Cancer initiatives in Sudan

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The broad ethnic and climatic diversity of Sudan makes it in many ways a microcosm of Africa. Sudan is experiencing a burgeoning cancer epidemic that carries many challenges that are characteristic of developing countries. These include a high incidence of advanced, difficult-to-treat disease at presentation, and a high cancer burden that is related to infectious diseases. To address this problem, Sudan has instituted a comprehensive national cancer control programme which is focused on prevention, early detection, improved treatment and palliative care. This programme focuses on three common cancers for which effective prevention, screening and treatments are available; breast, cervical and oral cancer. This article describes some preventive approaches through public awareness campaigns and education of medical professionals, and screening programmes that are being instituted in Sudan. Sudan provides an example of how the implementation of a comprehensive and carefully planned national cancer control programme in a very low-resource setting can improve the lives of cancer patients.

Key words: Sudan, epidemiology, neoplasms, etiology, chronic disease, mortality, primary prevention, developing countries

Introduction

Sudan, the biggest country in Africa by area, sits between North Africa, Sub-Saharan Africa, and the Middle East. With ethnic populations from all these regions and very diverse regional climates Sudan could be considered a microcosm of Africa. Over 80% of the population live in rural settings or are nomadic, presenting great challenges to any disease control initiative.

Sudan first initiated a national cancer control programme (NCCP) in 1982 in association with the World Health Organisation (WHO), and this was updated in the early 1990s based on the new WHO guidelines [1]. This programme focuses on prevention, early detection and screening, improved diagnosis and treatment and palliative care. This article describes the current status of cancer in Sudan, some key aspects of the Sudan NCCP, and some challenges faced in its implementation.

Cancer in Sudan

There is increasing awareness that chronic diseases like cardiovascular disease and cancer represent an epidemic that is not confined to rich countries [2]. While much international attention is given to communicable diseases like HIV/AIDS and malaria, chronic diseases are a rapidly increasing burden on developing countries. In Sudan hospitals in 2000, cancer was the third leading cause of death after malaria and viral pneumonia, accounting for 5% of all deaths (Table 1).

In the 18 years to 1984 nasopharyngeal carcinoma and NHL were the most common tumours in Sudanese males (Figure 1). In the last 20 years CML became the predominant cancer, while lymphomas remained the second most common cancer in men. In women, breast, cervical and ovarian cancer remained the three most common cancers over both time periods, but there was also an increase in the incidence of CML among women (Figure 2). At present, the causes of this high incidence of CML are not known, but epidemiological studies have been initiated to address this growing problem. A preliminary study suggested it may be related to smoking (Personal Communication: Ilham A. Bashir, University of Khartoum).

Breast and Cervical Cancer account for about 50% of all cancers in Sudanese women (Figure 2). Routine screening for both these cancers has markedly reduced the mortality in the developed world, but in developing countries, which largely lack screening programs, these two cancers remain the primary cause of death due to cancer (combined crude mortality 18.5/100 000) [3]. This disparity between developed and undeveloped countries is particularly evident with cervical cancer. In 2002, there were an estimated 493 200 new cases of cervical cancer in the world, 83% of which were in developing countries, and 273 500 deaths due to cervical cancer, 85% of which were in developing countries [3]. Widespread testing for HPV has reduced the mortality from cervical cancer in developed countries (age-adjusted mortality 4.0/100 000), but in Sudan (12.7/100 000), as in other developing countries (11.2/100 000), cervical cancer remains the major cause of death due to cancer in women [3].
Nasopharyngeal cancer is relatively rare, occurring at an incidence of less than 1 per 100,000 in most populations [4]. However, the incidence of this tumour is much higher in certain regions such as Southern China (20–30 per 100,000 men, 15–20 per 100,000 women) [4], in some regions of Northern Africa including Sudan, in Kuwait, and in isolated populations such as Inuits [5]. A previous study using records from our institute and the Sudan Cancer Registry also found that this type of tumour was very common in Sudan, frequently presented in younger patients, and that the ethnic and geographical distribution of the cases suggested the possibility of a genetic susceptibility [6]. Studies in Chinese populations in China and in North America have also suggested a genetic basis for this cancer [7, 8]. There is also increasing evidence that the Epstein–Barr virus (EBV) is an important etiological factor for nasopharyngeal cancer [9]. A preliminary study in Sudan found higher EBV capsid antigen antibody titers in nasopharyngeal carcinoma patients that were independent of age, ethnic population or locale [10].

Although lung cancer is not one of the 10 most common cancers in Sudan, tobacco-related oral cancers are evident in this list. In Sudan, tobacco is commonly consumed in a moist form of oral dipping tobacco called toombak, which is left in the mouth for extended periods. Toombak has been shown to contain very high levels of carcinogenic tobacco-specific nitrosamines [11], and has been associated with risk for oral cancer [12]. Over one-third of adult males may use toombak regularly, and the prevalence among older men in rural areas is close to 50% [13]. Oesophageal cancer is the fourth most common cause of cancer in Sudanese males, and the fifth most common in females (Figures 1 and 2). The incidence of tobacco smoking is increasing in Sudan, particularly among urban adult males, and we expect to see a rapid increase in other tobacco smoking-related cancers in the near future. Public education has been shown to have a major impact on the incidence of preventable cancers like tobacco-related cancers, and we discuss below initiatives that have been undertaken in Sudan to increase awareness of the risks of tobacco.

A major challenge to treatment of cancer in Sudan, as in most developing countries, is that most patients first present with advanced stage disease. A total of 78% of Sudanese patients have stage III or IV disease (TNM classification) when they first seek medical treatment (data from Sudan Federal Ministry of Health). In these stages, treatment may often involve multiple modalities, including surgery, radiotherapy, chemotherapy and hormone therapy, and has a markedly diminished chance of success. In addition, cancers like cervical cancer are largely curable if detected early. Therefore, there is an urgent need for better early detection of cancer in Sudan to make treatment more effective, less costly, less invasive, and more accessible and acceptable to patients.

### cancer early detection initiatives

Effective early detection of cancer requires both early diagnosis in symptomatic patients and screening of asymptomatic patients at risk. In low-resource settings, any programme for early detection must be focused and sustainable. In Sudan, we are implementing early screening programmes for three cancers, breast, cervical and oral cancer, that were selected because of their prevalence, and because the efficacy and cost effectiveness of screening and prevention for these cancer has been shown.

### Table 1. Ten leading causes of death in Sudan hospitals in 2000.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Number of deaths</th>
<th>% of total deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>2162</td>
<td>19.1</td>
</tr>
<tr>
<td>Viral pneumonia</td>
<td>691</td>
<td>6.1</td>
</tr>
<tr>
<td>Malignant neoplasms</td>
<td>530</td>
<td>4.7</td>
</tr>
<tr>
<td>Iron deficiency anaemias</td>
<td>504</td>
<td>4.4</td>
</tr>
<tr>
<td>Streptococcal septicemia</td>
<td>434</td>
<td>3.8</td>
</tr>
<tr>
<td>Heart failure</td>
<td>403</td>
<td>3.6</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>387</td>
<td>3.4</td>
</tr>
<tr>
<td>Severe malnutrition</td>
<td>382</td>
<td>3.4</td>
</tr>
<tr>
<td>Meningococcal infection</td>
<td>362</td>
<td>3.2</td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
<td>351</td>
<td>3.1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>6206</td>
<td>54.7</td>
</tr>
</tbody>
</table>

### Figure 1. Ten most common cancers in Sudanese males. Based on referrals data from the Radiation & Isotopes Centre of Khartoum (RICK), the only cancer centre in Sudan prior to 2002. Incidence is percentage of total number of referrals to RICK. CML, chronic myeloid leukemia. NHL, non-Hodgkin’s lymphoma.

### Figure 2. Ten most common cancers in Sudanese women. Based on referrals data from RICK. CML, chronic myeloid leukemia. NHL, non-Hodgkin’s lymphoma.
The initial NCCP established in Sudan in 1982 had three primary objectives: To update the National Cancer Centre (RICK) to provide adequate therapeutic and diagnostic facilities for cancer patients, to develop sufficient trained healthcare personnel to meet cancer patients needs, and to develop a programme for early detection of cancer. The NCCP in Sudan was updated according to the new WHO NCCP Managerial Guidelines [1], to include primary prevention, secondary prevention including early detection and screening, diagnosis and treatment, and palliative care. These guidelines, which were an important resource in the planning of Sudan’s screening programme, identify, for example, a number of factors that must be taken in account when any screening technique is being assessed for efficacy (Table 2).

In developing countries the cost of any test is also a very important consideration. The WHO guidelines note that any NCCP should avoid imposing the ‘high technology’ of the developed world on countries that lack the infrastructure and resources to use the technology appropriately or to achieve adequate coverage of the population. In addition to the cost of any specific test, there must be sufficient numbers of personnel and facilities to perform the screening tests. In fact, in Sudan initial attempts to screen women at risk for cervical cancer were severely limited by the lack of facilities to perform the screening. While this is being addressed, we have undertaken an education programme to improve the knowledge of detection of cervical cancer among young doctors and postgraduate students. The population to be screened must be carefully selected based on accurate epidemiologic data for the country. Like many developing countries, in Sudan cancer may occur in patients at least 10 years younger than in the developed world. Therefore, the national screening programme for cervical cancer, for example, targets women aged 35 to 50 years. This underscores the importance of having solid data on the incidence of cancer in each country planning to institute an NCCP.

For an early detection programme to be sustainable, there must be comprehensive diagnostic facilities, adequate treatment for diagnosed cases, and a well-planned follow-up protocol for patients with positive results, so that the diagnosis can be rapidly confirmed and appropriate therapy commenced. These requirements can be an enormous challenge in a developing country. For example, Sudan only established the first facility for proper immunohistochemical screening of tumours in the last year. Prior to that, all breast cancer patients were treated empirically with hormone therapy because it was not possible to determine their estrogen receptor status, which placed a large...

Table 2. WHO NCCP Policies and Managerial Guidelines: Factors to take into account when reviewing a screening technique [1]

- **Sensitivity**: the effectiveness of a test in detecting a cancer in those who have the disease;
- **Specificity**: the extent to which a test gives negative results in those that are free of the disease;
- **Positive predictive value**: the extent to which subjects have the disease in those that give a positive test result;
- **Negative predictive value**: the extent to which subjects are free of the disease in those that give a negative test result;
- **Acceptability**: the extent to which those for whom the test is designed agree to be tested.

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**Figure 3.** Poster from public awareness campaign on Toombak, a moist oral tobacco widely used in Sudan. Inset shows severe leucoplakia on the gingiva and lower lip, and thinning and loosening of teeth that are associated with toombak consumption. Malignant changes are usually observed at the site where the toombak is placed in the mouth.
burden on the health system and on the patients themselves, and impacted the effectiveness of treatment. When computed tomography and MRI screening first became available in Sudan, there were too few neurosurgeons to treat the increased numbers of patients diagnosed with space-occupying lesions in the brain.

**public education initiatives**

More than one-third of all cancers are preventable. A second major component of any cancer early detection programme is education to promote early diagnosis and ensure compliance with screening programmes. Any education strategy must work to increase awareness among the public and among healthcare professionals.

In many countries cancer may carry a stigma that prevents people from seeking medical care in the early stages of the disease. In Sudan, there is a common perception that cancer is transmissible, leading to isolation of patients and breakdown of marriages, which may lead patients to hesitate to seek proper care. Ignorance about the signs and symptoms of cancer also means many people do not present until they have very advanced disease.

Sudan has initiated a series of educational strategies for both the general public and medical professionals that aim to dispel many of the misconceptions about cancer and promote early detection and referral of cancer patients. In considering the range of communication channels, radio was selected as an important medium in a country where 80% of the population is rural or nomadic, and where literacy rates remain low, but television and newspapers have also been considered. Face-to-face contact reinforced by posters and other publications in the workplace, schools, hospitals, youth clubs and places of worship is also an effective means of raising awareness (Figure 3). To raise awareness amongst women about the importance of self-examination for breast irregularities, a simple booklet was produced and widely distributed (Figure 4).

In all these approaches, healthcare professionals play a key role, but often in developing countries where the burden of disease has been primarily infections, the medical community itself must also be educated about the importance of detection and early treatment of cancer. Sudan has started programmes to train health professionals on the hazards of major environmental health risks like tobacco smoking and alcohol consumption, on the benefits of a healthy diet and risks of obesity, on the effective implementation of screening, and on the importance of recognizing the early signs of common cancers and referring those patients for appropriate care.

**evaluation of the Sudan NCCP**

The NCCP in Sudan has an integrated system for ongoing evaluation of its effectiveness, efficiency, competence, appropriateness and accessibility. Key outcome indicators include: quality of life of cancer patients, incidence of disease, staging of disease at presentation, and outcome of treatment, including overall and disease-free survival rates in patients. To handle all this data, an information management system was put in place at the initiation of this programme. Although all evaluation data is not yet available, there is already evidence that the NCCP is having an impact by leading to earlier diagnoses and more patients receiving treatment. The quality of life of many patients has also been improved with the provision of a standard palliative care programme. Furthermore, primary prevention measures are also having an effect, with some evidence of a decrease in tobacco and alcohol consumption, and the endorsement and implementation of new legislation on control of these risk factors.

**conclusions**

The cancer epidemic represents a huge challenge to developing countries. A comprehensive NCCP is mandatory for developing countries to ensure that limited resources are optimally used. Well-managed programmes for screening and early detection of cancer are essential to reduce the proportion of patients presenting with advanced disease, and coordinated education strategies that target both the public and health professionals must be vigorously pursued. Sudan provides an example of how an NCCP can be implemented in a very low-resource setting to improve the lives of cancer patients.
disclosures
The author has nothing to disclose.

references