Thalassemia Prevention Program in Iraq: Cost-Effectiveness and Applicability Assessment

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Abstract

Thalassemia is an inherited autosomal recessive hemoglobinopathy which has a prevalence of 35.7/100000 and incidence of 4.5 per 100000 in Iraq. The disease is totally preventable as many countries succeeded in accomplishing this. Many domains are included in the prevention program, beginning from education, carrier detection, molecular diagnosis, genetic counselling to prenatal diagnosis and therapeutic abortion. The last option may find difficulties in its accomplishment in Arabic countries as it finds contradictions to some religious and tradition habits.

In Iraq, it does cause burden on health budget as a report from the federal board of supreme audit in 2016 revealed that the cost of management of each patient is 1,428.00-3,785.00 US$/month, this include blood transfusion, drugs. As this calculated for the life expectancy for thalassemic major patient and number of patients in Iraq, the Burden of the disease will be identified clearly. Comparing this pattern to that of single case prevention calculations may show the cost effectiveness of thalassemia prevention. In Iraq, Ministry of health applied thalassemia prevention program in 2012 through premarital screening program for couples before marriage.

The aim of this study is to assess the cost-effectiveness of applying a complete prevention program and the difference in expenditure between case prevention and management per year and to see the extent of applicability of the prevention program.

Keywords: Thalassemia, Prevention, Cost, Applicability.

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Introduction

Thalassemia disease can be defined as a genetic, inherited abnormality in hemoglobin synthesis, either in a complete or partial failure in synthesis of specific type of the globin chain. Beta Thalassemia major is the homozygous state with either complete failure to synthesize beta chains or only small amounts of the beta chains are being formed, those group tend to have severe symptoms of anemia at 4-6 months. Beta thalassemia Minor is the heterozygous state of the disease in which only one gene copy is affected so the disease is mild and maybe asymptomatic as there is sufficient amount of beta chains.(1) Thalassemia Major needs both parents to be carriers for occurrence, which carries a risk of 25 percent of having an affected child.(2) Thalassemia patients suffer from many complications, mainly from Iron overload due to repeated blood transfusion, which will lead to organ failure if not properly managed. Infection due to blood transfusion and post-splenectomy is another problem. Thus, thalassemia patients need lifelong precise management to prevent the disease complication. (2)

Beta thalassemia is most common among Mediterranean, southeast Asians and African descent. (3)

Each year, more than 70,000 infants are born with thalassemia worldwide. (4)

It is the most common hereditary anemia registered in Iraq in 16 thalassemic centers in 2015 which has a prevalence of 35.7/100000 and an incidence of 4.5 per 100000 and thalassemia constitutes 66.2% of all hereditary anemias in Iraq (73.9% of which are Beta thalassemia major). (5).

In Iraq, Ministry of health applied thalassemia prevention program in 2012 through premarital screening for couples before marriage, Where in Al-Rusafa side of Baghdad, 322 tests were done in one year, 19 cases were at high risk. However, these couples were not followed (6). Another preventive screening program was done in Sulaimaniyah in northern Iraq from 2008 to 2012, the study showed that the preventive programme for haemoglobinopathies based on the concept of premarital screening, counseling, and prenatal diagnosis is feasible Iraq (7)

The following questions will be discussed in this review article:

1. Can thalassemia be prevented successfully?
2. Is prevention program in Iraq cost effective?
3. Is it applicable in Iraq?

1. Can thalassemia be prevented successfully?

Thalassemia is a preventable disease and many countries have succeeded in the prevention or in the effective reduction of its incidence.

1. According to what happened at Cyprus in 1978, using thalassemia prevention program, hundreds of thalassemic births were saved. After the prenatal diagnosis have started in 1984, affected birth rates showed a sharp decrease in contrast to an average of 18-20 incidence of cases per year before the implementation of the "Thalassemia Prevention Program". Between 1991 to 2001, only five thalassemic babies were born, one in every 2-3 years. No thalassemic babies were born in the period between 2001 to 2007. [8]
2. In Sardinia, the number of thalassemia major incidence shows a reduction from 1:250 live births to 1:1660 in 2009 with an effective prevention of 85% of the cases.[9]

   These two studies relied on prenatal diagnosis and therapeutic abortion as an essential way for prevention, as dissolution of marriage is a less acceptable method.
3. In most studies in Iran in different provinces, Thalassemia prevention program showed success in reducing thalassemia incidence [10].

   A study done by Miri et al [11] showed that thalassemia incidence has decreased from 864 in 1996 to 239 in 2009, suggesting success in preventing thalassemic cases.

   In all studies, they referred to the great efficacy of prenatal diagnosis (PND) in enforcement of thalassemia prevention program and all the researchers in different studies recommend that the decision maker to be more persistent for more centers and for easier access to the carrier couples. [10]
4. In Lebanon, the process of prevention program showed significant decrease in number of patients [12]
5. In Turkey, Thalassemia prevention program started in 2003. The number of newborn with hemoglobinopathies including thalassemia was 272 in 2002, it dropped out to 25 in 2010. This is a total of 90.0% reduction in affected births in the last 10 years. [13]
6. In Saudia Arabia, the program involved premarital screening program to

successfully prevent thalassemia, from 32.9 to 9 per 1000 from 2004 to 2009. This study also showed 5 times increase in marriage cancellation by the couples. [14], and this relates to the education and awareness level.

Note that in these countries, in exception of Cyprus where the law obligated the couples to break off their marriage, cancelling the marriage was a personal selection.

In general: Thalassemia prevention program includes the following [9]:

1. Educating the population and rising the awareness through Health care workers education, TV Channels, Social media. This was associated in increased compliance for prenatal diagnosis.

Proper education programs and increasing public awareness are mandatory for successful implementation of preventive services.

In a report from Turkey Ministry of Health, the number of infant born with Thalassemia have declined by 87% from 2003 to 2008, this success is attributed to educational programs and campaigns. [15] As these campaigns educated 62,682 (0.12% of population) people from different social levels.

In Iraq, a study done by Mutar M and Majid M et al [16] showed a low level of awareness among thalassemia major patients' parents in two provinces: Baghdad and Al-Nasiriyah. This may give an impact of low level of awareness in the general population, So a good educational program is needed.

An important point to mention, the rate of consanguineous marriage in Iraq was 33% in 2004 according to the Central organization of statistics and information technology [17], this is considered as a main problem, as about 80% of thalassemia patients' parents were related. [5]

2. Premarital Screening for couples.
3. Molecular diagnosis: in short, for those with positive finding of low Mean corpuscular volume (MCV) and increased HbA2 (Beta thalassemia carrier) or those with Low MCV and normal HbA2 (Alpha thalassemia or other forms), after exclusion of low level of iron

   In the Iraqi study by Allawi N et al in Iraq, the screening did not depend on molecular diagnosis, rather, it depended mainly on hematological indices and high performance liquid chromatography for detection of the types of hemoglobin (HPLC).[7]
4. Genetic counselling for the carriers of thalassemia traits.

5. Prenatal diagnosis, DNA of the fetus is analyzed for the mutations detection. Chorionic villous sampling is the preferred by many centers as can be performed by first trimester and with low mortality rate (1%)
6. Preimplantation and preconceptional genetic diagnosis, which is of benefit in assisted reproductive technique.

In a study done in 2012 over 5 years by Allawi N. et al in northern Iraq, using premariral screening, counselling and prenatal diagnosis, the prevention program succeeded in decreasing the number of births affected by haemoglobinopathies by 65%. [7]

2. Is prevention program in Iraq cost effective?

First let's have a look on previous studies then discuss this issue in Iraq.

In a study done in Iran, the calculated cost for preventing one case of thalassemia was 100 United States dollar (USD), while the cost for management of a single case, in a single year, was 6,500 USD. In addition, screening of population (which was equal to 44,500 USD) plus full management of those 46 patients who were born against the implementation of the prevention program would cost much lower than the optimum management of 235 potential thalassemia cases who may be born if the program was not started. The program involved premarital and prenatal screening program including one therapeutic abortion so the finding of the study is that the cost of detection of high risk couples or an affected fetus and therapeutic abortion are cheaper than the cost of full treatment of thalassemia major case [18]. Thus, the ratio of management of one case in only one year to its prevention is 65:1 USD according to this study. In a Canadian study by Julia T et al,[19] They evaluated the cost effectiveness of thalassemia prevention program using genetic screening and prenatal diagnosis in high risk communities in Quebec province, They found that the cost of prevention of one case was about 6,754$ to 6,638$ which precludes cost per carrier couples identified (which also includes clinical, laboratory, educational materials, administrative supplies) and cost of homozygous case prevention (like fetoscopy, amniocentesis, labor and fees and DNA analysis). The total cost of case treatment was 176,426$ for life expectancy of 25 years old. This includes surgical procedures plus annual maintenance therapy of blood transfusion, chelating agent, diagnostic techniques and nursing and social care. The ratio of management of one case

per only one year to its prevention is 1.05:1 USD according to this study. In northern Israel, the same results persist, the cost of management of a single patient was about 1,971,380$ which included the regular medical and surgical care for a year, meanwhile the cost of single case prevention was 63,660$ which included genetic and carrier screening, prenatal diagnosis, and therapeutic abortion [20] The ratio of management of one case in one year to its prevention is 30:1 USD.

In Iraq, a report from the federal board of supreme audit in 2016 revealed that the cost of management of each patient is 1,428-3,785US$/month [5], this is of average of 2,606.5$ per month with 31,278$ per year and for a life expectancy of 25 years, this will equal to 781,950$ and since the prevalence of thalassemia is 1,165 In Iraq, the total cost for all thalassemic patients for 25 years is 910,971,750$ for all patients in Iraq. The incidence of thalassemia in Iraq in 2015 was 335 patients, If these cases were prevented (Assuming the value of the preventive measures in the previous study which is 63,660$) this will equal 21,326,100$ which is much more cost effective than cases management.

3. Is it applicable in Iraq?

The focus here will be on prenatal diagnosis, as therapeutic abortion, which is important in the prevention program, in Islamic countries form a religious problem. Also, thalassemia prevention program in Lebanon failed to achieve complete eradication mainly because of the abortion is considered illegal there. [12] Islamic countries differ in taking the decision of abortion, some prohibit it at all and some allow it only before 120th day. Fatwa committee in 2002 allowed abortion before 120th day if the embryo of disfigured, ill or will cause harm to the life of the mother [21] Meanwhile in Egypt, the problematic aspect was solved; traditionally, prenatal diagnosis has not been successful in reducing the births of affected children in Egypt, because the majority of women undergoing prenatal diagnosis continued to have affected pregnancies. But in a study held recently in Cairo, 71 pregnant women were having thalassemic fetuses diagnosed prenatally, in-depth discussion was held with the couples, which addressed the religious aspects of termination of pregnancy; the religious fatwa, which permits termination of pregnancy up to 120 days of fetal life when the fetus is found to have a severe condition. After these discussions with the couples, all mothers with affected fetuses opted to terminate their

pregnancies contributing to preventing 71 cases. This can give hope for the future, if this program was applied in Iraq. [22] Figure 1 represents the religious decision regarding abortion. An important limitation of applying this program in Iraq is that there is unregistered marriages that occur on traditional religious basis, thus impairing premarital screening program. This limitation was mentioned by Hadipour Dehshal et al [23] study who stated that unofficially married couples will fall out the premarital screening, and this was attributed as a limitation in success of thalassemia prevention program in Iran. Therefore, the program is strongly recommended to be made more native and compatible with the norms of the provinces.

Conclusion

Thalassemia in Iraq can be readily prevented in a cost-effective manner, after incorporating all the complementary steps into the thalassemia prevention program following the countries who could succeed in preventing the disease.

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The Muslim world league- high Islamic council- fatwa12th session dated 15-22 Ragab 1410 H (1990)

It is proved before 120 days of pregnancy, counted from the conception, and confirmed by a report from a committee formed of competent trustworthy physicians and on the basis of medical and laboratory findings the fetus is growthly malformed with an untreatable severe condition and if he or she stays and is born on time, his or her life will be vicious and painful for him or her and for his or her family, then it is allowed to abort it on the basis of the parents requisition.

وكانت رابطة العالم الإسلامي و المجلس الأعلى للشؤون الاسلامية و مجلس الإفتاء في دورتة الثانية بتاريخ ١٥ رجب ١٤١٠ (١٩٩٢) قد افتت بأن:
في حالة اكتشاف تشوه شديد غير قابل للعلاج في الجنين قبل ١٢٠ يوما من الحمل،تحسب من بداية الحمل، وبعد تقرير من لجنة تشكل من الأطباء الثقات المختصة وعلى أساس النتائج الطبية والمخبرية و انة في حالة استكمال الحمل سوف تكون حياتة مؤلمة لة و لاسرتة فيسمح لها بأسقاط الجنين.

Figure 1: Religious decision regarding therapeutic abortion

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