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Neonatal Screening for Genetic Blood Diseases

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Background: Previous neonatal screening in 1986 showed that the incidence of sickle cell disease (SCD) is 2.1% and (SCT) is l1%. Since 1984 the Ministry of Health (MOH) instituted a prevention campaign. The incidence has been falling gradually since then.

Objective: To update the national data on the incidence of SCD among the newborns and to compare it with the previously available data.

Method: All Bahraini newborns delivered at the (MOH) maternity hospitals for a period of three months from February to April 2002 were targeted. Cord blood samples were analyzed by HPLC.

Result: Two thousand newborns constituted the study population five were excluded. Eighteen were found to be affected with SCD with an incidence of 0.9%. SCT was found in 325 (16.3%). G6PD deficiency was found in 18% of males, and 10% of females. Parental age distribution and consanguinity were documented.

Conclusion: Bahrain has for the first time recorded less than 1% babies with SCD.

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Sickle cell disease and thalassemia are common in many parts of the world especially in tropical Africa, the Middle East, the Mediterranean basin, the Indian subcontinent and South America. Experimental evidence and Epidemiological studies support the argument that the heterozygote state of hemoglobinopathies may provide some protection against Malaria.

Many studies indicate that these diseases are common in the Gulf region, in Saudi Arabia, Bahrain, Kuwait, United Arab Emirates, Oman and Qatar. These diseases are also common in the other Arab countries such as Egypt, Iraq, Syria, Jordan, Palestine, and Lebanon etc[1-5].

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This study is a collaborative project between the Ministry of Health, the World Health Organization, and the Bahrain Hereditary Anemia Society. The national Hereditary Disease Committee had organized and directed the project.

The diseases are chronic and the affected person suffers from anemia and ill health all through his life. Preventive measures remain the best way of reducing the incidence of the diseases[1,2].

In Bahrain, a previous neonatal screening done between the years 1984-1986 showed that the incidence of sickle cell disease (SCD) is 2.1%, sickle cell thalassemia (SCT) is 11%, alpha thalassemia trait 20% and Glucose six phosphate deficiency 25% of live births[7,8].

In contrast to the premarital study done in 1995, which showed a prevalence of 1.6%[9].

The prevalence figure was also lower in the student-screening project conducted in 1999, as the prevalence of SCD homozygous was found to be 1.2%[10].

This may indicate a gradual decline in disease frequency, which may be due to the effect of increased awareness among the people of Bahrain, as a result of the educational and awareness campaign which was started some twenty years ago.

The aim of this study is to update the national data on the incidence of SCD among the newborns and to compare it with the previously available data.

METHOD

The study was performed between February 1 and April 30, 2002.

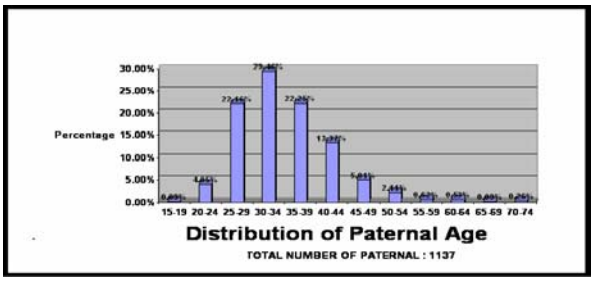
The target group included 2000 Bahraini newborn delivered in the Ministry of Health maternity hospitals. Cord blood samples were collected in tubes containing EDTA, and transferred to the Hematology Laboratory at Salmaniya Medical Complex for analysis.

High performance liquid chromatography was used to perform electrophoresis on the cord blood samples, with a fluorescent screening technique for G6PD deficiency.

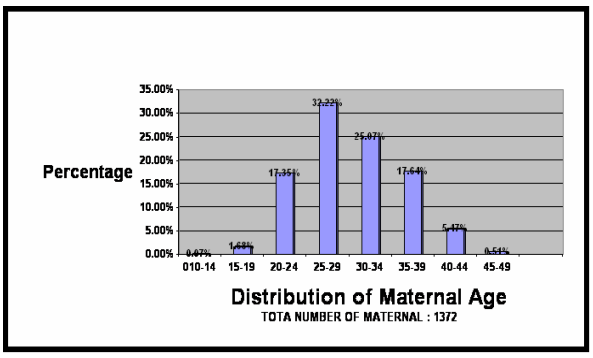
A questionnaire was completed for each new born. The form included characteristic data, parental age group, and consanguinity and was coded for computerization. Senior personnel in each field undertook the requisite training of involved doctors, nurses and technicians. A confirmatory test was conducted on all the newborns with abnormal results.

RESULT

The total number of samples analyzed was 1995; five of the samples were excluded because the blood had clotted. Male to female ratio among the sample group was 1.1/1 with slight excess of males. The paternal age distribution shows that the majority of the fathers were aged between 25–44 years (87%), and 29% were 30-39 age group.



Maternal age distribution shows a lower figure, with most women having children between the ages of 20–39 (82%); the majority of these were between the ages of 25–34 years (57%).



Consanguinity rate: marriages between relatives was found to be 20% (242/1197), with first cousin marriages of 12.5% (150/1187) and 7% (92/1187) for marriages between distant relatives.

Only 0.9% (18/1995) of Bahraini neonates, born in Ministry of Health facilities had Sickle cell disease SCD, while sickle cell trait was found in 16.3% (325/1995) of the newborns, see table 1.

Table 1: Sickle Cell Disease & Sickle Cell Trait Frequency among New Born, Mothers and fathers, 2002

Status	Child		Mother		Father	
	No	%	No	%	No	%
Normal	1652	82.81%	1024	84.63%	234	90%
Carrier	325	16.29%	170	14.05%	21	8.08%
Disease	18	0.9%	16	1.32%	5	1.92%
Total No	**1995**		**1210**		**260**	

Glucose 6 phosphate dehydrogenase deficiency, which represented 28% of the total, was found in 10% of the male newborns, and 18% of the female newborns.

DISCUSSION

The male to female ratio among the samples was 1.1/1 with a slight excess of males.

The paternal age distribution showed that the majority have children at 20–54 years; the maternal age distribution of the mother is lower, majority between 20–29 years.

Consanguinity rate: marriages between relatives was found to be 20% (242/1197), with first cousin marriages of 12.5% (150/1187) and 7% (92/1187) for marriages between distant relatives. The previous figure in the year 1995 was 39% consanguinity and 24% first cousin marriage[11]. In the year 1998 the figure was 32% consanguinity and 24% for first cousin marriage[12]. Accordingly there is a gradual decline in the rate of marriages between relatives.

The study showed that only 18 of the 1995 newborn (0.9%) were affected with SCD. The 0.9% SCD birth prevalence in 2002 compared with the previous estimate of 2.1% reported in 1984-85, indicates a decline by almost 60% ($p = 0.001$).

The sickle cell trait prevalence of 16.3% in 2002 compared with previous estimates of 11% in 1986 ($p = 0.001$) (table 2), 13% in student screening during 1998, and 14% in 2001 demonstrates an increasing trend.

As shown from table 1, the incidence of SCD was higher in the parents than their children. The trait rate showed the opposite trend, which has been expected as more carriers (HbA/HbS) marry normal persons with HbA/HbA.

There was a significant reduction in the birth prevalence of SCD between 1986 and 2002 ($p=0.001$). Similarly, there was a significant increase in the frequency of carriers during that time ($p = 0.001$), see table 2.

Table 2: Comparison of the prevalence of SCD and SC carriers' frequency in 1986 and 2002

Year	No Screened	No Affected	No Carriers
1986	10,327	217 (2.1%) 1.8→2.4)	1,135 (11%) (interval analysis 1.04→11.6)
2002	2,000	18 (interval analysis 14.7→18.0)	1.326 (interval analysis 0.5→1.42)
p		0.001	0.001

A previous molecular study showed that approximately 90% of patients had the mild form of sickle cell disease[17]. DNA analysis has proved the presence of the Asian as the common haplotype[13-17]. This mutation is associated with high level of HbF, a situation similar to that in the Eastern Province of Saudi Arabia. In contrast to the common gene found in Oman and western province of Saudi Arabia where the severe type of the disease predominate and the common haplotype is the benign haplotype[18,19] .

G6PD deficiency of 18%, in male and 10% in female newborns, the total is 28%, compared favourably with almost 25% in many previous studies.

The Lyon hypothesis indicates that female heterozygotes have one normal gene for G6PD, and one of the X is active. If the active X has the defective gene, the disease will manifest itself. Patients with this disease have little clinical implication. Few cases are admitted with hemolytic crisis although fava meal is one of traditional food recipes. G6PD deficient patients have also higher rate of neonatal jaundice. The molecular studies on G6PD deficient patient showed that 95% of patients had G6PD Mediterranean variant (nt 563 C—T; 188 Ser—Phe) [20,21].

CONCLUSION

This study shows that SCD incidence is less than 1% among the study group compared with previous studies in Bahrain.

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