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Stress in pregnancy may affect the unborn child

Stress experienced by a woman during pregnancy may have an effect on her unborn child, most likely mediated by the transfer of stress hormones across the placenta. Research published in May's edition of *Clinical Endocrinology* shows that from 17 weeks of age, the amount of stress hormone in the amniotic fluid surrounding the fetus is positively related to that in the mother's blood. This is the first report of this relationship noted at such an early stage in pregnancy.

Stress hormones are pumped into our blood when we become anxious. These hormones are good in the short term because they help our bodies deal with the present stressful situation. But if we are stressed for a long time they can affect our health including making us tired, depressed and more prone to illness. Although we know stress during pregnancy affects the unborn child, little is understood about the mechanisms behind this or when in development the child is most susceptible to these effects.

Researchers led by Prof Vivette Glover at Imperial College London and Dr Pampa Sarkar at Wexham Park Hospital Berkshire examined the relationship between the stress hormones in the mother's blood and stress hormones present in the amniotic fluid around the baby in the womb. They studied 267 women, taking a blood sample from the mother and a sample from the amniotic fluid surrounding the baby. They then measured the levels of a stress hormone called cortisol present in both samples. At gestational age of 17 weeks or greater, they found that the higher the cortisol levels in the mother's blood, the greater was the level of cortisol in the amniotic fluid. Amniotic fluid is predominantly produced by the fetus, and reflects the exposure of the fetus to various substances including hormones.

Recent work on animals shows that high levels of stress in the mother during pregnancy can affect brain function and behaviour in her offspring. While evidence in the scientific literature suggests that maternal stress in humans can affect the developing child, the mechanisms and period of time when the fetus is susceptible is still unclear. This is the first study to show that maternal stress may affect the unborn child as early as 17 weeks in development. More work is now needed to better understand the mechanisms of this relationship and the implications to the unborn child.

Researcher Dr Pampa Sarkar said:

“We are all a product of our developmental history. One of the times when we are most susceptible to the influences of our surrounding environment is when we are developing as a fetus in our mother’s womb. Our research shows that the fetus is exposed to cortisol in the maternal blood, and we also demonstrated that at and above 17 weeks, the cortisol in amniotic fluid had a strong positive relationship with cortisol in maternal blood. We found that the strength of this correlation became stronger with increasing gestational age.

We now need to carry out further work to unravel the mechanisms by which maternal stress affects the fetus, both during fetal life and through into childhood. We do not wish to unduly worry pregnant women. It should be remembered that one of the best ways for people to avoid general stress is to lead a healthy, balanced lifestyle.”

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Notes for editors:

This paper appears in the May edition of *Clinical Endocrinology* 66 (5), 636-640. *Clinical Endocrinology* is the official clinical journal of the Society for Endocrinology.

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ABSTRACT

Ontogeny of foetal exposure to maternal cortisol using midtrimester amniotic fluid as a biomarker

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Objective There is increasing evidence that antenatal stress has long-lasting effects on child development, but there is less accord on the mechanisms and the gestational window of susceptibility. One possible mechanism is by foetal exposure to maternal cortisol. To explore this, we investigated the relationship between cortisol in maternal plasma and amniotic fluid, and any moderating influence of gestational age.

Patients and measurements Two hundred and sixty-seven women awaiting amniocentesis for karyotyping were studied. Samples were collected between 0900 and 1730 h. Gestational age was determined to the nearest day by ultrasound biometry and time of collection noted to the nearest 15 min. Total cortisol was measured by radioimmunoassay in paired amniotic fluid and maternal blood samples ($n = 267$) [gestation range 15–37 weeks, median 17 weeks (119 days)].

Results Both maternal and amniotic fluid cortisol levels increased with gestation ($r = 0.25$, $P < 0.001$; $r = 0.33$ $P < 0.001$, respectively). Amniotic fluid cortisol was positively correlated with time of collection ($r = 0.22$, $P < 0.001$) and negatively with maternal age ($r = -0.24$, $P < 0.001$). There was a positive correlation between amniotic fluid cortisol with maternal plasma levels ($r = 0.32$, $P < 0.001$), which persisted after multivariate analysis controlling for gestation, time of collection and maternal age. The association appeared to be dependent on gestational age, being nonsignificant at 15–16 weeks' gestation and increasing in strength thereafter.

Conclusion This study shows a positive correlation between maternal and amniotic fluid cortisol levels, which becomes robust from 17 to 18 weeks onwards. The results provide support for the hypothesis that alterations in maternal cortisol may be reflected in amniotic fluid levels from this gestation.