Pattern of Atherosclerotic Diseases Among Kenyans: Reality of Myocardial Infarction.

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(Running Title: Atherosclerosis in Kenya)

Abstract:

Background: Atherosclerotic diseases such as myocardial infarction and aneurysms are rapidly gaining prominence in Sub-Saharan Africa. Data on these conditions are required to mitigate the rise, but are generally scarce.

Objective: To describe the pattern of atherosclerotic diseases in a black Kenyan population.

Materials and Methods: Cases of cardiovascular deaths were examined prospectively during autopsy at Chiromo Funeral Parlour, Department of Human Anatomy, University of Nairobi, Kenya, between December, 2005 and November, 2011. The exact cause of death was determined from antemortem history and autopsy findings. These deaths due to atherosclerotic conditions were evaluated for category, age and gender. Frequencies and means were determined. Results are presented in histograms, pie chart and tables.

Results: Out of 336 cases of cardiovascular deaths, atherosclerotic diseases were 102 (30.2%). Myocardial infarction was the most common manifestation of the atherosclerosis (39.2%) followed by ruptured cerebral (35%) and aortic (26%) aneurysms. Mean ages were 48 years, 46 and 52.8 years for myocardial infarction, cerebral aneurism and aortic aneurism respectively. About 21% of them occurred before age 40 years. All the conditions were more common in males than in females.

Conclusion: Atherosclerotic diseases constitute a major cause of cardiovascular deaths. Acute myocardial infarction is the leading manifestation of atherosclerotic disease and cause of cardiovascular mortality. More than 20% of cases occur before 40 years of age and affect more males than females. Control and preventive measures should target young people.

Keywords: Atherosclerosis, myocardial infarction, Kenyan, Africa

Introduction:
Atherosclerotic diseases have hitherto been believed to be rare in Africa, accounting for less than 1% of morbidity and mortality. Some studies have even suggested that black African people with exposure to known cardiovascular disease (CVD) risk factors are immune to acute myocardial infarction. In Kenya, an autopsy study in 2002 revealed that coronary artery atherosclerosis was not common. Over the last 10 years, however, ischaemic heart diseases appear to contribute more substantially to morbidity and mortality. The INTERHEART Africa study revealed that people from Africa who are exposed to known CVD risk factors are as vulnerable to ischaemic heart disease as their Caucasian counterparts in the developed countries. In Soweto, South Africa, for example, acute myocardial infarction and ischaemic syndromes have shown a clear increase in prevalence. In the case of stroke, age standardized mortality, case fatality and prevalence of disabling cases in Africa are similar to, or higher than those measures in most high income regions. In Kenya, clinical studies reveal that ischaemic heart disease and stroke have increased in prominence, causing 4 - 5% of deaths. We recently reported pattern of acute myocardial infarction at Kenyatta National Hospital and causes of cardiovascular deaths from an autopsy study in Nairobi. Data on atherosclerotic disease, however, still remain scarce although they are important to mitigate its projected rise. This study, therefore, aimed at describing the pattern of atherosclerotic diseases in a black Kenyan population.
History of hypertension, treatment for heart disease, angina pectoris, breathlessness at rest or exertion and leg oedema were recorded. Diagnosis of atherosclerotic disease was based on these features and autopsy findings shown in Table 1. All the autopsies were done by a consultant pathologist assisted by a research assistant for the study. During autopsy, all systems were examined, but with emphasis on the heart, lungs, brain and blood vessels. Coronary arteries were given special attention. Heart ventricles were sectioned serially 10mm apart, and myocardium inspected macroscopically for pallor, and coronary arteries checked for narrowing, blockage and hardening.

**Table 1: Criteria for diagnosis of atherosclerotic Causes of death.**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Antemortem Complaint</th>
<th>Autopsy Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocardial infarction</td>
<td>History of angina pectoris</td>
<td>Visible significant narrowing or blockage of coronary artery</td>
</tr>
<tr>
<td>History of hypertension</td>
<td>Medical record of treatment for coronary heart disease</td>
<td></td>
</tr>
<tr>
<td>Ruptured cerebral aneurysm</td>
<td>Sudden history of headache, neck stiffness and neurological deficit</td>
<td>Blood in the subarachnoid space</td>
</tr>
<tr>
<td>Ruptured aortic aneurysm</td>
<td>Sudden onset chest or abdominal pain</td>
<td>Haemoperitoneum or hematoma intradural</td>
</tr>
</tbody>
</table>

Data were analysed for age, sex and predominant cardiovascular and atherosclerotic cause of death. Those in whom age was unknown, cardiovascular diagnosis uncertain, or in whom another major pathology was detected were excluded from the study.

**Results:**
The total number of cases of natural deaths which underwent autopsy was 1200. Of these, 236 (19.7%) were due to cardiovascular diseases (CVD) or events. The spectrum of CVD extended from infective and nutritional to hypertensive and ischemic conditions. The predominant CVD were myocardial infarction (16.9%), cardiomyopathy (16.1%), and pulmonary thromboembolism (16.1%), ruptured cerebral aneurysm (13.5%) and hypertensive heart disease (12.7%). Rheumatic heart disease was the least common (Figure 1).

**Figure 1: Distribution of causes of cardiovascular deaths among black Kenyans.**

**Spectrum of atherosclerotic diseases:**
Atherosclerotic diseases were found in 102 cases (43.2%) of the cardiovascular causes, and 8.5% of all the natural deaths.

The most common complication was myocardial infarction (39.2%). Ruptured abdominal aortic aneurysm (AAA) occurred in 20% of the cases (Figure 2).

**Figure 2: Distribution of atherosclerotic diseases among black Kenyans**

**Age and gender distribution of atherosclerotic diseases:**
For the atherosclerotic diseases, 22 (21.6%) occurred below 40 years, 28 (27.5%) between 41 and 50 years, while over 50% were found after 50 years (Figure 3).

**Figure 3: Age distribution of atherosclerotic diseases among black Kenyans.**

The age distribution was, in general, similar for both male and females.

The mean age varied between the different conditions (Table 2).

**Table 2: Mean ages of atherosclerotic diseases causing death among black Kenyans.**

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>N</th>
<th>Mean age (in yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocardial infarction</td>
<td>40</td>
<td>48</td>
</tr>
<tr>
<td>Ruptured cerebral aneurysm</td>
<td>36</td>
<td>48.0</td>
</tr>
<tr>
<td>Ruptured aortic aneurysm</td>
<td>28</td>
<td>52.8</td>
</tr>
<tr>
<td>Total</td>
<td>102</td>
<td></td>
</tr>
</tbody>
</table>
The overall male:female ratio was 1.6:1 with male predominance in every condition and age group (Table 3).

Table 3: Gender Distribution of cardiovascular deaths among black Kenyans.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Gender Distribution</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>26</td>
<td>14</td>
</tr>
<tr>
<td>Ruptured cerebral aneurysm</td>
<td>22</td>
<td>14</td>
</tr>
<tr>
<td>Ruptured aortic aneurysm</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>62</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

Discussion:

Over 40% of CVD, and 8.5% of overall non-violent deaths were due to atherosclerotic diseases. This is at variance with previous reports that these diseases are uncommon\(^6,17\) and cause only 4-5% of deaths in Kenya\(^14\). This high prevalence is, nonetheless, commensurate with recent reports that in Sub-Saharan Africa, atherosclerotic diseases such as myocardial infarction and ischemic stroke have gained greater prominence\(^5,10,11,18\). This may be related to the presence of risk factors, similar to those described in Caucasian populations of developed countries\(^12,18\).

The pattern of individual atherosclerotic diseases observed in current study also indicates this shift in prominence.

Myocardial infarction (MI) was the leading cause of death accounting for 16.9%. This is at variance with studies in other African countries which reported prevalence rates of less than 10%\(^6,12,20\). autopsy studies reveal, for example, that in Ghana, the incidence of MI is very low\(^1\). In Ethiopia, MI accounts for only about 6.5% of deaths\(^1\). In West Africa, in general, it accounts for 6-9% of cases\(^1,15\) and in South Africa it constituted 3.3%\(^20\). In Kenya, an anatomopathological study revealed that coronary atherosclerosis was uncommon\(^1\). Review of the literature, however, showed that the disease and its risk factors were increasing\(^22\). The present study indicates that it is already an established problem, and a leading cause of mortality. These observations resemble those of Caucasian populations\(^23\) suggesting that atherosclerotic CVD have come of age in Kenya.

Subarachnoid hemorrhage due to ruptured cerebral aneurysm is a frequent cause of morbidity in Kenya. It is most commonly caused by ruptured intracranial aneurysms\(^24\). The current study demonstrates that stroke due to ruptured cerebral aneurysms constitutes 15.6% of CVD deaths. These findings confirm that this condition, like coronary artery disease, and therefore, atherosclerosis is a significant cause of morbidity in Kenya.

Aortic aneurysm is rarely reported in Africa. In Caucasian communities, it is a frequent CVD whose prevalence and incidence parallels that of atherosclerosis\(^25\). Findings of the current study reveal that it causes 11.2% of deaths, again suggesting that it is more prevalent than hitherto perceived. Indeed, a recent study among Kenyans revealed that it is not uncommon, and causes mortality by rupture\(^26\). This suggests that aortic atherosclerosis is an established problem.

Atherosclerosis is generally believed to be a disease of old people\(^27,28,29\). Observations of the current study reveal mean age of 46, 48 and 52.8 years for cerebral aneurysms, myocardial infarction and aortic aneurysms respectively. These are significantly lower than those reported for Caucasian and Asian populations in which the mean age ranges are 66 - 75\(^{30,31,32}\), 48 - 69\(^{33,34,35,36}\), and 68 - 79\(^{37,38}\) for aortic aneurysm, intracranial aneurysm and myocardial infarction respectively. In the case of myocardial infarction, the mean age of 48 years is lower than 59.8 and 59 years reported for Eritrea\(^39\) and Senegal\(^40\) respectively. We recently also reported relatively low mean ages of myocardial infarction, cerebral and aortic aneurysms in the hospital series\(^39,41\). These findings support reports which indicate that atherosclerosis, and cardiovascular diseases in general, occur earlier among black African populations\(^19,30\).

There are recent reports indicating that up to 17% of AMI may occur in individuals younger than 40 years\(^42,43\). In tandem with this, the current study reveals that 22.5% of acute myocardial infarction, for example, occurred before the age of 40 years. These findings are consistent with reports that atherosclerosis may start in the first or second decade\(^44,45\). This early onset may be related to the profile of risk factors\(^46\). It implies that control measures against this disease should commence early to mitigate development of complications in the Kenyan population.

Atherosclerotic diseases cause death more commonly in males than in females. This is concordant with literature reports that atherosclerosis is more common and starts earlier in young men than premenopausal women\(^47,48\). The male predominance is consistent with age distribution of the females in which most are aged less than 50 years and still enjoy the relative protection of estrogen\(^49\).

Conclusion:

Atherosclerotic diseases constitute a major cause of cardiovascular deaths. Acute myocardial infarction is the leading manifestation of atherosclerotic disease and cause of cardiovascular mortality in Kenya. More than 20% of cases occur before 40 years of age and affect more males than females. Control and preventive measures should target young people.

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References:
