

NEONATAL LEUKEMIA AND MATERNAL IRRADIATION

Report of a Case *

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Congenital leukemia, or leukemia appearing during the first days after birth, is rare although reports of such have come from many sources and in 1959, Pierce¹ reviewed the literature.

During the last twenty-five years, there has been an increase of leukemia in the world. Every age group has been affected by this increase. Although facility of diagnosis has made it possible to register cases more accurately, according to Burnet,² this cannot explain the entire increase of incidence. This upsurge of leukemia is particularly evident in countries having a high standard of living.³

Various opinions regarding the etiology of leukemia have been formed. Some physicians believe that mutation, chemicals and viruses are the causes. Other physicians suggest that ionized irradiations and especially roentgen ray irradiation play important roles as agents in leukemia. We present a case of neonatal leukemia in which the patient's mother had roentgen ray examinations during the first days of her pregnancy.

Case: M. N., a three months old girl, was admitted to the hospital on September 4, 1959. She had been vomiting for several days and her abdomen had been distended for two months. She is the seventh child of the family and her mother was fluoroscoped on three occasions, for reasons unknown, during the first three months of pregnancy.

Physical Examination: The child, on admission, was excessively pale and apparently in pain. Lymph nodules ranging in size from chick-peas to walnuts were found on the neck, the axillary and inguinal areas. Her liver was palpable 2 cm. below the costal margin and the spleen was palpable 3 cm. below the costal margin.

Laboratory Data : The laboratory tests showed 5.4 gr. per 100 cc. hemoglobin, 1,860,000 red blood cells per cmm., 27,500 white blood cells per cmm., hematocrit, 13 per cent and reticulocytes 1.4 per cent. Her urine test was normal. The fetal hemoglobin was 3.17 per cent. The blood group was O, Rh + and the erythrocyte fragility was 0.42 - 0.28. All myeloid elements had disappeared from the area.

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The peripheral blood examination also revealed lymphoblasts.

Discussion

According to Bernhard⁴ and his associates, the presence of the following criteria is useful in establishing leukemia:

1. Anemia not severe enough to account for the illness.
2. Presence of thrombopenia.
3. Symptoms appearing immediately after birth.
4. Appearance of abnormal cells in the peripheral blood.
5. Enlargement of the liver and spleen.
6. No history of syphilis or fetal erythroblastosis.

In our patient, most of these criteria were present.

To diagnose any leukemia case as congenital, the symptoms should have appeared at birth or immediately after. However, in cases where symptoms do not appear until the first or second week after birth, certain indications may point to congenital leukemia. If, for instance, there is widespread infiltration through all the organs, a study must be made to ascertain that such infiltration is possible in the period after birth. If the infiltration is too great for the life span of the patient, congenital leukemia must be suspected. In our case, the first symptoms appeared between the third and sixth week after birth. This does not look like congenital leukemia from the time factor, but the fact that the mother was fluoroscoped in the early days of her pregnancy does suggest neonatal rather than congenital leukemia and we shall present our case as such. As is discussed below, it is our belief that the amount of radiation accepted by the body in a fluoroscopic examination is enough to cause leukemia in the fetus and embryo.

Before developing this opinion a review of the etiology of congenital leukemia, probable agents and heredity as a factor should be made. For example, in mongolism cases it is reported that congenital leukemia appears frequently.^{5, 6, 7, 8, 9} Why this is so is not definitely known but the granulocytes appear in the seventh embryonic week, lymphoblasts appear in the eighth embryonic week, and the defects causing mongolism appear in the same weeks of development,¹⁰ a contributing factor to the validity of this claim. In the literature there are no reports of mongolism with congenital leukemia showing any history of irradiation of the mother during her pregnancy. Nor are there any cases in the literature of congenital leukemia which show that the mother also had leukemia. There is a report,¹² however, of a nine month old leukemia patient whose mother did have it. Heredity in the etiology of leukemia cannot be denied but it should not be stressed.

The belief that leukemia is a virus disease is held by many physicians, but there is no proof of this in congenital or neonatal leukemia. On the other hand there is increasing evidence to show that any radiation, even the roentgen rays used in the diagnosis of a pregnant woman may cause leukemia in the child. After the atom bombing of Hiroshima and Nagasaki, the incidence of leukemia in the people who were in the 1200-1500 meter area of the drop, was 200 to 300 per cent higher than in those people outside the 1500 meter limit.¹³ In 1957, patients treated for ankylosis and spondylosis by roentgen rays were found to have a high rate of leukemia and aplastic anemia.¹² Also, it has long been known that roentgen ray specialists have a percentage of leukemia eight to nine times higher than other doctors.¹⁴ Finally, Stewart and his associates showed that there is a relationship between pelvis roentgen ray examination of a young woman and the appearance of leukemia in her newborn infant. According to Burnet,² fetal tissues are more apt to be affected by radiation,³ than other tissues. The consensus is that there is a higher percentage of leukemia among children born to women who have had radiation across the abdomen during pregnancy. Burnet says that 5 per cent of all leukemia cases are due to the unnecessary use of roentgen rays in medical practice.

The amount of radiation accepted in the usual roentgen ray examination of a pregnant woman may be considered too small for harmful results, but Dr. Gunz and his associates,¹⁵ after diagnosing acute leukemia in a ten month old child, found that the mother had had three roentgen ray examinations during her pregnancy for the purpose of ascertaining the position of the fetus. (Table 1).

TABLE 1
FETAL EXPOSURES

DATE	VIEW	KV	MA/S	FETAL SKIN DISTANCE	SKIN DOSE	CENTRAL FETUS DEPTH	DOSE TO CENTER OF FETUS
Nov. 15	A. P.	78	550	19 in.	53.2r	4.0 in.	6.15r
Nov. 15	Lat. L. to R.	81	600	20 in.	55.9r	3.5 in.	8.4r
Nov. 28	A. P.	76	500	19 in.	46.0r	4.0 in.	5.3r
Dec. 7	A. P.	76	500	19 in.	46.0r	4.5 in.	4.1r
Dec. 7	Lat. L. to R.	76	500	22 in.	34.2r	6.0 in.	1.4r
Total							25.35r

This patient, whose acute granulocytic leukemia was proved post-mortem, had taken 25.35 r radiation. This amount seems small until the size of the fetus and other conditions are considered. Actually this amount of radiation equals the amount affecting people within

the 200 meter limit of the bomb drop at Nagasaki and Hiroshima. In general, all symptoms appear nine or ten months after radiation.

The problem to be faced, is that through scientific research, exposure to radiation is going to increase and protection against it must be devised. From the medical standpoint the simplest rule is not to use roentgen rays on any one unnecessarily, particularly pregnant women. If such treatment or use is necessary at that time, a specially filtered machine should be used and the technique employed should be one in which the smallest possible amount of the ray is used.

Summary

The authors report views of leukemia in newborn infants and a case is presented in which the mother received radiation during pregnancy. It is concluded that this irradiation might be an etiologic factor in this case of neonatal leukemia.

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