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# Prevalence of Sickle Cell Anemia and Thalassemia among Anemic Patients of Al-Noor Specialist Hospital, Makkah, KSA

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**This study aimed to to determine the prevalence of Sickle cell diseases and trait and high hemoglobin (Hb) A2 β- thalassemia in the province of Makkah among patients of Al-Noor Specialist hospital, Makkah. Retrospective studying the results of 620 requested saudi patients (256 male and 364 female) suffer from Anemia for gel electrophoresis. Covering the period between 1 January 2012 to 30 December 2012 was presented. It was found a significant increase (P<0.05) in prevalence of anemia among females compared to males (1.42/1 ratio). The prevalence for Sickle cell anemia was (38.38%) which showed highly significant increase comparing with (P>0.01) ²-Thalassmia (5.32%) and Non $A_2$ Hemoglobin (2.90%). ²-Thalassmia also, showed significant increase P<0.05) compared with Non $A_2$ Hemoglobin. Hemoglobinopathies occurs frequently among our patients, with majority of cases having Sickle cells anaemia, and cases with heterozygous mutation (trait disease) was the predominant.**

**Key words:** Sickle Cell Anemia, Anemic Patients and Thalassemia.

Hemoglobinopathies and thalassemias are two distinct groups of inherited disorders of hemoglobin synthesis arising from mutations and/ or deletions of one or more of the globin genes resulting in production of structurally abnormal hemoglobin variants in the former and reduced rate of synthesis of structurally normal globin chains in the latter [(1)].

The frequency of these disorders varies considerably with geographic locations and racial groups. Thalassemias and sickle cell hemoglobin in particular are endemic in geographic areas where malaria is endemic or had been endemic in the past and these are included in the thalassemia belt that spread from Spain through the Mediterranean Basin, Africa, the Middle East, India, Tropical Asia and the Pasific [(2)].

Genetic studies of DNA linked to ßs-gene suggests that this gene had probably arisen from three different mutations in tropical Africa [(3)]. A different pattern of polymorphism associated with the ßs-gene in Saudi- Arabia and India suggests that the Asian gene may have arisen from an independent mutation [(4)].

Many single gene disorders had been reported in the population of the Saudia Arabia including different types of structural hemoglobinopathies, thalassemias, enzymopathies such as Glucose-6- Phosphate- Dehydrogenase (G6PD) deficiency, phenyleketoneuria, cystic fibrosis, hemophilia, fragile X- syndrome, spinal muscular atrophies and many others [(5).] However according to the reports of the Third and Fourth Annual Meetings of the WHO Working Group for the Community Control of Hereditary Anaemias

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1985; (HMG/WG/85.8, WHO Geneva, Switzerland), hemoglobinopathies and thalassemias are the most frequently encountered single gene disorders among the Arab population with a frequency of up to 9.9/1000 births in Saudi Arabia[5].

The high incidence of consanguity among the populations of Saudia Arabia plays a very important role in maintaining the recessive pattern of inheritance and increases the risk of homozygous or doubly heterozygous clinically affected offsprings. These diseases represent serious medical, social and economic problems to the family and to the public[6].

Since the prevalence varies from one county or even village to another, so a countrywide survey does not effectively show the prevalence in particular area[7]. Thus, the aim of this study was to determine the prevalence of abnormal hemoglobins and high hemoglobin (Hb) A2 β- thalassemia in the province of Makkah among patients of Al-Noor Specialist hospital. Accordingly, it also aims to find if diseases really exist, emphasize the need for premarital screening and prenatal diagnosis as preventive measures in this area.

## METHODS

The study included 620 requested saudi patients (256 male and 364 female) suffer from Anemia for gel electrophoresis, at the AL Noor Specialist Hospital in Makkah city during the period from 1 January to 31 December 2012. The blood samples were analyzed for presence of haemoglobinopathies by denaturing gradient gel electrophoresis[8] , whereas Cellulose plate Polyacylamide gel electrophoresis was applied for all the involved study samples .

Results were interpreted as absence of haemoglobin $A_1$ and presence of haemoglobin S is diagnosis of sickle cell disease (homozygous for haemoglobin S) and presence of both haemoglobin $A_1$ and haemoglobin S is diagnosis of carrier state (heterozygous for haemoglobin S). Also, Absence of haemoglobin $A_1$ and presence of haemoglobin $A_2$ with concentration above 3.5% is diagnosis of ² thalassaemia disease (homozygous for absence of ² globin genes) and presence of haemoglobin $A_1$ and haemoglobin $A_2$ with concentration above 3.5% is diagnosis of β-thalassaemia trait[9].

**Statistical analysis**

Characteristics of subjects were compared using $c^2$ test. A p-value < 0.05 was used for statistical significance.

## RESULTS

**In the involved study patients (table 1)**

It was found a significant increase (P<0.05) in prevalence of anemia among females compared to males (1.42/1 ratio). The prevalence for Sickle cell anemia was (38.38%) which showed highly significant increase comparing with (P>0.01) β-Thalassmia (5.32%) and Non $A_2$ Hemoglobin (2.90%). β-Thalassmia also, showed significant increase (P<0.05) compared with Non $A_2$ Hemoglobin.

**Table 1.** Screening for the most common haemoglobinopathies by electrophoresis

| | Male | | Female | | P value | Total | |
|---|---|---|---|---|---|---|---|
| | Count | % | Count | % | | | |
| Anaemic subjects | 256 | 41.29 | 364 | 58.71 | P<0.01 | 620 | |
| Sickle cell | 98 | 38.28 | 140 | 38.46 | P>0.05 | 238 | 38.38 |
| Thalassemia ($A_2$) | 8 | 3.13 | 25 | 6.87 | P<0.05 | 33 | 5.32 |
| Non $A_2$ | 8 | 3.13 | 11 | 3.02 | P>0.05 | 19 | 3.06 |

There was a significant increase (P<0.05) in prevalence of β-thalassemia among females (6.87%) compared to males (3.13%) while no significant difference (P>0.05) between males and females regarding sickle cell anemia.

**Table (2) showed that**

Sickle cell trait (62.60%) prevalence was highly significantly (P<0.01) more than Sickle cell disease (37.39%). There was no significant difference (P>05) between males and females regarding the prevalence of S cell disease, while prevalence of S cell trait prevalence showed highly significant increase in females (P<0.01).

**Table 2.** Evaluation the prevalence of sickle cell disease and trait

| | Male | | Female | | P value | Total | | P value |
|---|---|---|---|---|---|---|---|---|
| | Count | % | Count | % | | | | |
| Total (238) | 98 | 41.18 | 140 | 58.82 | P< 0.01 | Count | % | P< 0.01 |
| S Cell (Diseased) | 43 | 43.88 | 46 | 32.86 | P> 0.05 | 89 | 37.39 | |
| S Cell (Trait) | 55 | 56.12 | 94 | 67.14 | P< 0.01 | 149 | 62.60 | |

**Table (3) showed that**

There was a significant increase in prevalence of β-Thalassemia trait in females comparing with males while there was no difference regarding β-Thalassemia disease.

**Table 3.** Evaluation the prevalence of ?-Thalassemia disease and trait.

| | Male | | Female | | P value | Total | |
|---|---|---|---|---|---|---|---|
| | Count | % | Count | % | | | |
| Total (33) | 8 | 24.24 | 25 | 75.76 | P< 0.01 | Count | % |
| $A_2$ (Diseased) | 4 | 50 | 5 | 20 | P> 0.05 | 9 | 27.27 |
| $A_2$ (Trait) | 4 | 50 | 20 | 80 | P< 0.05 | 24 | 72.73 |

## DISCUSSION

Despite the fact that this is a hospital based study including only those anemic cases referred to the laboratory for investigation we hope that this study will provide an insight about the frequency of these disorders among the Saudi anemic patient of province of Makkah city.

Since the first report of the sickle-cell (Hb S) gene in Eastern Province, Saudi Arabia by Lehman et al., its presence in several other regions of Saudi Arabia has also been documented[10]. The overall prevalence of Hb $A_2$ was 7.36% and Hb SS was 1.06%, giving an Hb S gene frequency of 0.047. The prevalence of Hb $A_2$ and Hb SS cases ranged from O to 25.88% and O to 5.27%, respectively[1].

The present study, revealed high prevalence compared with the previous Studies whereas, the overall prevalence of Hb $A_2$ was 24.03% which is comparable with the highest recorded range while Hb SS was 14.35% which much higher comparing with the highest range recorded (5.27%). This can explained mainly by being the study was carried out among symptomatized anaemic patients whereas the percentage of sickle-cell disease is usually higher than common populations.

The high prevalence of Hb $A_2$ in females than males, as revealed by this study, can be attributed to being females are more sympmtomatizing to anaemia than males due to pregnancy and delivery[12].

Also highlighted by those earlier studies conducted during the 1960s and 1970s, was the mild presentation of sickle-cell disease (SCD) in Eastern Province[13,14]. The clinical investigations reveal that almost 30% of the SS cases had not required blood transfusion, and none of the patients had suffered from leg ulceration or hand and foot syndrome [15]. Whereas in the western provinces the disease is severe and similar to that reported in African populations [16,17]. So, the more symptomatizing and consequently the prevalence of Hb $A_2$ and Hb SS in this study.

Several factors have been investigated to identify the possible causes of a mild clinical presentation. It appears that the polymorphic sites for different restriction endonucleases associated with the $b^S$ globin gene and Gg/Ag ratio have a profound effect on the SCD phenotype, and hence on the clinical presentation of SCD [18]. SCD in the western provinces, where the $b^S$ is linked to the Benin haplotype, and the Gg/Ag ratio is low, is very closely related to the disease reported in the African population[1].

The beta-thalassemias are a

heterogeneous group with respect to molecular pathogenesis, and different populations and ethnic groups differ with respect to the predominating mutations [20].

Beta-thalassaemia occurs frequently among Saudis, with the majority of cases having IVS1-110 mutation [21]. This is a $b^+$ mutation, and cases with homozygous mutation have mild to moderate anaemia. As severe anaemia often accompanies IVS1-100 homozygosity in other reports, this variation in Saudis may be due to associated a-thalassaemia or other polymorphisms known to influence the clinical presentation of haemoglobin disorders [22]. In addition, double heterozygotes with this mutation and $b^\circ$ mutation present with moderate to severe anaemia [22]. However, Beta-thalassaemia is not a big problem compared with sickle-cell anaemia in the province of Makkah whereas the overall prevalence as revealed by this study was 5.32% which detected the highest prevalence in the area because of type of people subjected for this study.

The high prevalence of Beta-thalassaemia trait in females than males, as revealed by this study, can be attributed to same cause as in sickle-cell anaemia.

This study showed that the Hb S gene occurs frequently in the province of Makkah and there is an urgent need to implement control and prevention programs [22] to reduce the number of Hb S homozygous cases.

The effectiveness of control measures is dependent on the strategy adopted and must pertain to the country-specific needs. A monitoring body may be required to ensure fairness, effectiveness, and improvement in service delivery. Approaches for control of genetic diseases must accept that prevention and treatment are usually impossible [23].

The premarital counseling is one of the important approaches for carrier detection; however, it is recommended that, when a carrier is identified, his/her spouse must offer testing [24]. Fortunately, a premarital screening program for haematological hereditary disease is now applied in Saudia Arabia and its implications on the prevelence of such diseases in makkah will be obtained in the future (Dhaffar et al., 2005).

In the early 1980s, a WHO working group noted that a national register of patients is a powerful tool for obtaining epidemiological information on genetics and for assessing treatment (survival) and prevention (the birth rate of affected children); from time to time patient data has been aggregated in several countries for surveillance purposes. Health services often support the use of registers of congenital anomalies [25].

When patient information was registered by using computer software. After 1 year of integration by using facilities of the Ministry of Public Health service system, a wide range of problems were identified. They underlined the need for effective health service structure co-operation, adequate education of responsible health professionals, explicit policies and a clear line of responsibility at local, regional and national levels for service development and quality management [26,27]. It is hoped that all information conducted in the present study will be useful to health authorities to develop an explicit policy and promote the health service structure co-operation in the country that will finally lead to successfully reducing the frequency of severe hemoglobinopathies in the future.

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