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Cancer Epidemiology, Prevention And Control: Bangladesh Perspective

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ABSTRACT

The epidemiology of cancer is the study of the factors affecting cancer, as a way to infer possible trends and causes. The study of cancer epidemiology uses epidemiological methods to find the cause of cancer and to identify and develop improved treatments. This area of study must contend with problems of lead time bias and length time bias. Lead time bias is the concept that early diagnosis may artificially inflate the survival statistics of a cancer, without really improving the natural history of the disease. Length bias is the concept that slower growing, more indolent tumors are more likely to be diagnosed by screening tests, but improvements in diagnosing more cases of indolent cancer may not translate into better patient outcomes after the implementation of screening programs. A related concern is over diagnosis, the tendency of screening tests to diagnose diseases that may not actually impact the patient's longevity. This problem especially applies to prostate cancer and PSA screening. Some cancer researchers have argued that negative cancer clinical trials lack sufficient statistical power to discover a benefit to treatment. This may be due to fewer patients enrolled in the study than originally planned.

Keywords: *Cancer epidemiology, cancer prevention, Control, Bangladesh*

INTRODUCTION

Chronic diseases such as cancer and other non-communicable diseases are fast replacing communicable diseases in India and other developing countries. We deal here with the epidemiology of cancer, its control and prevention measures as applicable to Indian situation. Tobacco is the most important identified cause of cancer followed by dietary practices, inadequate physical activity, alcohol consumption, infections due to viruses and sexual behavior. Cancer prevention includes primary and secondary prevention measures. Public education on 'tobacco and its health hazards', recommended dietary guidelines, safe sexual practices, and lifestyle modifications form the main features of primary prevention of cancer. Incorporating screening for cancer of cervix, breast and oral cancers into peripheral health infrastructure can have a significant effect on reducing mortality from these diseases.

THE burden of cancer is still increasing worldwide despite advances for diagnosis and treatment. Epidemiological studies have shown that many cancers may be avoidable. It is widely held that 80–90% of human cancers may be attributable to environmental and lifestyle factors such as tobacco, alcohol and dietary habits. Cancer prevention includes primary, secondary and prevention methods.

Primary prevention refers to avoiding cancer-causing substances in the environment or dietary elements associated with increased risk; dietary supplementation with putative protective agents. Secondary prevention aims at early detection and removal of benign tumours of oral, cervical and breast cancers. It was estimated that in the year 2000, worldwide over 10 million new cases of cancer occurred (approximately 5.3 million men and 4.7 million women) and over 6 million people died from cancers. The most frequently affected organs are lung, breast, colon, rectum, stomach and liver. Epidemiology of cancer, its control and prevention measures as applicable to Indian population has been discussed here.

There are many common beliefs or speculations about causes of cancer. However, putative causes of cancer for which there exist very little scientific evidence, positive or negative, are not considered in these summaries. Therefore, absence of an environmental, dietary, or lifestyle factor from these summaries implies insufficient evidence for detailed consideration and not necessarily absence of effect. Many such factors are deserving of research regarding their potential roles in cancer, but if that research does not exist, has not been published, or the Editorial Board judges the research to be of poor quality, then they are not addressed in these summaries. Carcinogenesis refers to an underlying etiologic pathway that leads to cancer. Several models of carcinogenesis have been proposed. Knudson proposed a “two-hit” model requiring a mutation in both copies of a gene resulting in cancer. Expansion of this concept has resulted in other widely cited models of carcinogenesis including those of Vogelstein and Kinzler and Hanahan and Weinberg. The model of Vogelstein and Kinzler emphasizes that cancer is ultimately a disease of damaged DNA, comprised of a series of genetic mutations that can transform normal cells to cancerous cells. The genetic mutations include inactivation of tumor suppressor genes and activation of oncogenesis. Compared with cancers arising in the general population, individuals with a major inherited predisposition to cancer are born with inherited (i.e., germ line) mutations in genes involved in cancer causation, giving them a head start on the pathway to cancer. Similar mutations would be expected to result in cancer progression among all individuals; however, in those without a major inherited cancer predisposition, the mutation would occur as a somatic mutation later during their lifetime.

CANCER EPIDEMIOLOGY DEMOGRAPHIC SHIFT

Urbanization, industrialization, changes in lifestyles, population growth and ageing all have contributed for epidemiological transition in the country. The absolute number of new cancer cases is increasing rapidly, due to growth in size of the population, and increase in the proportion of elderly persons as a result of improved life expectancy following control of communicable diseases. In India, the life expectancy at birth has steadily risen from 45 years in 1971 to 62 years in 1991, indicating a shift in demographic profile⁴. It is estimated that life expectancy of Indian population will increase to 70 years by 2021–25. Such changes in the age structure would automatically alter the disease pattern associated with ageing and increase the burden of problems such as cancer, cardiovascular and other non-communicable diseases in the society.

CANCER CONTROL AND PREVENTION

Cancer is one of the most important causes of morbidity and the magnitude of the problem is gigantic. Its burden on the economy for providing health care will be substantial. For the treatment of cancer patients, hospitals, beds, sophisticated equipment, machinery, drugs and other health care facilities such as trained nurses, oncologists, large number of hospital days are required. In addition to this, the indirect costs such as loss due to premature deaths, loss due to hindrance of productivity, economic dependence, etc. cannot be quantified. Hence cancer prevention and control is the most appropriate measure.

The Government of India launched the National Cancer Control Programme (NCCP) in 1975–76 to tackle the increasing incidence of cancers in the country. This was later revised in 1984–85 stressing on primary prevention and early detection of cancers. The primary prevention focused on health education regarding hazards of tobacco consumption, genital hygiene, and sexual and reproductive health. Secondary prevention aims at early diagnosis of cancers of uterine cervix, breast and or pharyngeal cancers by screening methods. For the purpose of detecting cancer of cervix at an early stage, early cancer detection centres in different medical colleges and postpartum smear testing units in medical colleges in the country have been established. A National Cancer Control Board was constituted at the Centre to operationalise the programme. Similar boards were suggested at the state levels called as State Cancer Control Board (SCCB) for the proper co-ordination of activities. Several states have formulated SCCB.

During the period 1990–91, a demonstration project named district cancer control programme (DCCP) was initiated in selected districts of the country for early detection of cervical, oral and breast cancers at the doorsteps of rural community. The programme created awareness amongst people regarding early symptoms of cancer, importance of observation of personal hygiene and healthy lifestyle, ill effects of tobacco consumption, etc. The project has five components, viz. health education, early detection, training of medical and paramedical personnel, palliative treatment and pain relief and co-ordination and monitoring. The district projects are linked with Regional Cancer Centres (RCC), medical college hospitals having infrastructure for treatment of cancer and the appropriate institutions that supervise and monitor the programme in collaboration with the concerned state governments.

The DCCP scheme has been further reoriented on a pi-lot basis as Modified District Cancer Control Programme. The project has been implemented in the states of Bihar, Tamil Nadu, Uttar Pradesh and West Bengal under the supervision of the state Regional Cancer Centres. Twenty/ ten rural blocks from each of the above states have been selected. For each block, 20 female non-communicable workers have been appointed to advice women about healthy lifestyles, ill effects of tobacco and to detect the early symptoms of cancers.

CANCER PREVENTION STRATEGIES

Primary prevention

The data from the National Cancer Registry Programme showed that one third of the cancers occurring in Indian population are related to tobacco usage and thus are preventable. The main strategy for control of tobacco-related cancers would be through primary prevention. Tobacco-related cancers such as oral, pharyngeal and lung are mainly amenable to primary prevention programmes. Extensive persuasive health education needs to be directed to control/reduce the tobacco habit. Teen-aged students need to be targeted as most of them pick up habits at this time.

The school curricula should involve messages for a healthy lifestyle and warn about the harmful effects of tobacco and alcohol. Appropriate legislative measures need to be taken up for prohibiting sale of tobacco to youngsters, to help in protection of the non-users of tobacco – ‘passive smokers’ and for stopping advertisements on tobacco. Though there is a ban on advertisement of cigarettes, cigarette smoking is glamorized in various ways. Existing rules and regulations concerning smoking in public places of entertainment and public transport need to be rigidly enforced. In addition to the above, more strategies are needed for control of tobacco-related cancers.

There are several core strategies for a comprehensive tobacco-control programme that have the support of the International Agency for Research on Cancer (IARC), the WHO, and the Bureau Against Smoking Prevention and several other international organizations interested in tobacco control. Top priority should be given to control of tobacco; this is likely to have the greatest impact on reducing cancer incidence and cancer mortality compared with any other strategy currently known. Based on the recommendations for Indian situation, the strategies which have been suggested are

- education of public,
- practice of tobacco control and
- Advocacy for tobacco control.

Results of an eight-year primary prevention follow-up study of oral cancer among Indian villagers have shown that through extensive and persuasive health education programme, it is possible to control/ reduce the tobacco habits in the community.

The tobacco control could be achieved by government (including through legislation) and societal actions. It has also been suggested that in terms of tobacco control policies, appropriate health warning labels on cigarette and bidi packets and on all tobacco products, advertisements, warning on smokeless tobacco products, prohibition for smoking in public places, ban on sale of tobacco products to minors, higher taxation on bidis similar to that on cigarettes needs to be adopted. Public education on tobacco and its health hazards, price increase and legislative measures form the main features of primary prevention of tobacco-related cancers. Heavy consumers of alcohol should be advised to moderate their consumption and to stop smoking. The impact of this advice could be in the control of cancers of upper respiratory tract.

Nutrition education is important for increasing the public awareness, promoting good health and for control of cancers. The recommended dietary guidelines need to be propagated. Dietary intervention for cancer prevention in terms of lowering dietary fat content, increasing intake of fibre, fruits and vegetables is needed to control cancer and other diseases, besides avoiding risk factors such as smoking and alcoholism and exposure to genotoxicants. Public education and awareness about the beneficial effects of consuming plenty of fresh vegetables and fruits with species such as turmeric in adequate amounts to pre-vent cancer are required. There is a need to popularize the following dietary guidelines for prevention of cancer.

Secondary Prevention

Cervical cancer screening

Though cytological examination has been the mainstay for early detection of cervical cancer, its widespread use is not possible in our country due to paucity of resources, manpower and other facilities. Alternative strategies such as naked eye visual inspection of cervix (down staging), visual inspection with acetic acid (VIA), magnified VIA (VIAM), visual inspection with Iodine (VIAL), cervicography and HPV DNA testing in detecting cervical cancer and its precursors have to be adopted. The findings from various research studies support the possibility of reducing mortality by earlier clinical detection, followed by basic treatment. This offers a hope for countries with limited resources.

In India, under district cancer control programme project, in selected districts medical and paramedical staff of the district hospital and anganwadi workers have been trained on the visual examination of the cervix, collection of Pap smears and referring the suspected cases to the district hospital for further evaluation. However, modified district cancer control programme need to be extended to more states and peripheral areas of the country.

Oral cancer screening

Oral cancer satisfies the criteria for screening and oral visual inspection is a suitable test for oral cancer screening. Several studies carried out have indicated that it is possible to train Para medical staff to perform the oral cancer-screening test as accurately as doctors. Under the district cancer control programme the paramedical staff of the primary health centre have been trained to conduct oral examination for early detection and for providing health education.

Breast cancer screening

The model proposed for the control of breast cancer in the country relies mainly on physical examination of the breast by trained female health workers in a primary health care set up and refer-ring the palpable lesions to district hospital/medical colleges/RCT and TC for further evaluation. The use of fine needle aspiration cytology would cut down the cost and disadvantage of unnecessary biopsies. Breast self-examination could be another effort towards picking up early lesions. Training of existing human resources and health education could be undertaken towards this objective, which would involve minimal funds. In our country, mammography is unlikely to be a cost effective approach to early detection of breast cancer. It is also noted that most of the breast cancer cases in developing countries occur in women below the age of 50 years while the mammography has been found to be effective in post-menopausal women.

As research advances, leading to proven intervention strategies, it is critical that knowledge about these strategies should be disseminated to the public for improving awareness about the prevention and control measures.

Non-communicable diseases including cancer are emerging as important public health problems in India. The major risk factors for these diseases are tobacco, dietary habits, inadequate physical activity, alcohol consumption and infections due to viruses. The greatest impact to re-duce the burden of cancer comes from primary prevention. Extensive persuasive health education is needed to be directed to control/reduce the tobacco habit. Nutrition education, safe sexual practices, attention to personal and genital hygiene needs to be imported for increasing public awareness. Prophylactic vaccinations against HPV infection and hepatitis B virus are useful strategies for the prevention of cancerous lesions of cervix and in the control of liver cancer. Further, screening for uterine cervix, oral and breast cancers could have a significant effect on reducing mortality from cancer.

METHODOLOGY

In this paper secondary data has been used by reviewing relevant literature. In doing so, the desktop survey that includes, browsing internet sources related to cancer and epidemiology affiliated institutions, and content analysis from the texts of related medical journal articles and policy papers was used.

CHALLENGE FOR EPIDEMIOLOGISTS

Ionizing radiation was discovered in 1895 by Wilhelm Conrad Roentgen, and its utility for diagnostic purposes was quickly recognized. By 1902, the first radiation-caused skin cancer was identified and the first radiation-caused leukemia case followed in 1911. Several clusters of radiation-caused cancer were described over the ensuing decades: radon and lung cancer in underground metal miners in Eastern Europe, and estrogenic sarcoma in radium dial painters. In 1944, based on more formal epidemiological inquiry, an excess of leukemia was reported among radiologists in the United States. By World War II, there was sufficient understanding of the risks of radiation to motivate a program of protection for workers at the Manhattan Project in the United States.

Radiation epidemiology was launched when a program of studies was initiated by the then Atomic Bomb Casualty Commission (eventually to become the Radiation Effects Research Foundation) to determine the consequences of radiation exposure from the nuclear blasts at Hiroshima and Nagasaki. A large, prospective cohort was designed, the Lifespan Study of 120,000 survivors, which is still in progress. This cohort has proved to be a remarkably informative resource, providing a temporal profile of leukemia and cancer associated with the blast and a robust data set for making quantitative estimates of risk. Many cohort studies have followed with radiation exposures received through therapeutic intervention or occupation, or by accident. The resulting data base is extensive for several types of radiation including X and gamma radiation and radon. The data have been sufficient to support a radiation protection approach that is grounded in the epidemiological evidence.

RISK ASSESSMENT, RADIATION, AND CANCER

Radiation exposures are ubiquitous, coming from medical and industrial applications and from naturally occurring sources. Exposures are regulated through an evidence-based approach that is used to characterize risks, drawing primarily on the epidemiological evidence. Risk assessment is an applied methodology, used to characterize risks to populations as the basis for risk management. A 1983 report of the United States National Research Council, Many subsequent reports from the National Research Council and other groups have refined the elements of risk assessment, though the four components have proved to be invaluable in approaching risk questions. The framework is useful, not only for assembling evidence on risk, but for identifying evidence gaps, attendant uncertainties, and related research needs. Most recently, a National Research Council Committee gave emphasis to the need to make certain that questions were properly framed to assure that the findings of a risk assessment will prove valuable for risk management.

Risk assessment has become fundamental to strategies for limiting cancer risks associated with radiation exposures. There is a need to minimize risk at the population level and to assure that risks to individuals do not reach unacceptable levels, particularly for workplace exposures. Determination of the acceptability of risk requires an assessment of the magnitude of risk and a societal judgment as to acceptability of the estimated risk. We are also learning that there is a spectrum of susceptibility to radiation that needs to be taken into account. Additionally, the millions of people receiving radiation for diagnostic and therapeutic purposes need to have an understanding of the attendant risks. Such medical exposures have now surpassed radon as the leading contributor to radiation exposure in the United States as use of diagnostic imaging has risen sharply.

For ionizing radiation, the principal uncertainty at present lies in the form of the dose-response relationship. There is no doubt as to the existence of a hazard and exposures are known with reasonable accuracy. However, at "low levels" uncertainty persists as to whether the dose-response relationship is linear and whether there is a dose threshold, below which there is no risk. Some have proposed that "low" exposures to radiation may be beneficial, a hypothesis referred to as "hormesis". This controversy is discussed subsequently in this manuscript. Over recent decades, various expert groups have adopted linear no-

threshold dose-response models for radiation and cancer, based on review of epidemiological and biological evidence. This assumption is important because it assigns risk to any exposure and the burden of cancer attributable to radiation is consequently driven by the lower levels of exposure that contribute the bulk of the radiation dose to the population.

CONCLUSION

On the basis of the studies described above, we propose a unifying hypothesis that all lifestyle factors that cause cancer (carcinogenic agents) and all agents that prevent cancer (chemo preventive agents) are linked through chronic inflammation. The fact that chronic inflammation is closely linked to the tumorigenic pathway is evident from numerous lines of evidence.

In most cancers, chronic inflammation precedes tumorigenesis. Most carcinogens and other risk factors for cancer, including cigarette smoke, obesity, alcohol, hyperglycemia, infectious agents, sunlight, stress, food carcinogens, and environmental pollutants, have been shown to activate NF- κ B. Constitutive NF- κ B activation has been encountered in most types of cancers. Most chemotherapeutic agents and γ -radiation, used for the treatment of cancers, lead to activation of NF- κ B. Activation of NF- κ B has been linked with chemo resistance and radio resistance. Suppression of NF- κ B inhibits the proliferation of tumors, leads to apoptosis, inhibits invasion, and suppresses angiogenesis. Polymorphisms of TNF, IL-1, IL-6, and cycling D1 genes encountered in various cancers are all regulated by NF- κ B. Also, mutations in genes encoding for inhibitors of NF- κ B have been found in certain cancers. Almost all chemo preventive agents described above have been shown to suppress NF- κ B activation.

In summary, this review outlines the preventability of cancer based on the major risk factors for cancer. The percentage of cancer-related deaths attributable to diet and tobacco is as high as 60–70% worldwide.

RECOMMENDATIONS

- Maintain BMI in range of 18.5–25 kg/m², and avoid weight gain in adulthood
- Engage in regular physical activity
- Consumption of alcoholic beverages is not recommended: if consumed, do not exceed 2 units/d (1 unit is equivalent to approximately 10 g of alcohol and is provided by one glass of beer, wine or spirits)
- Minimise exposure to aflatoxin in foods
- Chinese-style salted fish should only be eaten in moderation, especially during childhood. Overall consumption of salt-preserved foods and salt should be moderate
- Have a diet which includes at least 400 g/d of total fruit and vegetables
- Meat: those who are not vegetarian are advised to moderate consumption of preserved meat (e.g. sausages, salami, bacon, ham etc.) and red meat (e.g. beef, pork, lamb).
- Poultry and fish (except Chinese-style salted fish, see 5. above) have been studied and found not to be associated with increased cancer risk
- Do not consume foods or drinks when they are at a very hot (scalding hot) temperature.

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