Prevalence of Oesophageal, Cervical, Breast and Prostate Cancers at the Chris Hani Baragwanath Hospital in Johannesburg, South Africa (1954-2010)

C Isaacson, M Altini, P Michelow and M Hale

Department of Anatomical Pathology, School of Pathology, University of the Witwatersrand, and National Health Laboratory Service, Johannesburg, South Africa

*Corresponding author: Dr. M Hale, Department of Anatomical Pathology, School of Pathology, University of the Witwatersrand and National Health Laboratory Service, Johannesburg, South Africa, Tel: +2711 489 8479; E-mail: martin.hale@nhls.ac.za

Received Date: 07 June, 2016; Accepted Date: 16 November, 2017; Publication Date: 13 December, 2017

Abstract

Background: The aim of this study was to evaluate the prevalence of cancers of the oesophagus, cervix, breast and prostate and of cervical pre-cancer which were histologically or cytologically diagnosed at the Chris Hani Baragwanath Hospital, Johannesburg, over a period of 56 years (1954-2010).

Methods: The archival records of the Department of Anatomical Pathology, at Chris Hani Baragwanath Hospital, were manually searched.

Results: While the prevalence of cancer of the breast, and prostate have increased dramatically reaching a peak in 2010, the prevalence of cancer of the oesophagus, after reaching a peak in 1987, has decreased. The prevalence of cancer of the cervix has remained stable, however the prevalence of cervical pre-cancer has risen sharply.

Conclusions: The key question is whether the increasing trend in prevalence rates are real or represent an artefact resulting from increased medical surveillance, development of better diagnostic modalities or an increase in the numbers of patient at risk. We suggest that urbanisation and adoption of a western life-style contributed to the sharp increases in the numbers of new cases observed in this study.

Keywords:
Prevalence; Cancer; Pre-cancer; Oesophagus; Breast; Cervix; Prostate
Introduction
Social, nutritional, hormonal, infectious and environmental factors may play a major role in the aetiology of certain cancers especially in emerging populations. The aim of this study was to evaluate the prevalence of cancers of the oesophagus, cervix, breast and prostate and of cervical pre-cancer in a hospital sample of mainly black South Africans and to suggest possible mechanisms which may show how urbanisation, the adoption of a western life-style with a diet rich in saturated fats and obesity, may have played a significant role in the genesis of these tumours.

Clinical setting
The clinical setting for this study was the Chris Hani Baragwanath Hospital, in Johannesburg, South Africa, which is the largest hospital in the southern hemisphere. It is a 3200 beds hospital which is financed and managed by the Gauteng Provincial Department of Health and is a teaching hospital for the Faculty of Health Sciences, University of the Witwatersrand. The hospital mainly serves the people of SOWETO (South-Western Townships) but also admits patients from a wider South African and African catchment area. Soon after the opening of the hospital in 1947, government policies determined that only black patients be treated. The advent of democracy in South Africa, in 1994, ensured that the hospital was opened to all races, but its geographic location and socio-economic realities determined that the hospital continues to admit a high proportion of black patients. More than 2000 patients per day are seen at the Hospital’s specialist clinics and out-patient departments. No one is quite sure how large the population of SOWETO is. The influx of huge numbers of refugees and continued urbanisation of the South African population has made estimation very difficult, but a population size of up to 3 million is thought to be a reasonable estimate.

Histopathology services at Chris Hani Baragwanath Hospital have been rendered by the Department of Anatomical Pathology, since its inception at the hospital in 1954 as part of the University of the Witwatersrand and South African Institute for Medical Research (SAIMR). Prior to 1954 the Johannesburg laboratory of the SAIMR was responsible for reporting the histopathology from Chris Hani Baragwanath Hospital. The Department of Anatomical Pathology is now a joint structure of the National Health Laboratory Service (NHLS) and of the University of the Witwatersrand.

Methods
Data collection

The accessions registers, the card index and the NHLS-DISA computerized SNOMED systems were manually searched for all cases of cancer of the oesophagus, cervix, breast and prostate which had been histologically diagnosed in the Department of Anatomical Pathology at Chris Hani Baragwanath Hospital since its inception in 1954 to 2010. Care was taken not to duplicate any cases and only new cases were included. Only those cases in which the diagnosis was histologically confirmed were included except for the data on cervical high grade squamous intra-epithelial lesions (HSIL) when cytological smears were used. The microscopic slides were not reviewed to confirm the histological or cytological diagnosis. Only the sign-out diagnosis was recorded. The early data for the prevalence of cancer of the oesophagus (1913-1954) was obtained from the Johannesburg laboratory of the SAIMR.

Results
Oesophagus

Carcinoma of the oesophagus started manifesting at Chris Hani Baragwanath Hospital in the 1930s with an average of 4 cases per year. The prevalence doubled to average 9 cases per year in the 1940s and doubled again to average 18 cases per year in the 1950s. The number of cases then increased rapidly to average 160 cases per year in the 1960s, 176 in the 1970s and 225 in the 1980s. The peak prevalence occurred in 1987 when 255 cases were recorded. After that the numbers of cases started to decline to average 134 cases per year in the period 1991 to 2000 and showed a further substantial decrease to average 44 cases per year in the period 2001 to 2010. In 2010, 50 cases were recorded (Figure 1).
Cervix

Cervical pre-cancer (High grade squamous intra-epithelial lesion- HSIL): These included all cases diagnosed as cervical intra-epithelial neoplasia (CIN II and III), carcinoma in situ and high grade squamous intraepithelial lesion. The diagnoses were made on cervical smears. An average of 14 cases per year were recorded in the period 1961-1970. The prevalence increased more than 10 folds, to average 151 cases per year in the 1970s and then increased to average 220 cases per year in the 1980s. The prevalence then decreased to average 130 cases per year in the 1990s and then showed a 10 folds increase to average 1257 cases per year during the period 2001 to 2010. The peak prevalence occurred in 2010 when 1842 cases were diagnosed (Figure 2). Cytological smears as a basis for screening for cervical pre-cancer were not routinely available prior to 1965 and hence data for this period is missing.

Figure 1: Number of cases per year of cancer of the oesophagus. Note the sharp decline in prevalence since 1987. Reprinted with kind permission of the Editor – South African Medical Journal [7].

Figure 2: Number of cases per year of high grade squamous intra-epithelial lesion.
Figure 2: Number of cases per year of cervical high-grade squamous intra-epithelial lesion (HSIL). The prevalence has risen sharply since 2005.

Cancer of the cervix: Cancer of the cervix was consistently the most commonly diagnosed cancer in the population studied. During the period 1954 to 1960 the average number of cases per year was 91. This increased to average 97 cases per year during the period 1961 to 1970 and further increased markedly to average 148 cases per year in the period 1971 to 1980. A further increase to 165 cases per year was noticed in the period 1981 to 1990 and to 174 cases per year in the period 1991 to 2000. The average then decreased slightly to 163 cases per year in the period 2001 to 2010. The highest annual frequency occurred in 1993 when 225 cases were recorded. In 2010 the frequency was 198 cases (Figure 3).

Figure 3: Number of cases per year of cancer of the cervix. The prevalence seems to have stabilised although the increasing trend since 2007 is cause for concern.

Breast

Cancer of the breast has shown a steady, continuous and marked rise in prevalence since an initial yearly average of 16 cases in the period 1954 to 1960. The average number of cases per year more than doubled to 39 in the 1960s, doubled again to 75 cases in the 1980s and then showed a further increase to average 88 cases per year in the period 1991 to 2000. The prevalence then approximately doubled again to average 148 cases per year in the period 2001 to 2010. The annual prevalence peaked in the year 2010 at 266 cases (Figure 4).
Figure 4: Number of cases per year of cancer of the breast. Note the increasing prevalence since 1997 and the sharp increase since 2007.

Prostate

Cancer of the prostate has shown a more than 40 folds increase in frequency since the first cases were recorded in 1954. In the period 1954 to 1960 an average of 6 cases per year were recorded. This number then increased three folds to average 17 cases per year in the period 1961 to 1970, then showed a sharp increase to average 48 cases per year in 1971 to 1980 and 76 cases per year in 1981 to 1990. The numbers continued to increase to average 95 cases per year in 1991 to 2000 and then virtually doubled to 178 cases per year in the period 2001-2010. The peak frequency occurred in 2010, with 249 cases occurring in that year (Figure 5).

Figure 5: Number of cases per year of cancer of the prostate. The prevalence has been sharply increasing since 1975.
Discussion

Before the advent of computerisation the early data was recorded on a diagnostic card index system. Unfortunately, some of the cards were ‘missing’ and this resulted in some data not being available for this study. Nevertheless, the trends shown by the data have not been affected.

The results of our study show, a marked increase in prevalence of cancers of the, breast and prostate and of cervical pre-cancer (HSIL). The key question however is whether this represents a real increase or is an artefact resulting from improved medical surveillance and better detection methods or the establishment of community-based screening programs. Other factors which need to be considered are whether there has been an increased patient flow through the hospital, the effect of the HIV pandemic and the development of better clinical diagnostic and surgical modalities. For example, in the field of prostate cancer development of the trans-urethral resection surgical procedure (TURP) and of the PSA test are held to largely be responsible for an almost doubling of the incidence of prostate cancer in Scotland [1]. In the case of breast cancer, mammography screening has had an enormous impact on breast cancer incidence rates [2], while cytology screening has similarly resulted in the early detection of numerous cases of cervical pre-cancer and cancer.

The numbers of persons at risk of developing these cancers has increased in keeping with the greater numbers of people living in SOWETO and surrounding areas and due to an increase in their life expectancy. But to what extent this has occurred, and how this might have influenced the patient flow at Chris Hani Baragwanath Hospital remains open to conjecture.

It is well known that the population at risk is in the midst of an HIV pandemic and that this is closely associated with increased numbers of cancers such as lymphomas, Kaposi sarcoma, and cervical cancer. Studies have shown that up to 60% of admissions at Chris Hani Baragwanath Hospital are HIV sero-positive, but the extent to which HIV has contributed to the increased frequency of cancer in these patients remains unknown. It should however be pointed out that the increasing trend began before the emergence of the HIV pandemic and that in the case of the oesophagus the numbers are currently decreasing.

The frequency of cancer of the oesophagus increased rapidly in our sample in the period 1960 to 1994 reaching a peak in 1987 of 287 cases per year. Early epidemiological studies carried out in 1975 and 1976 led investigators to conclude that tobacco smoking, especially in traditional pipes, and malnutrition were of prime importance in the aetiology of this condition. Use of alcohol did not seem to play any significant role [3]. The emphasis changed to a dietary factor with the description of high levels of iron in the organs of patients with and without carcinoma of the oesophagus [4]. The iron was thought to be derived from large iron pots in which the local population brewed traditional beer. The greater the consumption of traditional beer, the higher the tissue levels of haemosiderin and the higher the risk of developing cancer of the oesophagus. However, the iron turned out merely to be a marker for the amount of alcohol consumed and was soon shown to play no direct role in the aetiology of this cancer. In any event use of the pots had been supplanted by large plastic containers. Attention turned to another dietary factor [5]. It has been suggested that a change in the staple diet of South Africans from sorghum to maize (corn) had occurred around the turn of the century and that the use of mouldy maize in the home brewing of traditional beer was responsible for the increased prevalence of this disease. The culpable agent was a mould or fungus, Fusarium moniliforme, that grew freely on maize but not on sorghum, producing a myco-toxin, fumonisins, which produced carcinogenic nitrosamines from nitrates and nitrites [5]. The induction of tumours of the oesophageal wall in experimental animals using methyl-alkyl– nitrosamines has been demonstrated [6]. Experimental research at the Medical School of the University of the Witwatersrand, has now shown the presence of carcinogenic nitrosamines in all samples of home brewed traditional beer tested [7].

The decreasing prevalence of cancer of the oesophagus which has occurred during the last decade may possibly be explained by increased incomes resulting in diminished consumption of home brewed
traditional beer and its replacement with commercially produced beer or spirits.

Cervical cancer is one of the most common cancers of women, especially in developing countries where 80% of all cases occur. In nearly all cases cervical cancer is preceded by precancerous lesions (HSIL). Early detection and adequate treatment of these precancerous lesions may prevent transformation to cervical cancer. In any event not all cases of HSIL will inevitably transform into cervical cancer. In our population cervical cancer was the most common of the cancers studied.

There is general acceptance that cervical cancer and its precursor lesions are due to infection with high risk HPV types. The vast majority of HPV infections are cleared within 18-24 months in women with a competent immune system. Persistent infection is the first step towards cervical dysplasia and cancer. Factors that increase the risk of HPV infection and cell dis-regulation include HIV/AIDS, smoking, multiple sexual partners, age at first intercourse, unsafe sexual practices, lack of personal hygiene and other sexually transmitted infections such as Chlamydia. It is easy therefore to understand why cervical cancer is reaching epidemic proportions in susceptible populations. A direct interaction between HIV and HPV increases the risk of HPV replication and transcription.

The huge surge in the number of cases of HSIL is undoubtedly a reflection of the HIV-HPV pandemic and the evolution of cytology as a diagnostic discipline in South Africa, which occurred from the 1970s and to higher detection rates of in situ lesions brought about by cervical screening programmes.

Correlation of our data for cervical cancer and HSIL showed that as the number of cases of HSIL increased so the number of cervical cancers stabilised and even decreased, thus emphasising the effectiveness of cytological screening programs, albeit limited, together with adequate surgical treatment of HSIL in preventing its transformation to invasive squamous carcinoma. Thus, despite the explosion in frequency of HSIL the number of cervical cancers has largely remained static and even slightly decreased.

Prevention of cervical cancer lies in sexual abstinence, safe sexual practices, male circumcision and limiting the numbers of sexual partners, early diagnosis and treatment of precancerous lesions and the use of HPV preventive vaccines. Well organised cytological based cervical screening programmes have seen a dramatic decline in the incidence and mortality of cervical cancer in both developed and less resourced countries [8]. Unfortunately, such screening programmes are limited and opportunistic in South Africa.

There is a great deal of evidence that obesity and or weight gain are risk factors for the development of breast cancer especially in post-menopausal women. In addition, elevated body mass index has a negative impact on prognosis for both pre-and post-menopausal women. Elevated serum oestrogen levels are considered to be primary mediators of how increased body weight promotes breast cancer development [9]. The high incidence of breast cancer in Western women has been linked to dietary factors such as high-fat/low-fibre diet and to obesity. It is postulated that a western diet rich in saturated fats, with inadequate exercise, and excessive weight gain at the time of a major change in hormonal balance, favours the manifestation of insulin resistance and that the hyper-insulinaemia acting in synergism with oestrogens promotes the development of breast cancer. It is suggested that the development of insulin resistance may be the link between obesity and increased breast cancer risk. Large abdominal fat deposits in women are frequently a marker of the presence of insulin resistance and are generally associated with an increased breast cancer risk from puberty onwards [10,11]. A further risk factor seems to be the frying of red meat products which has increased in popularity as urbanisation has taken place and as disposable incomes have increased.

As in many other countries, the frequency of prostatic cancer, has also increased in the population studied. Ageing of the population can only partially explain these observations. The extent to which this increase is due to increased detection through the advent of TURP and the PSA test is debateable. Whether early detection results in the diagnosis of tumours which would eventually cause symptoms or the detection of latent disease which may never have
become symptomatic is not clear. Increased detection has resulted in a considerable variation in incidence in different areas of Scotland. However, the increase in incidence was not accompanied by any substantial reduction in mortality. In addition, during the period 1981 to 1988 the incidence of prostatic cancer in Scotland could be closely correlated with TURP rates and in 1989 to 1996 with PSA testing rates. Furthermore, the mortality rates did not appear to be consistently higher or lower in health boards with high incidence and therefore presumably high detection rates. These authors concluded that in Scotland although a true increase in incidence cannot be discarded, most if not all of the increased incidence can be explained by better diagnosis resulting in early detection [1].

Although traditionally androgens have been considered to be the major sex hormone promoting and regulating both normal and abnormal growth of the prostate, epidemiologic and experimental data suggest that oestrogens play a major role in the pathogenesis of prostatic cancer [12-13]. The oestrogens act either alone or in synergy with androgens. Amongst the various cellular mediators, a key role for ER beta in the pathogenesis, progression and spread of prostate cancer has been determined. In fact it is even suggested that the risk of developing cancer of the prostate could be determined during early developmental life by a programme referred to as “oestrogen imprinting” [14].

Previous studies have shown an association between diets high in red meats and the risk of prostate cancer. A recent study has, in addition, shown that the method of cooking the meat is also of importance. Cooking red meat at high temperatures especially pan fried red meat may increase the risk of prostate cancer by as much as 40 %. The study found that men who ate more than 1 ½ servings of pan-fried- red meat per week, especially cooked at high temperature substantially increased their risk of developing cancer of the prostate. Researchers suspect that the higher risk is due to the formation of DNA damaging carcinogens especially heterocyclic amines and polycyclic aromatic hydrocarbons [15]. A second study linked the eating of deep- fried food such as French fries, fried chicken, fried fish doughnuts and snack chips to an increased risk of prostate cancer [16]. The potentially carcinogenic compounds included acrylamide, aromatic amines and polycyclic hydrocarbons. The authors also suggested that this linkage may be the result of the high consumption of fast foods, in general, citing the dramatic increase in fast food outlets in the USA in the past several decades. Similar observation may well be applicable to breast cancer.

Conclusion

The results of our study which was based on proven histological and cytological diagnoses has shown alarming increases in prevalence of pre-cancerous lesions of the cervix and of breast and prostate cancer in an urban black South African hospital sample. However, these increases may in some instances be ascribed to early detection or better detection methods, or increased life expectancy. Population based incidence studies will be needed to substantiate these observations. The aetiology of these cancers is both complex and varied including chemical carcinogens, hormones and infectious agents. We have suggested that dietary and socio-economic factors play a key role in the pathogenesis of these cancers, and that adoption of a western life-style with a diet which is rich in saturated fats, obesity and promiscuity are important factors in the pathogenesis of these tumors.

Contrary to the increases in prevalence of cervical pre-cancer, of cancer of the breast and of the prostate there has been a sharp decline in the prevalence of oesophageal cancer, an event which has occurred without any medical intervention.

Conflict of Interest

The authors declared that there is no conflict of interest.

Ethics

Human Research Ethics Committee (Medical), University of the Witwatersrand (M 10744).
References