Emerging epidemic of cardiovascular disease among urban Africans: Acute coronary syndrome at Baragwanath Hospital, Soweto

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ABSTRACT

Objectives:
To describe the recent increase in acute coronary syndromes among urban black South Africans in Soweto.

Design:
Cross-sectional study in 2004 and comparison with data from 1975-80.

Setting:
Chris Hani Baragwanath Hospital, Soweto.

Participants:
Patients admitted with a diagnosis of troponin positive acute coronary syndrome (ACS) in 2004, to Coronary Care Unit (CCU) and patients admitted with a diagnosis of acute myocardial infarction (AMI) in 1975-80.

Results:
We identified 154 patients with ACS in 2004. Of these 64 (42%) were black, 50 (32%) were white and 40 (26%) Asian. Between 1975 and 80, 54 patients were diagnosed with AMI (50 were black). Mean age in 2004 was 56 years and most were men (110; 71%). Risk factor prevalence was high in 2004. Black patients tended to be younger, less likely to have diabetes than Asians, and much less likely to have a family history of coronary artery disease. Black patients were more likely to have only one coronary artery affected by atherosclerosis than were white patients (48% vs 26%, p=0.07). Eight patients died in 2004 (5%) and eight in 1975-80 (15%).

Conclusion:
The annual incidence of ACS among black Africans has increased rapidly in Soweto. There seem to be significant differences in risk factor profile and extent of coronary arteries involved among the different ethnic groups studied. Continued emergence of coronary artery disease implies a significant additional burden to the health system.

KS and CA conceived of the study. Supervised data collection, and drafted the paper. CA, LN and AB collected data. DW and SS contributed to data analysis and paper drafting. EL analysed data. All authors reviewed the final paper.

No funding was used to support this study.
Introduction
The burden and spectrum of non-communicable diseases differs considerably between Africa and more developed countries. Doctors working in rural African settings observe the virtual absence of coronary artery disease. The frequency of ischaemic heart disease has been documented as being very low among black South Africans with an average of three patients each year admitted to Baragwanath Hospital, Soweto, South Africa with acute myocardial infarction (AMI) in the 1950s. However, it is now widely recognised that, in association with urbanisation and its associated epidemiological transition, Africa is facing a significant burden of non-communicable diseases, many of which act as risk factors for cardiovascular disease. It has been suggested that the prevalence of coronary artery disease is increasing in sub-Saharan Africa but there is limited data to confirm this, and what is available suggests regional variation. Furthermore, ethnicity, a construct that encompasses both cultural (e.g. language, habits, diet) and possibly genetic factors, is a potentially important additional factor explaining such variation.

Between 1975 and 1980 at Baragwanath Hospital, serving the (then) almost exclusively black African population of Soweto only 54 cases of AMI were reported (50 black Africans; average eight each year in a community of approximately one million in size). We have recently observed a significant change in the burden and spectrum of cardiovascular disease at Baragwanath Hospital, including the increased presentation of ischaemic heart disease. The population served by the hospital has however also changed to include Africans of European and Asian ancestry. This paper characterises acute coronary syndrome (ACS) at this hospital and compares the results with a study on acute myocardial infarction carried out in the same hospital between 1975 and 1980. A comparison is made in order to quantify the magnitude of change in the presentation of ACS in Soweto over the past 25 years.

Methods
Setting
Baragwanath Hospital has 3 300 beds and is the largest hospital in the southern hemisphere, with about 100 medical admissions each day. In 1975 the hospital had 2 734 beds with an average of 70 general medical admissions daily. The hospital historically served the (essentially black African) population of Soweto, reportedly comprising around one million people situated in the outskirts of Johannesburg. Since the re-organisation of South Africa’s health services along non-racial lines in 1994, Baragwanath now serves a mixed population, drawing Africans of Asian (Indian) ancestry from Lenasia, and Africans of European ancestry from Vereeniging. The total population served is estimated at 1.5 million, of which 1 million of these are black Africans. The coronary care unit at Baragwanath Hospital now routinely cares for black, Asian and white patients.

The above-mentioned population groups in the given geographical regions are also served by a network of primary care clinics and secondary care level hospitals. However, the Department of Cardiology at Baragwanath Hospital is the only source of specialist cardiology care in the public health system in Soweto. The cardiology outpatient clinic, which cares for about 100 patients each day (20-30 new patients) sees mainly non-referred patients (hence effectively providing a primary care service), but also sees patients admitted to the medical wards with a cardiac diagnosis. Furthermore the coronary care unit in the department is the only one serving this population, as is the coronary angiography service (in the public system). Patients have access to private health care if they can afford it.

The study was approved by the University of the Witwatersrand Ethics Committee. The cohort of patients studied were part of a larger group that participated in the on-going acute coronary syndrome study.

Methodology
We carried out a cross-sectional study of patients admitted to the coronary care unit (CCU) in 2004, with ACS and positive troponin T test in accordance with the current European Society of Cardiology guidelines (www.escardio.org). All patients presenting with ACS are routinely admitted to the CCU for further evaluation and treatment. This syndrome comprises the following specific diagnoses:

- **ST elevation myocardial infarction**: characterised by typical symptoms of acute myocardial ischaemia in addition to a positive serum troponin T concentration and evolving ST-segment elevation of ≥ 0.1 mV in two or more contiguous ECG leads.
- **Non-ST elevation myocardial infarction**: characterised by typical symptoms and a positive troponin T concentration, but with ECG changes indicative of acute myocardial ischaemia (i.e. ST-segment depression in two or more contiguous ECG leads).
- **Unstable angina pectoris**: characterised by typical symptoms of worsening angina pectoris or occurring at rest with ECG changes indicative of myocardial ischaemia. All patients included in the study presenting with unstable angina, ST elevation or non-ST elevation infarction needed to have a positive troponin T concentration to be included. Acute coronary syndromes share the same common pathophysiologic mechanism, namely disruption of atherosclerotic plaque with different degrees of superimposed intra-coronary thrombus and distal embolisation. For all patients admitted with this diagnosis in 2004, we collected data on demographic factors (age, gender, ethnicity), cardiovascular risk factors (previously diagnosed hypertension, diabetes, hypercholesterolaemia, current smoking, family history), blood pressure and electrocardiogram, standard Bruce stress test, coronary angiography, and left ventricular angiography. All diagnoses and results of investigations were verified by a qualified cardiologist and independently reviewed by KS.
Statistical analysis

Data for this study were entered into an Excel spreadsheet. Values are expressed as means ± standard deviation and percentages. Mean values were compared using ANOVA for normally distributed data. Percentages were compared using Chi-square test. A p value less than 0.05 was regarded as significant.

Results

Characteristics

In total, 154 patients with a diagnosis of ACS were admitted to the CCU of Baragwanath Hospital in 2004. The mean age was 56 years and there were more male (110; 71%) than female patients (Table I). Most patients were black (64; 42%), with 50 (32%) white and 40 (26%) Asian (Indian). The gender distribution was similar for each ethnic group.

The prevalence of risk factors was high (Table I) and similar in each ethnic group. However, black patients were significantly younger, less likely to have diabetes or dyslipidaemia than Asian patients, and much less likely to have a family history of coronary artery disease than either Asians or whites (Table II).

Coronary disease patterns, intervention and outcomes

There were significant differences in the type and extent of coronary artery disease among these patients (Table III). Black patients were more likely to have single vessel disease than were white patients (48 vs 26%, p=0.07), while the distribution of vessels affected by atherosclerosis was similar among black and Asian (Indian) patients. In all, 76 patients (53%) had PTCA and 35 (24%) had coronary artery bypass graft surgery. At index admission eight patients died in 2004 (5%) and eight in 1975-80 (15%).

Temporal trends

Between 1975 and 1980 only 54 patients were admitted to the intensive care unit of Baragwanath Hospital with a diagnosis of AMI, 50 of whom were black Africans (eighth per annum) and in the 1950s an average of three patients per annum with AMI were identified.

### Table I: Baseline characteristics (n = 154)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) (SD)</td>
<td>56.4 (11.8)</td>
</tr>
<tr>
<td>Gender (male) (%)</td>
<td>110 (71%)</td>
</tr>
<tr>
<td>Smoker (n = 145) (%)</td>
<td>83 (57%)</td>
</tr>
<tr>
<td>Hypertension (n = 143) (%)</td>
<td>84 (59%)</td>
</tr>
<tr>
<td>Family history (n = 149) (%)</td>
<td>53 (36%)</td>
</tr>
<tr>
<td>Dyslipidaemia (n = 148) (%)</td>
<td>61 (41%)</td>
</tr>
<tr>
<td>Diabetes (n = 149) (%)</td>
<td>49 (33%)</td>
</tr>
</tbody>
</table>

LV: left ventricular; EF: ejection fraction

In those years the hospital served an almost exclusively black African population. We identified 64 black Africans with acute coronary syndrome in 2004 alone (Figure I). The population of Soweto has almost certainly increased since that time and the 2001 Census determined the population to be 890 000. If we assume that all black Africans identified in our study lived in Soweto then the annual incidence of hospitalised ACS is 7/100 000. The population was estimated to be 1 million in the late 1970s, providing an annual incidence of 0.5/100 000.

### Table II: Frequency of coronary artery risk factors in patients from different ethnic groups (p-value refers to the comparison between blacks vs other ethnic groups)

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Risk factor</th>
<th>Whites</th>
<th>Asian</th>
<th>Blacks</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>50</td>
<td>40</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age (years) (SD)</td>
<td>57.7 (11.4)</td>
<td>59.5 (13.1)</td>
<td>53.6 (10.9)</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Smoker (%)</td>
<td>24/49(29%)</td>
<td>25/39 (30%)</td>
<td>34/57 (41%)</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Hypertension (%)</td>
<td>33/49 (39%)</td>
<td>18/35 (21%)</td>
<td>33/59 (39%)</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>Diabetes (%)</td>
<td>15 (31%)</td>
<td>20 (41%)</td>
<td>14 (29%)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Family history (%)</td>
<td>26 (49%)</td>
<td>18 (34%)</td>
<td>9 (17%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td></td>
<td>Dyslipidaemia (%)</td>
<td>22 (36%)</td>
<td>22 (36%)</td>
<td>17 (28%)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

### Table III: Distribution of number of coronary arteries with atherosclerotic lesions in patients from different ethnic groups

<table>
<thead>
<tr>
<th>Extent of coronary artery disease</th>
<th>Whites</th>
<th>Asian</th>
<th>Blacks</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single vessel (n,%)</td>
<td>12 (26%)</td>
<td>16 (43%)</td>
<td>29 (48%)</td>
<td>57 (40%)</td>
</tr>
<tr>
<td>Two vessel (n,%)</td>
<td>17 (37%)</td>
<td>7 (19%)</td>
<td>18 (30%)</td>
<td>42 (29%)</td>
</tr>
<tr>
<td>Triple vessel (n,%)</td>
<td>17 (37%)</td>
<td>14 (38%)</td>
<td>13 (22%)</td>
<td>44 (31%)</td>
</tr>
<tr>
<td>Total (n,%)</td>
<td>46</td>
<td>37</td>
<td>60</td>
<td>143</td>
</tr>
</tbody>
</table>
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cant epidemic of ischaemic artery disease in South Africa.

It is worth noting that reports from physicians working in the
rural areas of South Africa have reported very low rates of
ACS.5 Anecdotal observations from one of our colleagues
(DW) who had worked on stroke in the rural Agincourt area of
South Africa for 12 years showed that ACS was rare as only
one case was seen during the study period.5 Such observations
raise the important question of an epidemiologic transition due
to urbanisation, adoption of western life style and changes
from the traditional African diet to a diet high in saturated fats
consistent with a population in epidemiologic transition: Is an
urban epidemic of ischaemic heart disease emerging, second-
ary to the "westernisation" of the traditional (cardio-protective) African lifestyle in Soweto, and potentially, other urban areas?

Our data need cautious interpretation. Comparative data
come from historical publications that inevitably used differ-
ent diagnostic criteria and methods which are less sensitive
than current methods employed. Troponins have the greatest
sensitivity and specificity in detecting myocardial infarction
compared with clinical diagnosis and use of cardiac enzymes.

However, if we assume that the population estimate in the
1970s was a significant overestimate then the annual incidence
was probably higher – perhaps 1/100 000 if the population was
actually 0.5 million then. Nevertheless the annual incidence
seems to have increased considerably in recent years.

Discussion

The rising prevalence of cardiovascular diseases is an emer-
gent trend in the African continent.6,7 In this study we report on
acute coronary syndromes among urban black South Africans
in Soweto. Our data demonstrates a substantial increase in the
number of patients diagnosed with ACS at Baragwanath Hospital, South Africa in recent years. While about 50 years
ago, three such patients were identified each year,6 and about
25 years ago, five such patients were identified each year; in
2004 there were 64 black Africans with ACS. These data are
important because they may herald the emergence of a signifi-
cant epidemic of ischaemic artery disease in South Africa.

Figure 1: Comparison of the relative annual
number of patients by age group presenting
with ACS in 2004 and AMI during the
period 1975-80, for black Africans only

In our study, we used very strict criteria for diagnosis of
ACS in 2004 using current European Society of
Cardiology guidelines and it is unlikely that our 2004 data
are inflated. Although there are differences in diagnostic
criteria used in our study and the two previous studies, the
current data suggest an epidemiologic transition among
the black population from infectious diseases to non-com-
 municable diseases. Also, as unstable angina and AMI
were so rarely diagnosed 25 and 50 years ago, and are of
such clinical interest, it seems unlikely that the authors of
those reports missed significant numbers of patients.
However, a detailed prospective study is necessary to
determine the future emergence of ACS in this population.

Overall, in 2004 we noted the typical preponderance of
male cases and the high underlying prevalence of risk fac-
tors which is in keeping with coronary artery disease. Clearly,
there were some ethnic-based differences with, for example, Asian patients
demonstrating a significantly higher prevalence of dia-
betes. Conversely, black Africans were less likely to have
a positive family history of dyslipidaemia. These observa-
tions raise two important issues. Firstly, it appears that the
former likely reflects a "new" generation of coronary
artery disease in the local population with the emergence
of new "triggers" including the adoption of western
lifestyles. Secondly, the concurrent differences in dyslipi-
daemia and preponderance of single vessel disease in
black Africans suggest a different pathology in this group
of patients. One possibility is an association with HIV
infection which we are currently studying. There are
reports on AMI in HIV-positive subjects10,11 in the
literature. The possible mechanisms proposed are the use
of protease-inhibitor drugs which is associated with
increased levels of triglycerides, total cholesterol, and
low-density lipoprotein cholesterol and also its association
with advanced HIV disease.11,12 Finally we note that the
mortality rate among patients with ACS at this hospital has
fallen from 15% substantially to 5%, associated with the
use of modern therapy including thrombolysis and PTCA.

These data are important because they
may herald the emergence of a significant
epidemic of ischaemic artery disease
in South Africa

In conclusion, this study has highlighted a rising preva-
ience of coronary artery disease among South African
blacks which is in keeping with the observed epidemi-
ologic transition phase in most African countries.13,14

Although ethnic variation in risk factors was noted, most
of these factors are modifiable and efforts must be geared
towards promoting a healthy life style among the general
population in order to stem the impending epidemic of
chronic diseases in developing countries.
Louis Vogelpoel Travelling Scholarship

Applications are invited for the first annual Louis Vogelpoel Travelling Scholarship.

An amount of up to R15 000 towards the travel and accommodation costs of a local or international congress will be offered annually by the Cape Western branch of the South African Heart Association in memory of one of South Africa’s outstanding cardiologists, Dr Louis Vogelpoel.

Louis Vogelpoel was a pioneer of cardiology in South Africa who died in April 2005. He was one of the founding members of the Cardiac Clinic at Groote Schuur Hospital and University of Cape Town. He had an exceptional career over more than 5 decades as a distinguished general physician, cardiologist and horticultural scientist. His commitment to patient care, teaching and personal education is remembered by his many students, colleagues and patients. Medical students, house officers, registrars and consultants benefited from exposure to his unique blend of clinical expertise, extensive knowledge, enthusiasm and gracious style.

A gifted and enthusiastic teacher he was instrumental in the training of generations of undergraduates by regular bedside tutorials. He served as an outstanding role-model for postgraduates and many who have achieved prominence nationally and internationally acknowledged his contribution to the development of their careers.

The scholarship will be awarded for the first time in 2007 after all applications have been received and reviewed by the executive committee of the Cape Western branch of the South African Heart Association. Preference will be given to practitioners or researchers in the field of cardiovascular medicine who are members of the South African Heart Association and are resident in the Western Cape.

Applications should include:
1) a brief résumé of the work the applicant wishes to present at the congress, and
2) a brief letter of what the applicant hopes to gain by attending the relevant congress.

Applications should be sent to Prof Johan Brink, President of the Cape Western branch of the South African Heart Association, Chris Barnard Division of Cardiothoracic Surgery, Cape Heart Centre, Faculty of Health Sciences, University of Cape Town, Anzio Road, Observatory, 7925 or alternatively e-mail: johan.brink@uct.ac.za.

Applications for the first round of awards close on 15 December 2006.

References