexible sigmoidoscopy; it is superior to either, represent quasi total colon examination. It is however, cheaper than double contrast barium enema or colonoscopy. Foecal occult blood testing aims to detect occult blood in stool, it has little potentials to prevent colorectal cancer since it is insensitive to smaller potential precursor lesion. Flexible sigmoidoscopy allows the examiner to visualize the distal bowel directly and it has higher sensitivity and specificity for both adenocarcinoma and

polyp.^{29,30}

BARIUM ENEMA

Barium enema is an x-ray examination of the bowel that derives contrast from barium (a single contrast study) or the combination of barium and instilled air (a double-contrast study) double contrast barium enema is more sensitive than simple contrast study for both malignancies and polyps.

Bowel preparation for double contrast barium enema is more thorough than that required by flexible sigmoidoscopy.

COLONOSCOPY

Colonoscopy is a total colon examination and requires, through bowel examination. Colonoscopy has a unique advantage among all screening test for colorectal cancer, in that visualization of the entire colon is possible, and clinically significant adenomas can be identified, and removed. The test is highly sensitive and preferred to focal occult blood testing or an flexible sigmoidoscopy.²⁸⁻³¹

SCREENING RECOMMENDATION

Average risk adults should start screening at the age of 50 years

- Annual faecal occult blood testing
- Flexible sigmoidoscopy every 5 years.
- Total colon examination with double contrast barium enema every 5 years or total colon examination with coloscopy every 10 years

PROSTATE CANCER

Disease Burden

Prostate cancer is the most common cancer in men and a significant health problem. The incidence of prostate cancer is highest in Africans and African Americans worldwide. The incidence increases with advancing age.

^{2,3} This cancer is sometimes observed to be a disease a man is more likely to die “with” than from “because of other competing cause of death, owing to the older average age at prostate cancer diagnosis. Prognosis is good if the diagnosis is made when the cancer is still localized to the prostate. In fact prostate cancer is still the cause of death for men with the advanced disease.³²⁻³⁶

SCREENING AND DIAGNOSTIC METHODS

There are three ways of evaluating early detection of prostate cancer

- Direct rectal examination
- Prostate specific antigen test (PSA)
- Transrectal ultrasonography

DIRECT RECTAL EXAMINATION

Palpable asymmetry, of the prostate gland and particularly, hard nodular areas sometimes indicate the presence of prostate cancer.

It has been estimated that direct rectal examination may prevent as many as 50-70% of death due to prostate cancer. Direct rectal examination has poor sensitivity, it is recommended as one component of prostate cancer screening, because it may detect prostate cancer missed by other test.^{30,36}

- It is a low cost-procedure;
- Has value for evaluating other prostate abnormalities such benign prostate hyperplasia.

PROSTATE SPECIFIC ANTIGEN

PSA is organ specific but not cancer specific. The causes of elevated PSA include the following:-

- Nodular hyperplasia
- Prostatitis
- Prostatic infarct
- Instrumentation of prostate
- Ejaculation.

However normal organ specific prostate specific antigen which is confined to the prostate is 4ng/dl or less. Though in severe inflammation of the prostate it may be higher.

Because of the complexity involved in interpreting prostate specific antigen value, physicians must exercise great caution, otherwise over diagnosis may lead to wrong management.

Several refinements in the estimation and interpretation of prostate specific antigen values have been proposed. These include the following:-

- The ratio of serum prostate specific antigen value and volume of prostate gland (PSA density)
- The rate of change in prostate specific antigen with time (PSA velocity)
- The use of organ specific PSA and the ratio of free and bound PSA. Studies have shown that the percentage of free PSA seen divided by the total serum PSA is more valuable in measuring the risk of prostate cancer. The higher the value the more likely it is to be a cancer. PSA value alone cannot be used to detect early cancer, however when combined with rectal examination and transrectal ultrasonography, gives a better assessment. However, measurement of PSA levels is still useful in detection of early-prostate cancer. Although serum PSA levels are less than perfect for detection of early prostate cancer, there is little doubt that serial measurement of PSA are of great value in assessing the responsiveness to therapy.³²⁻³⁶

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