



Original article

The complex impact of five years of stress related to life-threatening events on pregnancy outcomes: A preliminary retrospective study



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ABSTRACT

Objective: To study the impact of chronic, life-threatening stressors in the form of daily missile attacks, for five consecutive years, on pregnancy outcomes.

Method: Charts of deliveries from two neighboring towns in the south of Israel, covering the years 2000 and 2003–2008, were reviewed retrospectively. One city had been exposed to missile attacks, while the other was not. For each year, 100 charts were chosen at random.

Results: Significant association was found between exposure to stress and frequency of pregnancy complications ($P = 0.047$) and premature membrane rupture ($P = 0.029$). A more detailed analysis, based on dividing the stressful years into three distinct periods: early (2003–2004), intermediate (2005–2006) and late (2007–2008), revealed that preterm deliveries were significantly more frequent ($P = 0.044$) during the intermediate period, as was premature membrane rupture during the late period ($P = 0.014$).
Conclusion: Exposure to chronic life-threatening stress resulted in more pregnancy complications and in particular more premature membrane ruptures. The impact was most significant during the middle period of the 5-year-exposure to the stressor. Hence it seems that factors of duration and habituation may play a role in the impact of chronic, life-threatening stressors on pregnancy.

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1. Introduction

There is convincing support for the importance of human foetal intra-uterine experience in determining developmental patterns, and the emergence of a variety of illnesses [1,7,12]. The concept of programming [12] is defined as a process by which a stimulus or an insult during a critical developmental period has a long lasting or permanent influence.

The impact of stress on pregnancy outcomes is complex and a precise definition of the nature of the measured stress is essential to the interpretation of the reported findings. One needs to differentiate between three major categories: psychosocial stress, acute life-threatening stress and chronic life-threatening stress.

1.1. Psychosocial stress

Two main categories of psychological adversity have been identified in pregnant women [13]: life stress (as the perceived burdens in major areas of life) and emotional symptoms, including pregnancy-related anxiety, i.e. anxiety inherent to the state of pregnancy (mainly mother's health issues, usually focused on her foetus, but also related to herself and to the fear of the delivery), to which each woman relates in differently, depending on her defence mechanisms, her own maternal representations, self-image and marital relationship. In addition, life burdens and unusual events may add to the pregnancy-related anxiety level. Again, the definition of what constitutes a stressor for a pregnant woman may differ greatly due to varying levels of resilience and vulnerability. For instance, life stress and emotional symptoms both predicted a shorter length of gestation, while life stress alone did not [3].

Additional factors that add to the complexity of assessing the impact of psychological stress on pregnancy outcomes are the

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timing and the permanence of the stressor. Two hundred forty-seven women with singleton full term pregnancies were studied [3,4]. Their psychological state (anxiety, depression, and perceived stress) and saliva cortisol were evaluated at three points in time: the 18th, 24th and 30th week of gestation. During the third trimester of pregnancy (30–32 weeks) endogenous maternal stress hormones (corticotrophin releasing hormone, cortisol) predicted infant's impaired cortisol regulation, behavioral inhibition and fearfulness in response to novelty. A recent study [2] has shown the link between prenatal maternal stress exposure due to the death of the father of the child or of a close relative, and between shortened gestational age, especially when the event occurred during months 5 and 6 of the pregnancy. In another study [18], it was found that vulnerable to stressful life events was higher during the first trimester and resulted in higher rates of preterm births and low birth weight.

1.2. Acute life-threatening stressors

Women who were in the first trimester of pregnancy at the time of the World Trade Center bombing in New York had a significantly higher rates of early deliveries than women who were at later stages of pregnancy [11]. According to the authors, the impact of the stressful event on the fetus depends on whether it occurs before or after the placenta produces the enzyme 11 beta-hydroxysteroid dehydrogenase, which converts noxious cortisone to benign cortisone.

In a sample of pregnant women exposed to earthquakes, similar phenomena of early deliveries were found, but only when the exposure occurred during the second trimester [8]. Thus, one may infer that there are multiple mediating factors involved. For example, it may be that the enzyme production onset time is only one factor among several, such as the intensity of its expression. Support for this hypothesis comes from a study [5] that found that the expression of the enzyme is dramatically reduced in the last period of pregnancy, allowing glucocorticoids to interact with their receptor systems and to influence fetal brain development.

1.2.1. Chronic life-threatening stressors

To the best of our knowledge, only recently has a controlled study [16] been published on the impact of long-term exposure to life-threatening situations on pregnant women. Indeed, this naturalistic study performed in the same area as our study showed a significant association between exposure to life-threatening rocket attacks and spontaneous abortions. The authors compared 1345 pregnancies of female residents of a town exposed to rocket attacks with 2143 pregnancies of female residents of an unexposed town, and found that stress during preconception and pregnancy was associated with increased risk of spontaneous abortions. Live birth outcomes were not investigated in that study.

In the present study, we evaluated the outcomes of live births among pregnant women, in the same naturalistic situation, where one group had been exposed for five consecutive years to daily life-threatening and unpredictable rocket attacks while the other had not.

2. Method

2.1. Participants

Charts of deliveries in the year 2000 and between 2003 and 2008, from two neighboring cities in the south of Israel that are both served by the same general hospital, were reviewed retrospectively. One of those cities (city S-E) was exposed regularly to missile attacks while the other one was not attacked, during that period (city A-UE – UnExposed). The missile attacks started in the year 2000. Till then,

it was quiet in both cities. Between the years 2000 and 2002, the missile attacks were sporadic. Starting in 2003, they became an almost daily occurrence. A random sample of 100 charts of live births were chosen from each of the years 2000 (i.e. pre-stress year) and 2003–2008 (i.e. stress years) for each of the two cities. The random sampling was done by including in the final analyses every 10th chart from the alphabetic list of deliveries (list per day). Table 1 presents the total yearly number of deliveries for the study years, in each city. In the year 2008 the missile attacks started reaching City A-UE as well, thus 2008 deliveries from City A-UE were not included.

Exclusion criteria for the study comprised: maternal age under 18 years and multi-foetus pregnancies. The total number of deliveries that were reviewed was 711 (97 prior to the stress years and 614 during the stress years) from S-E and 605 (101 prior to the stress years, 504 during the stress years) deliveries from A-UE were reviewed.

2.2. Procedure

The data collected from the charts included: maternal age, ordinal number of pregnancy and delivery for each woman in the study, pregnancy complications (toxemia, hyperemesis gravidarum, diabetes mellitus, intra-uterine growth retardation), week of amniotic fluid and delivery, premature contractions, Apgar score and head circumference at birth.

The Institutional Review Board of the Ashkelon Medical Center approved this study and declared it exempt from the need to obtain informed consent from the participants due to the retrospective, chart-based nature of the study.

2.3. Data analysis

The tools used to assess the differences between City S-E and City A-UN as well as the differences in City S-E between the period prior to the onset of the regular missile attacks (i.e. year 2000) and between the stressful years (2003–2008) were either independent samples *t* test or Pearson Chi² analyses. All analyses were two sided with $P > 0.05$ considered significant.

3. Results

3.1. Pregnancy outcomes in the exposed city (City S-E) in the pre-stress year and during the stressful period

Table 2 presents the results of Chi² analyses of the frequency of pregnancy complications, premature membrane rupture, week of delivery and gender ratio in the stressful years vs. the pre-stress year. There was a significantly higher rate of pregnancy complications ($P = 0.047$) and premature membrane ruptures ($P = 0.029$) during the stressful years. The gender ratio inverted from a higher rate of boys to a higher rate of girls, but the differences did not reach statistical significance ($P = 0.062$). No significant difference was found in the rate of premature deliveries.

Table 1

Number of deliveries per year in the exposed (EXP) City S-E and the unexposed (N-EXP) city A-UE.

Year	City S-E (EXP)	City A-UE (UN-EXP)
2000	344	1737
2003	168	1015
2004	249	1511
2005	256	1566
2006	280	1562
2007	252	1572
2008	79	577

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