

An overview of the Genesis of Preventive Oncology Unit at a Tertiary Cancer Care Hospital in a Developing Country – A concept paper

Abstract

Background: Preventing cancer is better than treating or curing it. Cancer prevention ensures reduced physical, emotional, financial burden to the individual. **Methods:** The focus of the preventive oncology unit at Healthcare Global (HCG) Enterprise Limited, Bangalore, India, is to increase the understanding of how lifestyle and risk of cancer are related. It also focusses on screening of normal individuals for estimating their risk of developing cancer, which in-turn can lead to earlier detection, improved treatment and outcomes. This unique endeavor started one year back, provides counseling and vaccination services for HPV (Human Papilloma Virus) and HBV (Hepatitis B Virus). Our outreach initiatives in collaboration with the State and City health Departments include screening camps, and awareness sessions focusing on HPV and HBV vaccination. **Results:** The focus of research is in the areas of cancer epidemiology, prevention, screening, and control. Such research involves a multidisciplinary approach involving the fields of epidemiology, biostatistics, behavioral science, nutrition, and basic science. **Conclusion:** This novel endeavor at a tertiary cancer hospital in a Developing Country is aimed at preventing the development or progression of the malignant cancer process.

Keywords: Early detection of cancer, mass screening, research

Introduction

During 2018, 9.6 million people worldwide have died due to cancer.^[1] Globally, about 1 in 6 deaths is due to cancer.^[1] In 2008, the economic impact of premature death and disability from cancer was 1.5% of World's GDP.^[1] 40% of all cancer deaths can be prevented.^[2] India contributes to 7.8% of the global cancer burden and 8.33% of the global cancer deaths.^[3] Cancer risk depends on a combination of genes, lifestyle and environment.^[4] Prevention ensures reduced physical, emotional, financial burden to the individual.

The preventive oncology unit at Healthcare Global (HCG) Enterprise Limited, Bangalore, India, was initiated during August 2019. Its focus is to increase the understanding of how lifestyle and risk of cancer are related. It also focusses on screening of normal individuals for estimating their risk of developing cancer, which in-turn can lead to earlier detection, improved treatment and outcomes.

HCG is the largest private cancer care provider in India. It has a network of

27 comprehensive cancer centers in India and abroad. Each center is provided with a business system, management expertise and capital resources to bring patient focused, state of the art cancer care. The hub and spoke model has helped to create an integrated approach to cancer care. Annually, >120,000 patients are treated through our centers. The group employs ~300 oncologists and 440 specialized Physicians. Also, the HCG foundation enables need-based patients through concessions and waiver of hospitalization costs. Since its inception during December 2006, around 4000 financially deserving patients have derived benefit from this noble cause. The academic programs at HCG include National board and University affiliated courses as well as Fellowship programs in the field of Oncology. This would provide the necessary infrastructure and manpower support for conducting research activities at HCG.^[5]

Preventive Oncology as a Specialty was declared by Dr. Michael Shimkin during 1975, at the University of California, San Diego. It includes any measures taken to prevent development or progression of

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How to cite this article: Ramani VK, Naik R. An overview of the genesis of preventive oncology unit at a tertiary cancer care hospital in a developing country – A concept paper. *Int J Prev Med* 2021;12:102.

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Access this article online

Website:
www.ijpvmjournal.net/www.ijpvm.ir

DOI:
10.4103/ijpvm.IJPVM_356_20

Quick Response Code:



the malignant process. Because of their causal association with the modifiable risk factors, 50% of the cancers are preventable.^[6] Preventing cancer is better than treating or curing it. Medical oncology clinics focus on secondary and tertiary levels of cancer prevention. The unique preventive unit set-up in our tertiary hospital one year back, provides counseling and screening services to normal individuals and assess his/her risk of developing cancer in the future. Vaccination services are provided for HPV (Human Papilloma Virus) and HBV (Hepatitis B Virus). Our outreach initiatives in collaboration with the State and City health Departments include screening camps, and awareness sessions focusing on HPV and HBV vaccination.

Individuals are at increased risk of cancer because of modifiable and non-modifiable risk factors, which are the targets for preventive strategies. In our unit, we elicit history based on the individual's predisposition for cancer stratified by gender, concurrent medical illness, family history, age, lifestyle, and occupation. We also screen for risk factors such as tobacco use, unhealthy diet (low fruit and vegetable intake), alcohol use, lack of physical activity, sexually transmitted infection, infection by (HBV), radiation exposure, urban (air pollution) or rural (pesticide) existence, occupational exposure and indoor smoke from household use of solid fuels. Non-modifiable risk factors include genetic factors, which are implicated in 10% of the cancers.^[6]

The unit's head is a senior Medical oncologist and technical support is provided by a Radiation oncologist. A community Physician provides consultation at the unit and is the interface for walk-in beneficiaries, relatives of patients and remission patients suspecting a relapse. The unit derives its roots from the feedback of cancer patients who opine that they would have utilized screening services at early stages of their disease, rather than going through the long-drawn treatment process. The multi-disciplinary approach involves accessing services from Oncology specialists, Obesity surgeon, Genetic counselors, Physiotherapist, and Yoga trainers.

The comprehensive 2-hour cancer screening program has been a recent introduction, and the package encompasses radiology (whole body MRI: WB MRI), endoscopy and blood tests to detect cancers of Oropharynx, gastrointestinal tract, liver, lungs, brain, breast, cervix, blood, kidney, prostate, and many more.

Literature Review for WB MRI

For screening services, MRI could concentrate on organ systems as per the patient's risk profile or to look for common lethal diseases (e.g. colon, lung, breast cancer). Lauenstein T C *et al.*^[7] opine that WB MRI should be supplemented with blood tests (CBC, PSA) and other laboratory tests. Lee S.Y's^[8] study reports that WB MRI could be used in cancer screening and regular health evaluation. Kwee R.M^[9] state that based on current evidence, WB MRI for preventive health screening of asymptomatic subjects

should be offered in a research setting or for genetically predisposed individuals. Such subjects should be informed of incidental indeterminate findings, lack of verification data and substantial false positive findings. The results from Richard S's^[10] study show that accuracy of MRI is high for detecting diseases of certain organs such as liver, brain, spine, pancreas, and kidneys. Anupindi S A^[11] infer that among children with genetic predisposition for cancer, WB MRI is a valuable screening tool due to its high sensitivity, specificity, and NPV.

MRI is an alternative for CT screening due to the multiplanar imaging, high spatial resolution, anatomical, and functional imaging capabilities. The radiofrequency energy and magnetic fields used in MR imaging do not pose biological risk when compared with PET/CT. WB MRI is a useful diagnostic tool for detection of incidental masses in otherwise healthy patients.^[12] WB MRI finds cancer tumors in <2% of patients without symptoms. Some of these tumors may not cause problems in future. Such scans, unlike specific tests could miss cancerous lesions thus providing a false sense of security to the beneficiary.^[13] The accuracy of MRI is only fair in the assessment of certain organs such as lung, prostate, colon, and breast.^[10]

Content

Objectives of our unit include

- Screening of asymptomatic and apparently healthy individuals to detect pre-cancerous lesions or early stage of cancer,
- Increasing beneficiary awareness of early signs and symptoms,
- Referral services for diagnosis and treatment,
- Collaboration with State health units for outreach screening activities,
- Research and academic activities,

Family history assessment of beneficiaries includes

- Information about both maternal and paternal relatives,
- Information on at least first (parents, siblings, children), and second degree (aunts, uncles, nieces, nephews, grandparents) relatives,
- Type of cancer, age at diagnosis and age at death for each family member with cancer, current age of family members living with cancer,
- Environmental exposures (radiation, smoking, occupational exposures),
- Genetic counseling and evaluation,

Common sites for cancer in India are oral cavity, lungs,^[18] prostate, esophagus and stomach in males, and breast, cervix, and oral cavity in females. The focus of research in Preventive Oncology is in the areas of cancer epidemiology, prevention, screening, and control. Such research involves a multidisciplinary approach involving the fields of epidemiology, biostatistics, behavioral science, nutrition, and basic science.

The educational and awareness initiatives of the Unit include lecture sessions for Corporate employees, group counseling for health workers and beneficiaries, one-to-one counseling for visitors to the clinic, and training sessions for Government Medical Officers.

Table 1 lists the specific activities of our Unit. The American Cancer Society (ACS) guidelines for cancer screening are shown in Table 2. Table 3 depicts the National Cancer Institute's (NCI) guidelines for cancer screening of high risk individuals. The screening tools used in our Preventive Oncology unit is listed in Table 4.

Table 5 enlists the cancer biomarkers and its utility for the purpose of screening.

CDC recommended vaccination schedule

- 1) Dosing schedule for HPV:
 - <15 yr age: 2 doses (6 months apart)
 - 15 to 26 yrs: 3 doses (current, 1 month later, 5-6 months later)
 - 27 to 45 yrs: catch-up vaccination,
 - >45 yrs: not used,
 - Males upto age 21 yrs can be vaccinated,
- 2) Dosing schedule for HBV:

Table 1: List of activities in our Unit

| Domain of work | Particulars and research | Biological mechanism |
|--|---|--|
| Early detection of cancer | Effectiveness and impact of screening methodologies | Clinical examination supported by imaging and molecular biomarker approaches |
| Biomarkers | Validate biological markers for early cancer detection and risk assessment | Cancer related dynamics of glycan markers which are complex carbohydrates |
| Chemoprevention | Preclinical studies to phase I clinical trials of preventive agents | Such agents potentially intercept the carcinogenic process |
| Nutritional science | Precise role of diet and food components in modifying cancer risk | Variability in individual responses to nutrients and dietary patterns |
| Community oncology and prevention trials | Clinical oncology trials in cancer prevention and control in community settings | Provides evidence base for improved patient outcomes and reduction in cancer disparities |
| Research | Consultation on methodologic needs and statistical reviews | Analysis of screening trials and measurement error, selection of statistical models, |

Table 2: ACS guidelines for screening¹⁴

| Disease | Age of beneficiary (for initiation) | Screening tool | Remarks |
|---------------------------------|-------------------------------------|---|---|
| Breast cancer | 40 yrs | Mammogram | Annual activity |
| Colon and rectal cancer, Polyps | 45 yrs to 75 yrs | FOBT ^a , Scopes | Sensitive or Specific test |
| Cervical cancer | 21 yrs to 29 yrs | PAP ^b test once in 3 yrs | HPV testing only when PAP is abnormal |
| | 30 yrs to 65 yrs | Co-testing done every 5 yrs | Continue testing even after HPV vaccination |
| | >65 yrs | Test only pre-cancerous lesions for next 20 yrs | Stop screening for those with normal results in past 10 yrs |
| Lung cancer | 55 to 74 yrs, | LDCT ^c | Current smokers (or quit <15 yrs back) with 30 pack years |
| Prostate cancer | 50 yrs | Digital rectal exam, PSA ^d test | Frequency of testing will depend on PSA level |

^aFecal occult blood test, ^bPapanicolou stain, ^clow dose CT scan, ^dProstate specific antigen

Table 3: NCI guidelines for screening of individuals at high risk¹⁵

| Cancer | Risk Group | Screening recommendation |
|----------|---|--|
| Breast | Personal or family h/o HBOC* or other genetic syndrome | Annual screening mammography starting at age 25 yrs or 10 yrs prior to youngest age at diagnosis in family, annual screening MRI, annual CBE/BSE** |
| Colon | Individuals with polyps on screening | <2 polyps, <1 cm: repeat colonoscopy every 5 yrs, Multiple adenomas: repeat exam within 3 yrs |
| | Inflammatory bowel disease | Begin colonoscopy 8-10 yrs after onset of symptoms, repeat every 1-2 yrs, |
| Melanoma | Known HNPCC*** | Begin screening at 20-25 yrs or 10 yrs prior to youngest diagnosis in family |
| | Family or Personal h/o Melanoma | Head to toe skin examination every 6-12 months starting at age 10, Encourage monthly skin examination, |
| Prostate | One or more first degree relatives diagnosed at age <65 | Annual screening beginning at age 45 |

*HBOC: Hereditary breast ovarian cancer syndrome. **Clinical breast exam/Breast self exam, ***HNPCC: Hereditary non-polyposis colorectal cancer

Table 4: Screening tools used for common cancers in our unit^[16]

| Organ | Screening tools |
|------------|---|
| Breast | Clinical/Self breast exam, Mammography (after age 40 yrs), MRI (for high risk women with mutation in BRCA1/BRCA2 gene), |
| Colorectal | Fecal occult blood test, Colonoscopy & sigmoidoscopy (average risk individuals in the age group of 50 to 75 yrs), |
| Skin | Clinical/Self exam, |
| Prostate | Digital rectal examination, PSA test for men aged 55 to 69 yrs, |
| Ovarian | Biomarker CA125 test for women with high risk, Transvaginal ultrasound, |
| Cervix | LBC ^a test (for women aged 30 to 65 yrs) HPV test |
| Lung | LDCT scan for heavy smokers (30 pack years or more), where 1 pack year is one pack of cigarettes per day for one year, Includes individuals 55 to 80 years old, and also those who have quit within past 15 years, |

^aLiquid based cytology. *No screening test indicated for thyroid, testis, pancreas

Table 5: Cancer Biomarkers and their potential uses for screening^[17]

| Proteins | Organ system | Use |
|-------------------------|------------------|---|
| BRCA1 germline mutation | Breast and ovary | Estimate risk of developing cancer |
| PSA | Prostate | Screening for cancer |
| CEA | Colon | Monitor for disease recurrence |
| AFP, LDH, βHCG | Germ cell tumor | |
| CA15.3, CEA | Breast | Monitor for progression in metastatic disease |
| CA125 | Ovary | |
| CA19.9 | Pancreas | |

- 0,1,6 month schedule
- Booster dose for immunocompromised individuals, hemodialysis patients (anti-HBs <10 mIU/ml)

Fellowship in preventive oncology unit

The one-year course in our Unit will train a Community Physician in the mechanisms involved in interplay of genetic, neurobiological, psychological and environmental factors for initiation for risk factors, and methodological approach for cancer prevention. The coursework includes: Prevention of organ specific tumors, Causal inference and evidence-based decisions, Community interventions, Biomarker assessment, Oncogenes and molecular epidemiology, and Occupation and Environment.

Conclusion

Our goal is to generate relevant knowledge in the areas of cancer epidemiology and prevention, which eventually will make a significant impact on reducing the morbidity of cancer. This novel endeavor in a tertiary cancer hospital in a Developing Country will enable dissipation of cancer phobia and empower individuals with knowledge about cancer. This in-turn will enable navigation for screening services and behavioral change initiatives for others in their community. In the near future, we intend to conduct chemoprevention

trials with nutrient supplements such as Vitamin D and other drugs such as tamoxifen, aspirin, and finasteride.

Challenges in preventive oncology

- Cancer develops over decades by multiple processes, some of which may be irreversible by adulthood,
- Varieties of cancers each with its set of causes and potential preventive strategies,
- Etiological cohort studies and prevention intervention trials with cancer as outcome, require large sample size (tens of thousands) and long duration of follow-up.

Acknowledgement

Dr. Nalini Rao, Radiation Oncologist, HCG.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Received: 24 Jun 20 **Accepted:** 27-Nov-20

Published: 24 Aug 21

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