

# Anencephaly in Singapore: vanquished or vanishing?

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It is a shocking and distressing experience for a woman and her family to find out that she is carrying an anencephalic baby. She might feel guilty and ashamed to have conceived a severely-deformed baby that is not compatible with life. The effect of such a traumatic experience is profound and far-reaching. There have been very few papers on the prevalence and incidence of anencephaly in Singapore over the past 50 years. Searle in 1959 and Stevenson et al in 1966 (quoting Lean's series) reported anencephalic babies born before 1966<sup>(1,2)</sup>; Toh and Ho reported anencephalic babies born between 1970 and 1976<sup>(3)</sup>; Tan et al, from 1976 to 1980<sup>(4)</sup>; and Ho (including part of the data from Toh and Ho<sup>(3)</sup>) from 1972 to 1989<sup>(5)</sup>. However, the data collected were not comprehensive and the studies were not well-designed. Also, these reports came from different hospitals.

It was not until the late 1990s that Singapore established its National Birth Defects Registry under the auspices of the Ministry of Health, Singapore. The Registry collects the most information and maintains a nationwide surveillance of birth defects. It enables monitoring of the annual trends in birth defects as well as their mortality. The information can also be utilised for research, and to identify the genetic and environmental risk factors for birth defects. With the information provided by the Registry, educational activities for the prevention of birth defects can be planned and promoted.

The aetiology of anencephaly is still unknown. Efforts have focused on elucidating the genetic risk factors contributing to its aetiology. Epidemiological and clinical data have been obtained over the last few decades. It is apparent that these multifactorial defects have a significant genetic component to their aetiology that interacts with specific environmental risk factors. Study of genetic as well as non-genetic factors that may influence neural tube defect (NTD) risks (including anencephaly) through effects on the nutrient status of the mother or embryo has emerged as a major research focus.

Many possible aetiological factors have been observed.

In 1977, Toh and Ho observed that there might be racial and ethnic differences, with higher prevalence of anencephalic babies borne by Malay and Teochew (or Chaozhou) mothers. They however commented that long-term

continuous studies in Singapore tended to be frustrated by the rapid demographical changes, and such changes in the character of the population rendered it non-homogeneous<sup>(3)</sup>. Nevertheless, it is noted that the Certificate of Registration of Birth continues to record the parents' dialect group. Are these data still useful in the study of anencephaly in our population?

Recent reports in China in 2001 have alerted people to the effects of long-term contact with chemicals such as hair dyes. Two women hair-stylists who delivered anencephalic babies, one lived in Qingdao in North China and the other in Hunan in South China, had long-term contact with hair dye. Their amniotic fluid was found to contain chemicals similar to that of hair dye<sup>(6,7)</sup>. While researchers are uncovering the causative factors for anencephaly, one should at least aim at reducing the prevalence, if not the incidence of this birth defect, as far as possible. Pulikkunnel and Thomas reviewed the pathogenesis of NTDs and its association with folate metabolism. Several gene defects affecting enzymes and proteins involved in transport and metabolism of folate have been associated with NTDs<sup>(8)</sup>. Finnell et al indicated that there might be several gene defects affecting enzymes and proteins that were involved in transport and metabolism of folate that have been associated with NTDs<sup>(9)</sup>.

In 1991, Wald et al<sup>(10)</sup> first provided unambiguous evidence that synthetic folic acid in a pill would prevent most children from getting spina bifida and anencephaly, and folic acid supplementation might have a protective role for birth defects including NTDs<sup>(11,12)</sup>. Oakley envisaged global prevention of all folic acid-preventable spina bifida and anencephaly by 2010<sup>(13)</sup>. It is encouraging to note that the association between folic acid and NTDs has become widely accepted in the early 1990s, and in 1992, the US Public Health Service recommended that women of childbearing age (15–44 years) should consume 400  $\mu\text{g}$  of folic acid to reduce the number of cases of spina bifida and anencephaly (NTDs)<sup>(14)</sup>. The US Food and Drug Administration had mandated that all enriched cereal grain products be fortified with folic acid from January 1998 onwards. Women are also encouraged to increase synthetic folic acid consumption through vitamin supplements.

In fact, in New Zealand, periconceptional folate supplementation, some as high as 800  $\mu\text{g}$  of folic acid, are

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given four weeks prior to and 12 weeks after conception<sup>(15)</sup>, with data suggesting that a daily intake of 400  $\mu\text{g}$  folic acid reduces the risk of first NTDs by up to 70%<sup>(16)</sup>. This decline in NTD-affected pregnancies highlights the partial success of the US folic acid fortification programme<sup>(17)</sup>. Recently, an appeal was made to the Food and Drug Administration to add more folic acid in “enriched” flour and other grains, in view of the fact that folic acid-preventable birth defects continue to occur<sup>(18)</sup>.

The decreasing incidence of total births with anencephaly in Singapore over a ten-year period (1993–2002) could also be attributed to an increasing usage of folic acid supplementation in the first trimester of pregnancy<sup>(19)</sup>. An earlier observation made by Toh and Ho was that there was an increasing risk of producing babies with NTDs as parity increases<sup>(3)</sup>. Would this decreasing prevalence be a result of many young couples choosing to have a smaller, one- to two-child families?

With available diagnostic techniques of amniocentesis, foetoscopy, and maternal serum alpha fetoprotein screening, approximately 85%–90% of NTDs can be detected. Combined with second trimester foetal ultrasonographical screening, the detection rates for anencephaly and spina bifida are virtually 100%. Other imaging methods, such as computed tomography and magnetic resonance imaging, have improved the accuracy in the diagnosis of foetal abnormalities, and determination of prognosis is possible in many instances<sup>(20)</sup>. Ultrasonographical screening identifies a growing number of central nervous system abnormalities, resulting in substantial changes in the neonatal presentation of neurological congenital abnormalities. Termination of pregnancy could be done and the prevalence of NTDs, including anencephaly, is expected to be reduced.

We aim at eliminating anencephaly, as well as other NTDs. Have we done enough? How far are we away from achieving this goal? Has the problem been vanquished or is the disorder vanishing? More studies are needed.

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