Identifying Prospective Biomarkers for Cognitive Impairments during Pregnancy – Review of Current Status and Some Preliminary Results

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Abstract

Pregnancy, childbirth, and early motherhood physiologically and psychologically affect a woman’s cognitive parameters. Hormonal alterations during early pregnancy, enlargement of the fetus during late pregnancy, and newborn with random sleep-wake patterns all contribute to cognitive parameters. Cognitive impairments are frequent in pregnancy and it is coupled with a range of undesirable outcomes, including maternal death. Recent studies indicate that pregnant women with cognitive impairment, mild to severe, are at increased risk for spontaneous abortion, preterm labor and for having a growth-retarded baby. The majority of older studies are cross-sectional designs, with comparisons to age-matched healthy controls. Many studies suffer from small sample sizes, lack statistical power for consistent interpretation and replication of findings about cognitive impairments during pregnancy. More recent studies are longitudinal designs to describe changes in cognitive parameters during the course of pregnancy. However, women’s baseline, pre pregnancy, psychiatric, neurological, and genetically inherited parameters are not considered. With very few published reports of cognitive complexities during pregnancy, it is very difficult to understand the implications of altered cognitive parameters patterns on postpartum period and women’s health outcomes. In prenatal period, a woman is in frequent contact with health professionals and it provides an opportunity to predict and prevent pregnancy complications. Early identification, appropriate referral to a specialist for pregnancy complications is key requirements to manage pregnancy outcome successfully. This requires the coordinated participation of professionals in primary care, maternity services and mental health services to work closely with women and their families. The purpose of this study is to review the current status of research being done in this nascent area and propose prospective biomarkers for cognitive impairments during pregnancy with reference to psychiatric parameters during pregnancy. The comprehensive model of accepted interrelationships between psycho-physiological, subjective, and objective assessment methodologies are presented. We identified a need for developing potential diagnostic instruments to screen pregnancy complications with more objective based methods and we present here some of the preliminary results of our work that has been done in this nascent area.

Keywords: Cognition; Pregnancy; Psychiatric symptoms; Eating disorders; Biomarkers

Introduction

Cognitive dysfunctions such as stress, frustration, memory loss, interest level, excitement, attention, and drowsiness are known to affect mother & developing fetus adversely. Behavioural health attitudes, habits, low socioeconomic status are associated with adverse pregnancy outcomes [1]. Depression that occurs for the first time in pregnancy presents as mild symptoms of nervousness that might not require any pharmacological treatment. It is constantly established that depressed mood or anxiety in pregnancy are considerable predictors of postpartum depression [2]. Physiological, psychological, and emotional disturbances are common during pregnancy [1]. Nausea is frequent in primigravida especially in first trimester; tenderness in the breasts and physical changes results in woman’s emotional stability. In the second trimester, changes in the body and its image, sexual attention, and, apprehension about childbirth are universal. However, in the third trimester, pregnant mothers are physically and mentally preoccupied in preparing for childbirth, further care of the forthcoming baby. Emotional distortion due to social isolation is also widespread among women in third trimester of pregnancy [2]. In this paper, we attempt to recognize the workable, low cost, and portable instrumentation system as a bio-marker with reference to (i) to discuss the prevalence, physiology, psychology, screening methods, and possibilities of noninvasive diagnosis, (ii) scientific, social and ethical challenges for prospective biomarkers for cognitive impairments in India, and (iii) prospective bio-markers to general practitioners for cognitive impairments specifically with reference to psychological symptoms during pregnancy.

Physiology, Psychology, Screening Methods of Cognitive Dysfunctions

Physiology of pregnancy

Woman’s body undergoes many anatomical and physiological changes that lead to stress during pregnancy. These changes are a continuous process throughout pregnancy and it is important to know the particularities of a woman’s physiology at different stages of pregnancy in order to differentiate them from pathological conditions that can affect health of the mother and her fetus. Knowledge of physiological changes and discomforts during pregnancy can also help a health worker give a pregnant woman appropriate counseling and...
advice about ways to minimize these discomforts and make pregnancy more enjoyable for her and her family members.

**Pregnancy hormones**

The significant hormones of reproductive system that help to sustain the pregnancy and the growth of the fetus are four: (i) human chorionic gonadotropin (hCG), is secreted by developing placenta and stimulates release of estrogens and progesterone from corpus luteum cells of the ovaries. Levels of hCG are high at initial stages of pregnancy. After the placenta develops and matures, producing estrogens and progesterone, these levels decline. hCG levels are higher in multiple and hydatiform mole gestations than in singleton pregnancies. Serum and urine hCG measurements are usually used to diagnose early pregnancy, (ii) human placental lactogen (hPL), is produced by developing placenta, its levels rise as the placenta develops and pregnancy progresses. It supports to maintain maternal metabolic requirements, (iii) estrogens are originally secreted by the ovaries, than by the placenta. After conception estrogens are by placenta. Estrogen dominates production. It excites uterine growth, relaxes blood vessels to the uterus, support fetal growth, helps to loosen up the pelvic ligaments, shore up breast growth and also contribute to sodium and water preservation, and (iv) progesterone is first created by corpus luteum in ovaries. Then placenta takes over progesterone production. This hormone supports and maintains budding process of embryo in near beginning of the pregnancy, inhibits additional production of luteinizing hormone (LH) and follicle stimulating hormone (FSH), and decreases prostaglandin production. Woman’s body undergoes significant anatomical and physiological changes [3-6]. Norepinephrine and cortisol hormones levels are high in women with depressive symptoms their babies [7-8]. Dopamine levels are also lower in both depressed mother and her baby [9]. Stress promotes the sympathetic activation and cortisol hormone but hyper levels of cortisol are seen depressed individuals [10].

**Eating disorders**

Eating disorders in pregnancy along with history of depression have a prominent significance in increasing the risk for depression and anxiety perinatally. Eating disorders like bulimia nervosa and anorexia nervosa are common during pregnancy, due to repeated vomiting, nausea, dietary restrictions and binge eating. Fear of fatness and avoidance of normal body weight could lead to anorexia nervosa. Evaluating the risk factors for anxiety and depression in the perinatal period are favorable [11]. Weight of pregnant women should not be less than 85% of expected for age and height. Significant numbers of pregnant women might be vulnerable to postnatal relapse due to anorexia and bulimia nervosa. Severe symptoms might results in women who wish to be very slim and beauty conscious but prediction of these issues during pregnancy is very difficult. Electrolyte disturbances in hypokalaemia and hyponatraemia, poor maternal weight, and intrauterine growth retardation, miscarriage, premature or an instrumental delivery are common in pregnancy due to eating disorders. Fear and guilt needs to be avoided with healthy eating behaviors, routine ultrasound scans, and positive reinforcement of weight gain are helpful during pregnancy.

**Prevalence of psychiatric symptoms**

**Stress:** One in 10 women seems to experiences some degree of transient and post-traumatic stress during pregnancy which leads to traumatic childbirth. The possible stressors might be hormonal changes, having no partner, low socioeconomic status, sexual abuse, young age, poor education, unwanted pregnancy, physical alterations, and poor preparation for pregnancy or delivery. Extreme stress at work place, being a victim to crime, and death of close relative could be the reasons for the increased risk of spontaneous abortion. Stress during third trimester and remarkable serum concentrations on placenta indicates for increased risk of preterm delivery. Fear of child integrity and fear of pain during delivery seems to be the pregnancy specific stressors. Growth retardation, lower birth weight of the puppies, smaller litter size, structural malformations are seen when pregnant animal exposed to stressors like capture, introduction of strange male, crowding, noise, and immobilization [12]. Psychosocial support system helps to reduce the psychological and physiological stress response during pregnancy. Persisting post-traumatic stress during pregnancy due to traumatic or still birth are benefited from cognitive behavioral therapy with professional medication and treatment [13].

When women were exposed to stressors, system of stress regulation, i.e. hypothalamic-pituitary-adrenal cortex system, sympathetic nervous system and adrenal medulla systems are activated. Large amounts of hormones like corticotrophin (CRH), adreno- corticotrophin (ACTH), Cortisol, and (nor) adrenaline are induced in the blood stream. The degree of stress response depends on personality characteristics, genetic factors, previous experience, support from the social environment, and the way of coping with stress (Miller and O’Callaghan, 2002). The salivary Cortisol Awakening Response (CAR) is consistent and noninvasive technique to notice the delicate changes in the HPA axis function [14]. There were no considerable demarcations from healthy control from the women distress with anxiety and depression on CAR but lowered HPA axis response was established with distressed women on medication, further lower Cortisol points were associated with elevated trauma scores [15].

**Anxiety:** The prevalence of anxiety has been estimated at 11.4 percent during pregnancy and it drops to 8 percent in post partum [16,17]. Symptoms of somatic complaints are probable and quite normal during pregnancy. There could be relationship between physical disturbances and anxiety during pregnancy. Ambivalent emotions, fear of leaving a safely place, blood-injury phobia, fear of needle, illness, and hospital might be expected anxieties in pregnancy. Feel nervous about herself, baby’s health, and changes that occur after delivery and fears of not being able to cope with the baby, especially in primigravitas, low birth weight baby is delivered to highly anxious and depressed women [18]. Women with depression during pregnancy experience additional anxiety, perinatal depression and anxiety are inter-related [19].

**Depression:** Emotional disturbances longer than 15 days with reference to memory, concentration, loss of attention, liveliness, generalized blame, despair, thoughts of self-harm, loss of appetite, weight loss, feels bad about her-self are well established signs of depression. It is one of the major health problems during pregnancy. Its incidence during pregnancy is found to be from 7% to 15% for the first to third trimesters as reported by many epidemiological studies across different countries [20-22]. Prevalence of depression is 15.5% and its risk is increased in unplanned pregnancies [23]. Matrimonial conflict record, unwanted pregnancy, low socio-economic status and low esteem due to underprivileged parenting association experienced by women throughout her childhood increases the likelihood of postnatal depression [24]. Babies of depressed women are elevated irritability with more delayed growth with inferior orientation towards motor tone activities, robustness as compared with babies of healthy women [25]. Modern family planning and sex education could be the effective measures in preventing unplanned and unwanted pregnancies.

**Stress, Anxiety, and Depression (SAD):** Stress, anxiety and depression in first trimester might be increased threat of developing...
pre-eclampsia in a later stage of pregnancy. Many studies on SAD during pregnancy established the complications like abortion, pre-eclampsia, preterm birth and low-birth weight babies [26-29]. Conversely, few researchers disagree with these findings [30]. Future studies require attention and research exploration to focus more on preventing prenatal persistent stress, depression and anxiety related complications or pessimistic outcomes during key life events which is appropriate for maternal child health care [31-34].

Psychological Disorders during Pregnancy

Psychiatric symptoms are associated in pregnancy and child-birth [35], it may lead to suicide or maternal death [2]. The impact of untreated psychiatric symptoms on fetal development is less well established but some evidence on stress, anxiety and depression are associated with prematurity and low birth weight. Different studies of women during pregnancy identified few psychiatric disorders, namely moderate to severe depression, bipolar affective disorder and schizophrenia. In daily life, women are required to confront with new situations which demand adaptation. If it is difficult or impossible to adapt to new situation, leads to physiologic and behavioral changes to the stressors. Divorces, serious illness, and family history of depression are severe factors for post-partum depression [36]. Poor socio-economic status, divorce, rapid socioeconomic changes and, alcohol consumption from mother’s family were strong predictors of postpartum depressive symptoms [37]. Daily hassles like domestic affairs, financial or relational problems are also stressors. Physiological stress could lead to symptoms of headache, loss of appetite, sweating and, stomach loss, and panic attacks.

Adjustment disorders

Emotional interruption in life like divorce, pregnancy loss, employment loss or unwanted pregnancy might leads to adaptability issues like depressed mood, unable to cope up, frustration and irritability. It is frequently treated with concise psychotherapy and counseling [2].

Bipolar affective disorder: Patients with bipolar affective disorder are easily distracted. Poor judgment, poor temper control, reckless behavior, lack of self control, binge eating, drug use, poor judgment, sex with many partners, spending sprees, very elevated mood like excess activity, increased energy, racing thoughts, talking a lot, very high self-esteem like very much involved in activities are symptoms of manic phase in bipolar disorder. Manic phase are seen from few days to months in bipolar disease. Repeated severe mood disturbances, depression, mania or a mixed affective state are frequent features of bipolar disorders. High risk prenatal relapse are established in bipolar disorders, so careful management is very much required. Childbirth, medications such as antidepressants or steroids, sleeplessness, recreational drug use can trigger manic episodes in bipolar disorder. Medications to treat and prevent these symptoms are very much toxic especially during first trimester embryogenesis. Rapid withdrawal of lithium or an anticonvulsant drug is associated with high rates of relapse. Medication needs to be tapered slowly rather stopping suddenly under specialist psychiatric supervision [2].

Schizophrenia: People with any type of schizophrenia have problems of anxiety, depression, and suicidal thoughts or behaviors. Other problems like irritable or tense feeling, sleeping and concentration difficulties are well established by the different researchers across the countries. Emotional blunting, behavioral disorders, all in the context of lost insight might be key manifestations. Joint perinatal care with close connection of mental health specialist is the requirement to manage this disease during pregnancy. Preterm delivery, low gestations age and low birth weight risks are well established for women with schizophrenia. Risks of congenital malformations were identified when schizophrenia pregnant women treated with antipsycthic drug phenothiazines during 4-10 weeks of gestation. Schizophrenia women have greater risk of unfavorable pregnancy outcomes compare to other women. The use of antipsychotic medications during pregnancy and lactation remains unclear, further exploration is required. It is recommended against breast feeding while women were receiving antipsychotics [38]. Fundamentally, antipsychotic medications, namely anticholinergic agents and benzodiazepines with mental stability are the preferred treatment modalities for schizophrenia related disorders [39]. Another adjunctive treatment is Electroconvulsive therapy [40]. Bright light treatment in case of negative symptoms of schizophrenia seems to be promising treatment with stable antipsychotic drug doses [41].

Assessment of Cognitive Dysfunction

Subjective measures

Questionnaire is subjective assessment; it is usually subjective perception for the questions but not clear about the actual facts. Many questionnaire set and behavioral observations are already tried and validated to assess psychiatric problems during pregnancy by various researchers across different countries. It requires patience from both health workers and subjects. Careful behavioral observation is also part of the assessment. Sensitivity and specificity to identify the problem depends on many complicated factors like patience, mood, interest, full cooperation from subjects, their family members, and health worker are required. Few international questionnaires and their limitations are considered in the study. (i) Perceived stress scale: It is used to assess the degree of stress in various life situations, with 10-item scale. It can assess the feeling and thoughts of women during the past month of pregnancy with support of five point rating scale, i.e. 0 for ‘never’ and 4 for ‘very often’, its range is from 0 to 40, perceived stress is proportional to the score of the assessment. (ii) Interpersonal support evaluation list: it is 40-item scale designed to predict the effects of stress. Each item is a four point scale. In this scale 0 is used to address ‘strongly disagree’ and 3 to ‘strongly agree’, its value ranges from 0 to 48, greater social support is indicated from higher score, and vice versa. (iii) Prenatal self-evaluation questionnaire: It is 79 items with four point scale, ranging...
Objective measures

Cognitive functioning is assessed by new-learning, memory, intelligence, language, visual-perception, and executive-functioning. Clinical neuropsychological assessment focuses on a person's psychological, personal, interpersonal and wider contextual circumstances. Broad goals of psychological assessment are to (i) determine the nature of the underlying problem, (ii) understand the nature of any brain injury, and (iii) its impact on the individual.

The comprehensive model of accepted physiological parameters of objective assessment includes (i) Stress assessment with physiological signals: Cortisol concentration in saliva and heart rate are used to assess stress responses. Sadness and fear are negative emotions, which activates right prefrontal cortex. This region is to coordinate biological and behavioral responses to the stress. Cerebral blood flow indicates about mild to moderate stress induced by a mental arithmetic task. Using fMRI scans, with cerebral blood flow in ventral right prefrontal cortex and left insula and putamen, are used to assess stress levels. Cortisol is associated with right prefrontal cortex’s activity; cortisol receptor blockers can reduce stress. Lower vagal tones and lesser attentiveness are reported in depressed mother and her neonate. Vagal tone can be determined by higher mean heart rate and a lower high frequency component of heart rate variability in 14-month-old infants [44]. Non-invasive physiological features like skin conductance peaks, and heart rate variability correlates with high stress situations found from many studies. Using these features, with simple linear models, stress and bluffing are identified. Many studies reveals that, the stress, anxiety, depression, and degree of truthfulness could be measured with noninvasive physiological parameters namely, heart rate, vagal tone, skin conductance, temperature and reaction time [42].

(ii) Electroencephalograph (EEG): These signals are the most predictive and reliable physiological indicator of cognitive impairments [43]. It reflects the high sensitivity variations in alertness and attention. It also manifests chaos in the nervous systems. It is used to understand gross disturbances of consciousness encountered in various psycho-physiological parameters of brain. Persistent depression is predicted by relative right frontal EEG activation [45,46]. Asymmetrical EEG distribution on the scalp hemisphere is related to depressive symptoms in adults [47]. Behavioral symptoms are identified by left hemisphere activation and differences in EEG asymmetry scores [48]. Its frequency information is useful in many applications. These signals are decomposed in to (i) delta frequency band, which is from 1 to 4 Hz, it informs about 3 to 4 stages of deep sleep. Deepness in sleep increases with increase of these signals. It is observed in temporal lobes. (ii) Theta band is 4 to 7 HZ, it indicates about the stage I sleep. Different phenomena of brain like memory, short term memory, emotion, plasticity, meditation, hypnosis and conscious mind is reflected by these waves. It informs about emotional arousal and neural plasticity, which appears in the hippocampus with slow oscillations. It helps to encode new memories, peacefulness, drifting and pleasant experiences. Also indicates the state of drowsiness with borderline of partial awareness. Everlasting experiences and extremely vivid memories with hypnologic state of mind produce theta waves. These waves are seen in blissful state of relaxation; (iii) alpha band is with 8 to 13 Hz, these waves are appears when eyes are closed with auditory and tactile stimulations. It informs about attention and concentration, found in relaxed wakefulness, creative thought processing and it is an integral part of relaxation before sleep. It indicates about positive emotion and attentiveness. Focusing intensively on a point produce balanced beta and alpha waves. Focus on one object longer and longer produce alpha waves. (iv) Beta frequency band is 13 to 30 Hz, Oscillates throughout the cortex, occurs only in wakefulness. These waves indicate about strong excited emotions like fear, rage or anxiety, alert attentiveness, solving math problems, apprehension, concentration and anticipation. Medications like Ritalin and Adder-all are used to induce beta state, which intern helps to increase concentration and alertness. (v) Gamma waves are low amplitude with high frequency of 30 to 100 Hz. There is no gamma state but it is associated with supporting states of beta, alpha, theta and delta waves. Increases with wakefulness, it is indicates about the memory processing, its rate increases with memory recall. These waves appears with musicians listen to music but not in non musicians listening to music. Decrease of alpha power denotes activation of underlying cortex, during behavioral arousal or active task engagement is seen. Deltas-hostile confrontation; theta indicates about sexual orgasm in adults or hedonic stimulation in infants; increasing stress or apprehension increases beta band and total power-increasing engagement in an emotional memory task. Increase in alpha
waves indicates about the maturity, with decrease in theta and delta power. In elderly people, considerable increase of theta and delta waves indicates about the decline of mental abilities. Lack of alpha indicates about lack of focusing abilities, more alpha power and decreased theta power informs about good cognitive memory. Mediation reduces overall theta and delta waves but increases alpha and beta waves. Theta waves bring more access to memory than alpha and beta. (iii) Event Related Potentials: These signals are used in cognition and emotional research. P300 is recorded by auditory or visual inputs through oddball paradigm, its amplitude ranges from 10 to 20 micro volts. Subject is asked to respond to infrequent stimuli presented from a series of frequent stimuli. Discriminations in stimulus produce the positive peaks from 250 to 500 ms in normal young adults. It is also observed in complicated tasks with broadly distributed but delayed positive peaks; they are called as late positive components. Smaller amplitude of P300 event related potential is observed in major depression. Reduced amplitude and hemispheric asymmetry of P300 is observed in depressives. Normalized P300 amplitude is observed in recovered major depression. Smaller P300 amplitude in depressed patients is nonspecific indicator of mood state. There is no significant difference in P300 latency. Thus P300 latency and amplitude are effective markers of depression during pregnancy [49].

Social, Scientific and Ethical Challenges

Social challenges

(i) Indian Maternal Mortality Ratio (MMR) is highest in south Asia and second highest in the world. Approximately 540 deaths per 100,000 live births. Most of the rural Indian pregnant women are in danger at the time of delivery due to lack of minimum facilities, they deliver with the help of family member or unskilled health worker from health care units. Lack professionally trained staff, skilled doctors and facilities in the health centre. 70% maternal deaths might be prevented by good sanitation, proper nutrition, avoiding overwork and stress [50].

(ii) Average women from rural India have little or no control over her reproduction process, they can’t access to safe and self contraceptives. India has highest number of married anemic women; they used to consume low quality food, illiteracy and high cost of medical facilities [51].

(iii) In many families, girls and women face nutritional discrimination within the family and most of them are anemic and malnourished. Heavy bleeding, skipped periods, sever pain during menstruation are common problems in India. Slim girls are considered to be more beautiful, which make most of young girls in India are vulnerable to amenorrhea i.e. lack of menstruation. (iv) smoking and taking alcohol are on rise among young girls and women in India [52]. It seems that, social and psychological health of women is ignored by family members, they might think that, smoking and alcohol consumption are sign of modernization among rich while custom among poor. In many upper class societies and families children die of negligence of alcoholic mother [53].

(v) Relationship difficulties with the mother-in-law and other family members, most of families are nuclear in nature. Increasing in number of divorces, live relationship are becoming serious issues in India and (vi) Women family is burdened major expenses with reference to marriage, delivery and taking care of child related issues [54].

Scientific challenges

(i) women are confused with somatic symptoms related to mild cognitive impairments, the relations between social supports, psycho-physiological adaptations, and effects of nausea, vomiting during pregnancy are need to be explored. (ii) The fundamental causes of pre-eclampsia and eclampsia, the association of depression with pre-eclampsia and operative deliveries, weight gain, sodium and water retention, metabolic changes increase the seizure frequency during pregnancy remains unresolved. (iii) Psychology provides only limited predictive and descriptive power with regard to cognitive impairments, mild to severe, during pregnancy. Recent improvements in cognitive studies ensure the efficacy for validating the predictions to psychological symptoms with support of computational theories [55], (iv) It is ambiguous why some infants born to women experiencing adversity remain unclear, (v) Challenges of the existing literature include reliance on self-report procedures, contradictory definitions of maternal stress/distress, Retrospective data collection and Lack of physiological measures to explain possible mechanisms. Further research is required to spot effective predictors of cognitive impairment, mild to severe, during pregnancy.

Ethical challenges

(i) Most of the deliveries are caesarian in nature, (ii) many medical tests, screening procedures leads to burden on the women families of urban society whereas in rural inadequate medical facilities, and (iii) informed concern is essential to carry out tests and screening procedures but illiteracy, fear about doctors brings bridge between patient and doctors.

Prospective Noninvasive Bio-markers to General Practitioners

(i) Development of low cost portable physiological data acquisition system which can acquire ECG, EEG, and PPG along with supporting user friendly software might be the promising bio-marker to diagnose cognitive dysfunctions for general practitioners or health worker. Further it could be the prospective bio-marker for mass health care in India. (ii) Microphone and camera are also embedded in that unit to recognize voice and face recognition, which might be the supporting modality for mass health care, (iii) subjective assessment could be performed with the structured questionnaire set, questions are converted into to regional format along with set points to indicate about the state of mind with reference to subjective perceptions with the support of software algorithms, and (iv) Authors developed the prototype model as shown in Figure 1 in the lab and working forward for prospective bio-marker instrumentation system for cognitive dysfunctions.

Conclusions

Pregnancy is a challenging time of life as the women’s body goes through several changes to create and support the development of new life. Backache, high or low blood pressure, painful breasts, constipation, heartburn, hemorrhoids, indigestion, kidney problems, leaking urine, nausea and vomiting, nerves, insomnia, swelling of hands and feet, tingling, numbness of limbs, varicose veins are some of the challenges during pregnancy. Many characteristics of Indian society lead to stress, anxiety, and depression. Frequently becoming pregnant, inadequate prenatal care, low educational level, living in an extended family, economic problems, becoming a pregnant without marriage, and domestic violence are significant factors of SAD. Unplanned
pregnancy is very common in India and it is about 50 %, it contributes to severe nausea and vomiting. Higher stress and lower social support enhances the adjustment difficulties. Nausea and vomiting are prenatal variables, indicates about adaptation of women during first trimester of pregnancy. Nausea and vomiting is connected with stress during first trimester. Pregnancy complications are possible to eliminate with excellent social support system and well-built relationship. Psychopharmacological healing has undesirable effects on the fetus, and is a risky approach during pregnancy, particularly during the first trimester. However, risk–benefit assessments with least invasive treatment are recommended. Social support, psychological adaptation is important during pregnancy. Mother, family members, doctors, and nurses are required to prevent the development of psychiatric symptoms in pregnancy. Stress reduction, adequate nutrition, preventing the nicotine and caffeine, regular exercise, active or passive smoking and adequate hygiene educating women about measures help to adapt for pregnancy. Developments of coping skills, particularly, for women who are separated or divorced are essential during pregnancy. Brief group interpersonal therapy, group sessions to educate about postnatal depression, role transitions, goal settings and interpersonal support are effective for severely depressed women during pregnancy. An accurate psychological assessment system is useful in detecting the specific underlying processes differentiating the co-morbid syndromes in pregnancy. Abnormal thinking about psychiatric symptoms leads to restrictive ability and capacity to fulfill the maternity care and fetal monitoring, which are key challenge to obstetric and psychiatric services. A close, regular interaction of multi- professional approach between obstetrician and psychiatrist are required to treat psycho-physiological symptoms during pregnancy. The morbidity and maternal mortality during pregnancy are associated with many psychiatric symptoms. Obstetricians need to be aware psychiatric symptoms with physical problems and find more complicated to prevent smoking or alcohol in pregnancy when these behaviors form part of their usual coping strategies. Many health challenges of pregnancy are prevented by paying awareness about nourishment. Low blood sugar contributes to morning sickness and mood swings. Hypertension, backaches and severe labor pains are due to inadequate calcium. Varicose veins, constipation, anemia, hemorrhoids, and skin discoloration are due to nutrient deficiency. Severe undernourishment is connected to pre-eclampsia. When the pregnant women are monitored with severe depression, at risk of suicide, electroconvulsive therapy (ECT) is safe. The other medication in antenatal depression includes supportive psychotherapies, individual therapy, interpersonal psychotherapy, cognitive behavioral therapy and phototherapy. Using multi model bio-signals like ECG, EEG, ERP, respiration, skin conductance, photo-plethysmograph (PPG), heart rate variability along with efficient acquisition protocol, and these signals are useful to reflect psycho-physiological activities. Linear and nonlinear characteristics, chaotic behaviors, fractal dimensional analysis of the EEG signals can quantify the psychiatric problems noninvasively. Multimodal bio-signal modality is non-invasive and low cost portable instrumentation systems can be exploited by general practitioners for effective assessment of cognitive impairments during pregnancy.

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