

Antibiotic concentrations in the mother and the fetus

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1. Pharmacokinetics

The transfer of antibiotics from the mother to the fetus in late pregnancy is mainly achieved through placental passage by simple diffusion. From the fetus, antibiotics pass into the amniotic fluid via fetal urine but also from fetal surfaces, umbilical cord and paraplacentally through the fetal membranes. Together with amniotic fluid they are swallowed, reabsorbed and retransferred to the mother via the placenta.

2. Single injections

After a single i.v. or i.m. injection, a peak level is quickly reached in the maternal serum. Thereafter, while the maternal blood level decreases, the serum level in the fetus rises and then decreases but more slowly than in the mother. The calculation of a distribution ratio is meaningless, since both concentrations are constantly changing. The same is true for amniotic fluid levels. In order to evaluate the therapeutic activity of the intrauterine antibiotic level, its absolute value has to be considered.

3. Continuous intravenous infusion

After a loading dose and during continuous intravenous in-

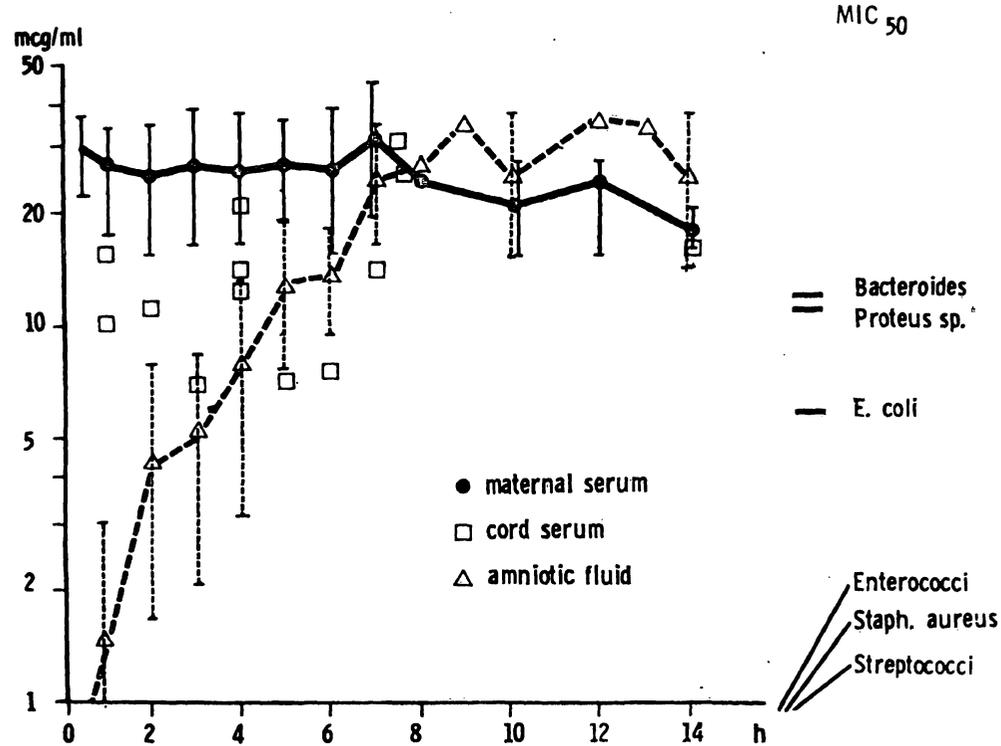


Fig.1: Maternal serum, cord serum and amniotic fluid concentrations during continuous infusion of 1g ampicillin/h in comparison to the MIC's of the most common pathogens of intra-uterine infections (3).

fusion of an antibiotic, a steady state is established in maternal serum. This allows a better study of intrauterine transfer and comes closer to the clinical situation in which usually more than one single dose is injected (1,2,3,4).

During the steady state of ampicillin (Fig. 1) cord serum levels of about 50% of the maternal serum levels are reached within less than one hour (3). Amniotic fluid levels rise constantly and reach a plateau after about 8 hours. Differences in the time necessary to reach a constant fetal serum or amniotic fluid level seem to correlate with the degree of protein binding of the antibiotic (5).

4. Repeated intravenous injections

During repeated intravenous injections of the same amount of the antibiotic per time, the maternal level zigzags around a mean comparable to the corresponding steady state level (Fig. 2). The fetal serum levels (Fig. 3) and the amniotic fluid levels are comparable to the ones achieved during continuous infusion (3).

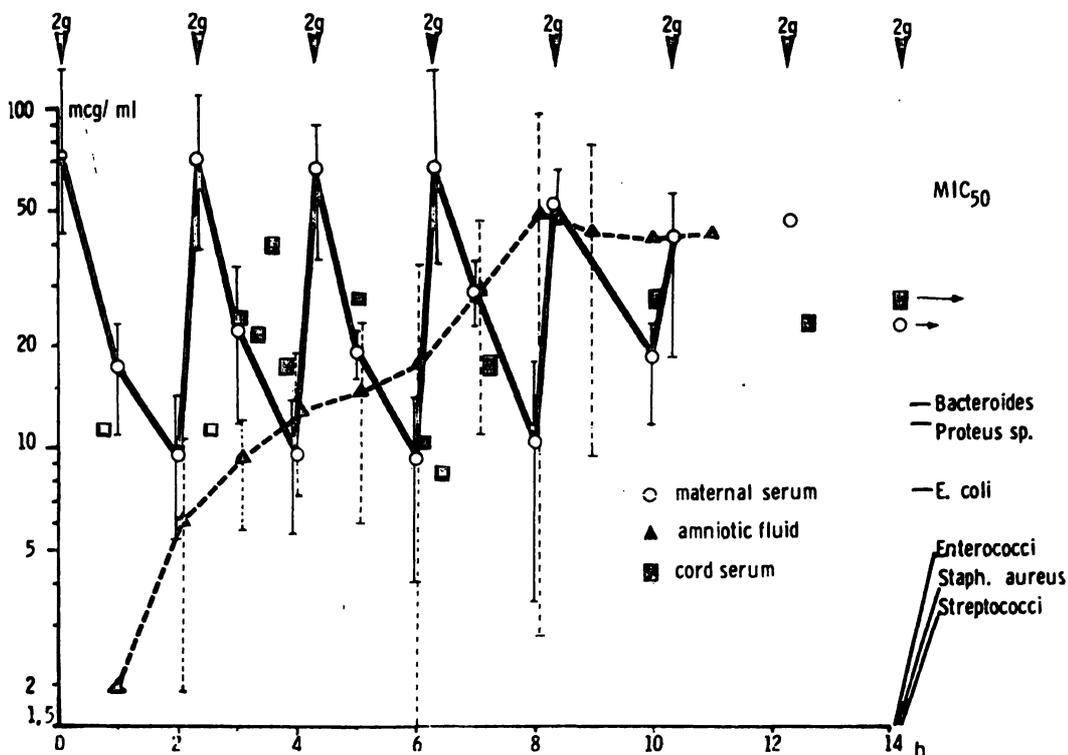


Fig.2: Maternal serum, cord serum and amniotic fluid concentrations after intravenous injections of 2g ampicillin every 2 hours, in comparison to the MIC's of the most common pathogens of intrauterine infections (3).

5. Therapeutic activity

When high doses of ampicillin (3), ticarcillin (1), cephacetril (4), or gentamicin (2) are given, therapeutic concentrations are reached in both fetal serum and amniotic fluid levels (Tab. 1).

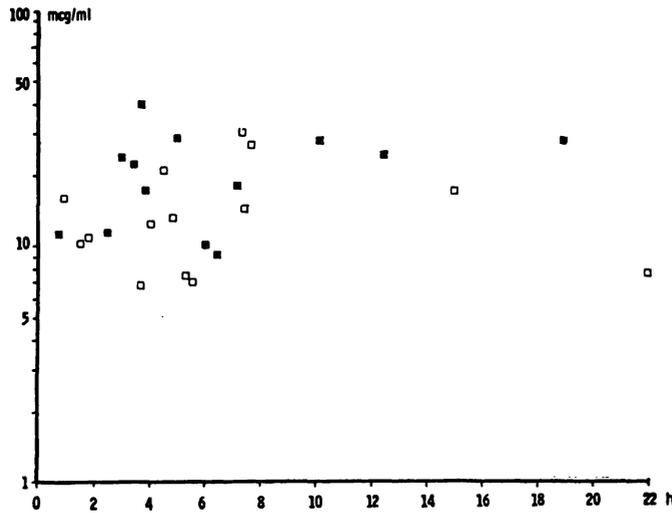


Fig. 3: Cord serum concentrations after continuous infusion (empty squares) and repeated intravenous injections (dotted squares) of ampicillin (3)

Table 1: Maternal serum and intrauterine concentrations of various antibiotics during a steady state in the mother.

	Infusion (g/h)	Maternal serum (mcg/ml)	Cord serum (mcg/ml)	Amniotic fluid (mcg/ml)
Cephacetrile	0.5	28 - 34	12 - 25	9 - 14
Ampicillin	1.0	20 - 30	12 - 22	25 - 30
Ticarcillin	2.0	130 - 220	90 - 115	40 - 90
Gentamicin	0.04	4 - 5	3 - 4	4 - 5

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