This study shows that reproductive health needs in adolescents are closely intertwined with the experience of violence and abuse, poor mental health and other risk behaviours such as substance abuse and the rural/urban setting of schools. There is growing evidence that poor mental health, as evidenced through high rates of depression and suicidal behaviour, are amongst the most common health problems in adolescents in south Asia.10,11 Girls are more likely to attempt suicide and this is inextricably linked with their lack of control on reproductive decision-making and restriction of reproductive rights.10 Recent studies have shown that abuse and violence against women is a serious social and public health issue in India; one-third or more of adult women experience violence at the hands of their male partners at some point during their lives.12 This study shows similar high rates of violence directed at adolescents. A key finding is that both boys and girls were victims of violence. However, gender differences were apparent in some types of sexual abuse. Especially worrying were the very high rates of CSI experienced by rural boys. The study also demonstrates that schools are not safe havens for adolescents. The FGDs and the low rates of discussion about abusive experiences demonstrate that violence and abuse are, to a large extent, a hidden problem. The findings of this study replicate those of a recent survey from north India which reported rates of physical violence amongst adolescent boys exceeding 50%.13

The implications for adolescent programmes and policy are the need to incorporate the issue of violence and abuse within the matrix of school-based interventions for adolescent health. Thus, interventions aimed at improving reproductive health must also include personal safety and prevention of abuse, mental health and self-esteem, substance abuse and communication skills (e.g. with parents). Gender-sensitive programmes for both boys and girls that take into account the varying environments of rural and urban schools as well as involvement of parents and teachers are essential components of any intervention. Campaigns to raise awareness are essential so that the culture of silence about violence and abuse is broken. Arguably, this may apply even more for boys who rarely, if ever, discussed their experience with friends or family. Counselling services must be made available in schools where adolescents can seek help in strict confidence. Health practitioners need to be sensitive to the possibility of abuse as a risk factor in adolescents who complain of physical ill-health or depression. Training is needed on assessment of abuse and mental health, and communication skills. We acknowledge that a methodological limitation of this study, like any cross-sectional survey, is the inability to interpret causal relationships from the data. Cohort studies are essential to examine the causal associations and outcome of abuse and violence. Studies are also needed to evaluate the efficacy of interventions aimed at preventing abuse.

ACKNOWLEDGEMENTS

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Sickle cell disease in Wayanad, Kerala: Gene frequencies and disease characteristics

M. FEROZE, K. P. ARAVINDAN

ABSTRACT

Background. A large number of patients with sickle cell anaemia are seen at the Medical College, Calicut from among the tribals and Chetti communities of the adjacent Wayanad district. We carried out a population-based study of gene frequencies and disease characteristics to plan an appropriate intervention.

Methods. Clinical examination and haemoglobin electrophoresis were done in 1016 subjects belonging to the tribal and
Chetti communities in Wayanad district, by visiting hamlets and schools and evaluating everyone present at the time of the visit.

**Results.** The gene frequency of haemoglobin S ranged from 0.019 in Kattunayakan to 0.196 in Wayanadan Chettis. Wayanadan Chettis, Kurumas and Adiyas showed a high number of homozygotes with the oldest being 48 years. The survival of homozygotes is longer than what is generally recorded in other states. The disease was mild in 52.2% of cases. Painful crises were found in 43.5% and splenomegaly and leg ulcers in 4.3% each. The mean haemoglobin F rate in homozygotes was 25.9%. It was higher in clinically mild cases and in those showing an absence of irreversible sickle cells in the peripheral smear.

**Conclusions.** The survival of patients with sickle cell anaemia seems to be higher in Kerala as compared to other states. It appears that even small improvements in primary health care available to the population (as in Kerala) are sufficient to achieve this effect. Integration of disease diagnosis and management into the already existing health care delivery system may lead to even better survival and quality of life.

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INTRODUCTION

The Medical College at Calicut is the main government tertiary care centre for the northern districts of Kerala. Many cases of sickle cell anaemia are seen at the institution every year, and almost all are from the adjacent Wayanad district. We had already done a pilot study in this area using the sickling test and found high sickling rates in several communities which were similar to other studies from India.

Wayanad is only three hours away by road from Calicut and has the largest number and density of scheduled tribes in the state, accounting for 36.5% of the state’s tribal population. Further, Wayanadan Chettis, a non-tribal community, identified as having a high frequency of the sickle cell gene are residents exclusively of Wayanad. Kerala has a wide and effective health care delivery system that has contributed immensely to the better health indicators found in the state. Given the generally mild nature of the disease in tribal populations of the country, the question was posed as to whether the better health facilities available would be reflected in the better survival of homozygotes compared to other tribal regions in India. A further aim was to estimate the gene frequencies of haemoglobin S (HbS) in various tribal communities of Wayanad and to record the clinical features and disease characteristics. This would enable formulation of a steady-state disease management, which could be integrated into the already existing health care delivery system.

METHODS

The study was conducted in the groups previously identified to carry the sickle cell gene, namely, various tribal communities and the non-tribal Wayanadan Chettis. Care was taken to include all the indigenous communities of Wayanad in the survey in proportions corresponding roughly to those found in the population. The actual sites of survey were fixed according to the contacts and convenience of the local organizers. In no instance was it influenced by any preconceived notion about disease or gene prevalence.

The centres set up for the survey were of three types. They were the tribal hamlets and colonies, schools and hostels for tribal students, and in one instance, a camp set up at the local primary health centre. All the persons present at the time, irrespective of whether they were ill or not, were tested. No attempt was made to deliberately choose only unrelated subjects. Of the 1016 people, 630 (62%) were tested at their place of residence, 357 (35.1%) in schools and hostels and 29 (2.9%) at the primary health centre.

Haemoglobin electrophoresis was done in all subjects with haemolysates prepared from finger-prick blood. Sickling test was done in a subset of cases with the HbS band to rule out other bands having similar mobility. The alkali denaturation method of Sanger was used to estimate foetal haemoglobin in all HbS homozygotes. The peripheral smear was examined in all subjects and screened for hypochromic microcytic anaemia, irreversible sickle cells, target cells, C-crystals and evidence of haemolysis. The clinical features pertaining to sickle cell disease were noted, especially a history of symptoms suggestive of crises, degree of anaemia, presence of splenomegaly and leg ulcers. Anaemia, if present, was graded as mild or severe. Cases with gross pallor with or without haemic murmurs were graded as severe. This is far from ideal but we had to resort to this subjective method since we were using the finger-prick method of blood collection, which did not always provide sufficient blood for haemoglobin estimation in addition to other tests. Cases of sickle cell anaemia were divided into mild and severe, according to the severity of the disease. Mild cases were defined as those who had not had more than one episode of crisis and did not have severe pallor.

The gene frequencies of the alleles HbA and HbS were calculated from the haemoglobin electrophoresis data. The frequency of the A gene would be \( (AA+AS/2)/n \) and that of the S allele, \( (SS+AS/2)/n \).

**RESULTS**

The frequency of the sickle cell trait (HbAS) and sickle cell anaemia (HbSS) and the gene frequency of HbS in various communities are given in Table I. Wayanadan Chettis showed the

**Table I. Frequency of sickle cell gene in Wayanad, Kerala**

<table>
<thead>
<tr>
<th>Community</th>
<th>n</th>
<th>AA</th>
<th>AS</th>
<th>SS</th>
<th>Gene frequency of HbS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paniya</td>
<td>279</td>
<td>228</td>
<td>49</td>
<td>2</td>
<td>0.095</td>
</tr>
<tr>
<td>Kuruma</td>
<td>256</td>
<td>170</td>
<td>80</td>
<td>6</td>
<td>0.18</td>
</tr>
<tr>
<td>Adiya</td>
<td>91</td>
<td>62</td>
<td>25</td>
<td>4</td>
<td>0.181</td>
</tr>
<tr>
<td>Kattunayakan</td>
<td>52</td>
<td>50</td>
<td>2</td>
<td>0</td>
<td>0.019</td>
</tr>
<tr>
<td>Oorali</td>
<td>11</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>0.045</td>
</tr>
<tr>
<td>Kurichian</td>
<td>68</td>
<td>68</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chetti</td>
<td>214</td>
<td>141</td>
<td>62</td>
<td>11</td>
<td>0.196</td>
</tr>
<tr>
<td>Settlers</td>
<td>23</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Table II. Summary of clinical characteristics of 23 cases of sickle cell anaemia detected in the survey**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>HbSS cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>19 years</td>
</tr>
<tr>
<td>Men</td>
<td>56.5</td>
</tr>
<tr>
<td>History of jaundice</td>
<td>100.0</td>
</tr>
<tr>
<td>History of crises</td>
<td>56.5</td>
</tr>
<tr>
<td>Severe anaemia</td>
<td>30.4</td>
</tr>
<tr>
<td>Mild-to-moderate anaemia</td>
<td>69.6</td>
</tr>
<tr>
<td>Splenomegaly</td>
<td>4.3</td>
</tr>
<tr>
<td>Leg ulcers</td>
<td>4.3</td>
</tr>
<tr>
<td>Mean haemoglobin F</td>
<td>25.9</td>
</tr>
<tr>
<td>Presence of irreversable sickle cells in smear</td>
<td>60.9</td>
</tr>
<tr>
<td>Presence of hypochromic microcytic anaemia in smear</td>
<td>8.7</td>
</tr>
</tbody>
</table>

All figures are percentages
highest gene frequency of 0.196 followed by the Adiya and Kuruma communities with 0.181 and 0.180, respectively.

The clinical features and peripheral smear findings of homozygotes are summarized in Table II. The ages ranged from 2 years to 48 years. The disease was mild in 52.2% and severe in the rest. The HbF values in HbSS cases ranged from 7.7% to 40% with a mean of 25.9% (SD 9.9). The mean HbF was 31.9% in clinically mild cases and 18% in severe cases (t=4.35; p=0.0003). It was 33.6% in patients showing an absence of irreversible sickle cells in the peripheral smear and 21.2% in patients showing irreversible sickle cells (t=3.46; p=0.003).

DISCUSSION
The communities included in this study in whom HbS is seen are the scheduled tribes of Paniyars, Kurumas, Adiyas, Kattunayakans and the Oorals, as well as the non-tribal communities of Wayanadan Chettis. According to the 1981 Census, the tribal population of Kerala totalled 261 475 and of these, 95 557 (36.5%) were residents of Wayanad. The frequency of sickle cell disease found in various communities in Wayanad is comparable to those found elsewhere in India.2-5 Our sample was unbiased in the sense that all subjects present at the time in a hamlet or school were surveyed. All subjects were not necessarily unrelated. However, this is not likely to produce a significant bias in the overall sample because of the large sample size and the high prevalence. However, in the smaller communities such as Kattunayakans and Oorals, the gene frequencies derived may not be accurate due to the small sample size.

We calculated the expected number of SS homozygotes according to the Hardy–Weinberg equation in large electrophoresisis-based studies reported from different states2 for comparison with our study (Table III). The actual survivors among homozygous cases as found in our study, was much higher than that found in tribal communities in other states of India. It is highly unlikely that the tribes in Kerala and the HbS haplotypes are genetically very different. This increase in actual survivors can be explained by greater awareness and access to the effective health care system existing in Kerala, which is lacking in other states. This is further exemplified by the difference in the literacy rate, taken as an indicator of socio-economic status, found among these communities. While the Chettis and Kurumas (who showed the highest actual survival) had a literacy rate of 80% and 38.5%, respectively; the Paniyas (who showed low actual survival) had a literacy rate of 11% only. This suggests that the availability of an effective health care delivery system and its proper utilization by socially aware communities can probably improve the survival and quality of life of the affected people.

Kaur et al.14 found a very high frequency of homozygous cases in the Wayanadan Chetti and Kuruma communities (16.3% and 13.3%, respectively) as compared to our findings (5.1% and 2.3%, respectively). Interestingly, the frequency of the sickle cell trait in the same communities in both the studies are comparable. They were 29.6% and 32.4%, respectively, in the study by Kaur et al. and 29.0% and 31.3%, respectively, in our study. This glaring difference in the frequency of homozygous cases could be due to a bias in subject selection in the study quoted earlier.

The standard method described in textbooks of laboratory haematology for haemoglobin electrophoresis is by collection of at least 2 ml of blood by venupuncture.6 This method is, however, not suited for large field studies. In the present study, we could standardize the procedure for haemoglobin electrophoresis by the finger-prick technique. But for this, we do not think the camps would have been the success that they turned out to be. We generally obtained 4–5 large drops of blood from each patient. This was usually sufficient for the peripheral smear and estimation of haemoglobin F as well as electrophoresis. To obtain enough haemolysate it is necessary to ensure maximum cell button after the final wash. For this, great care has to be taken to minimize the loss of cells during pipetting.

Our sample of 23 cases of sickle cell anaemia is not large enough to make definitive statements about disease characteristics. The detailed clinical work-up of cases that is possible in a hospital set-up was not possible in our study since we frequently did not know that we were dealing with a case of sickle cell anaemia during the clinical examination and blood collection. On the other hand, our sample was formed by an unbiased field study and was thus valuable as an approximation to the conditions prevailing in the population. In contrast, hospital-based studies are likely to be biased in favour of severe cases with complications who require admission.

There are not many reports on the clinical features of HbSS cases in India.5,7,12,13 Generally, the clinical features reported are milder than those in patients of African descent and comparable to those found in the Eastern Province of Saudi Arabia,14 Kuwait,15 and Iran.16 Reports from western India indicate a milder disease in the tribal populations associated with a very high prevalence of alpha-thalassaemia and more severe disease in the non-tribal population.17 The mild cases were associated with a high rate of splenomegaly. Reports from Orissa, on the other hand, found that the frequency of splenomegaly was not influenced by the alpha globin genotype.7 The prevalence of alpha-thalassaemia, however, was lower in the Orissa study compared to the study from western India. In our study, splenomegaly was not an important feature, though leg ulcers were uncommon. A history of crises was obtained from more than half the patients. Thus, the clinical severity seems to be less than that in the African population but more than the western Indian tribal population.

Haemoglobin F is higher in HbSS cases having mild symptoms and absence of irreversible sickle cells in the peripheral smear, highlighting the ameliorating effect of HbF on HbS. It has been postulated that alpha-thalassaemia could be an important genetic factor modulating the clinical expression and haematological severity of sickle cell anaemia in western India.18 The trimodal distribution of HbS levels in sickle cell heterozygotes has been used as an indirect approach to determine the prevalence of alpha-thalassaemia.18 Similar studies are worth undertaking in Kerala. The finding of hypochromic, microcytic anaemia in only 8.7% of tribals suggests that nutritional deficiency is not as important in the tribes of Wayanad as is usually expected amongst tribal communities in India. This, however, needs laboratory confirm-
tion. If one assumes that alpha-thalassaemia exists in the population, the prevalence of iron deficiency is likely to be even lower.

The problem of sickle cell anaemia in Kerala is likely to increase as more homozygotes survive and reach adulthood. A comprehensive strategy to tackle this problem would include: (i) a scheme for proper diagnosis in the form of sickling test and Hb electrophoresis; (ii) management of sickle cell disease at the primary health centre level with support from secondary and tertiary levels; and (iii) its integration into the already existing health care services in Kerala. Sickle cell disease cannot be seen as a problem in isolation but linked to the overall socio-economic development of the tribal communities.

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Management of prolonged pregnancy: A randomized trial of induction of labour and antepartum foetal monitoring

C. JAMES, S. S. GEORGE, N. GAUNEKAR, L. SESHADRI

ABSTRACT

Background. The two methods of management of prolonged pregnancy, induction of labour and expectant management with foetal surveillance, have pros and cons. Therefore, we compared the induction of labour with serial antenatal foetal monitoring in the management of post-term pregnancy.

Methods. Seventy-four women with uncomplicated pregnancy at 41 weeks (287 days) of gestation were randomly assigned to undergo either induction of labour or serial antenatal foetal monitoring. Labour was induced in the latter group whenever there was evidence of foetal compromise. Antenatal monitoring consisted of the foetal kick count, non-stress test and biophysical profile.

Results. Fifty-seven per cent of women went into spontaneous labour by 41 weeks and 4 days (291 days) of gestation and only 14% developed foetal compromise before that. However, when the gestational age was more than 41 weeks and 4 days (291 days), the incidence of meconium staining of amniotic fluid and evidence of uteroplacental insufficiency increased significantly. The rate of caesarean section, instrumental delivery, foetal distress and duration of labour did not differ significantly between the two groups.

Conclusion. The policy of inducing labour at 41 weeks and 4 days (291 days of gestation) in uncomplicated pregnancies is justified in our population. However, foetal monitoring should begin at 41 weeks of gestation.

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INTRODUCTION

The management of uncomplicated pregnancy extending beyond the expected date of confinement remains controversial. Prolonged pregnancy has been associated with increased foetal and neonatal morbidity and mortality rates.1-3 However, the benefit of reducing a potential foetal risk with induction of labour must be balanced against the morbidity associated with the procedure.

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