THE TRANSMISSION OF PENICILLIN THROUGH THE PLACENTA*

A Preliminary Report

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A STUDY was started in May, 1944, to determine what place penicillin might have in obstetric therapeutics. The first problem consisted of finding out whether or not the placenta would offer a barrier to the passage of penicillin from the maternal circulation into the fetal blood supply. If penicillin could be detected in the fetal blood, it seemed important to determine the amount necessary to give the mother in order to obtain an adequate therapeutic concentration in the fetus.

Procedure and Findings

Amorphous penicillin, as the sodium salt, was placed in solution with normal saline in concentration of 5,000 units per cubic centimeter. Labors were closely observed in order to give an intramuscular injection of penicillin to each patient within a period of less than two hours before delivery. At the time of delivery, penicillin blood levels were obtained both from the antecubital vein of the mother and the umbilical vein of the infant. In a few patients, in which delivery did not occur within the first hour after injection, maternal blood levels were obtained one hour after administration of the penicillin and at the time of delivery.

The bacteriostatic level of penicillin varies with different strains of organisms. The test strain used in this study was *Staphylococcus aureus* 209, for which the minimum bacteriostatic blood level has been determined to be 0.02 Florey units per cubic centimeter.[1, 2]

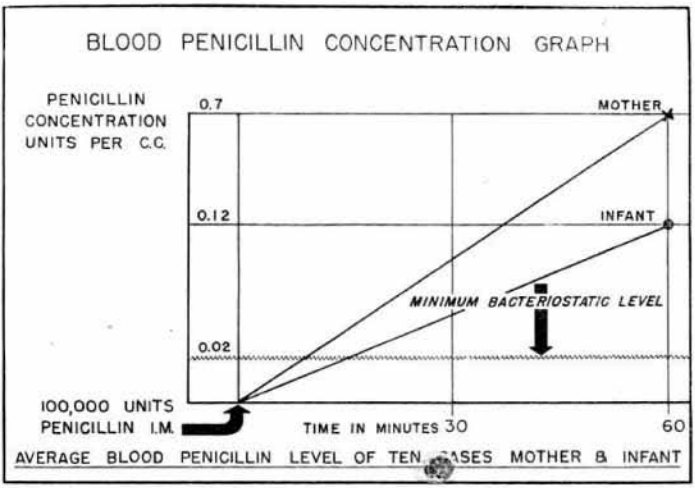
An initial dosage of 20,000 units was tried on one patient. Thirty minutes after intramuscular administration of penicillin to the mother, a penicillin level of less than 0.02 Florey units per c.c. was obtained from the infant cord. The maternal blood level at the time of delivery was 0.08 units per cubic centimeter.

Two patients were given 40,000 units of penicillin by intramuscular injections. Ineffective blood levels of less than 0.02 units per c.c. were obtained from the infants. The maternal levels were 0.08 units per cubic centimeter.

The dosage was then increased to a single 10 c.c. intramuscular injection of 100,000 units of penicillin (10,000 units per c.c.). With this dosage, observations were made on ten patients. Effective bacteriostatic levels were obtained in the fetal blood. The maternal levels ranged from 0.1 units per c.c. to 2.5 units per cubic centimeter. The fetal blood levels ranged from 0.02 units per c.c. to 0.2 units per cubic centimeter. A composite average of fetal and maternal penicillin blood levels is charted in Fig. 1. A complete record of maternal and fetal penicillin blood levels is given in Fig. 2.

*The opinions and views set forth are those of the writers and are not to be considered as reflecting the policies of the Navy Department.

Fig. 1.



PENICILLIN BLOOD LEVELS

PATIENT	DATE	PENICILLIN 100,000 UNITS I.M.	BLOOD LEVEL MOTHER IST. HR.	TIME INTERVAL BET. INJ. & DEL.	BLOOD LEVEL MOTHER AT DEL.	BLOOD LEVEL FOETUS
M.B.	6-27-44		0.3 U/c.c.	1 hr. 45 min.	0.1 U/c.c.	0.06 U/c.c.
M.R	6-27			30 min.	0.3 U/c.c.	0.02 U/c.c.
W.M.S.	6-27			55 min.	0.6 U/c.c.	0.1 U/c.c.
A.C.	7-5			1 hr. 05 min.	0.20 U/c.c.	0.14 U/c.c.
K.P	7-6		1.24 U/c.c.	1 hr. 19 min.	0.3 U/c.c.	0.2 U/c.c.
R.B	7-11			1 hr. 17 min.	0.4 U/c.c.	0.14 U/c.c.
M.M.	7-17			1 hr. 45 min.	0.3 U/c.c.	0.154 U/c.c.
G.T.	7-18			58 min.	0.62 U/c.c.	0.14 U/c.c.
E.D.	7-18			25 min.	2.5 U/c.c.	0.14 U/c.c.
A.J.	7-18			1 hr. 06 min.	1.2 U/c.c.	0.14 U/c.c.

Fig. 2.

Discussion

Our results confirm the report of Herrell, Nichols, and Heilman,[3] that 100,000 units of penicillin injected intramuscularly into the pregnant patient at term will result in an adequate bacteriostatic penicillin level in the fetal circulation. We have no data on the passage of penicillin through the placenta of the patient in the first or second trimesters of pregnancy. One patient, K. P., had positive blood serology, but a normal appearing placenta. Another patient, R. B., had moderately severe pre-eclamptic toxemia with multiple small placental infarcts.

The fact that penicillin passes from the maternal into the fetal circulation in effective concentrations suggests a wide therapeutic application of a relatively nontoxic agent for the control of penicillin susceptible infections which affect the mother and her unborn infant. Of these infections, syphilis should receive greatest consideration. If penicillin will eradicate syphilitic infections in the mother and fetus, it should replace the much more toxic arsenical preparations in the treatment of syphilis in pregnancy. Penicillin, given during labor to patients with known gonococcal infections, should reduce the incidence of postpartum gonorrheal salpingitis and gonorrheal ophthalmia neonatorum. The prophylactic use of penicillin in patients with prolonged rupture of the membranes should reduce puerperal infection in the mother and increase fetal resistance to intrauterine pneumonia. It seems that the factor of safety for mother and infant would be increased by substituting penicillin for the more toxic sulfonamides in the treatment of all penicillin susceptible infections complicating pregnancy.

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References

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