

Management of primary CMV infection in pregnancy using the Roy adaptation model: a case report

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ABSTRACT

Primary cytomegalovirus infection during pregnancy can result in significant maternal and fetal complications. This study explores the application of the Roy adaptation model (RAM) as a theoretical framework for managing such high-risk pregnancies. A case study approach was employed, focusing on RAMs four adaptive modes: physiological, self-concept, role function, and interdependence. Nursing interventions tailored to these adaptive modes aimed to enhance maternal psychological and physiological adaptation, alleviate anxiety, and strengthen maternal-fetal attachment. Family support played a pivotal role in achieving positive outcomes. The findings demonstrate that RAM effectively addresses the multifaceted needs of high-risk pregnancies, emphasizing its value as a guiding framework for individualized maternal care. This approach highlights the importance of integrating theoretical nursing models into practice to improve outcomes for both mother and fetus.

Keywords: Cytomegalovirus infection, high-risk pregnancy, Roy adaptation model, nursing care, maternal-fetal adaptation

INTRODUCTION

Cytomegalovirus (CMV), a member of the human herpesvirus family, is a leading cause of non-genetic congenital anomalies (Khalil, Heath, Jones, Soe, Ville, 2018). Transmission routes include body fluids, semen, breast milk, organ transplantation, and transplacental transmission. CMV infection is classified as primary, occurring in seronegative individuals, or secondary, involving reinfection in previously infected individuals (CDC, 2024).

Although CMV poses minimal risk to healthy individuals, infection during pregnancy significantly increases the risk of fetal transmission. The transplacental transmission rate is 30–40% in primary infections and 1-2% in secondary infections (Khalil, et al. 2018; CDC, 2024). CMV affects 0.2-2.2% of all births, with approximately 7 in every 1000 newborns being infected, varying by region (NHS, 2024).

Despite its potential to cause severe congenital anomalies, routine antenatal screening for CMV is not recommended internationally due to the lack of effective preventive treatments and the unpredictability of sequelae (Barton, Forrester, McDonald, 2020). Diagnoses are often retrospective, based on ultrasound findings or symptoms observed in newborns, especially in cases where prenatal follow-up was inadequate or in high-prevalence regions.

Detection of CMV infection during pregnancy can cause significant stress for pregnant women and their families.

Irreversible sequelae and uncertain outcomes may disrupt expectations of a healthy birth, potentially leading to psychological trauma and a mourning process, particularly in cases of fetal transmission (Melender, Lauri, 1999).

Managing such negative experiences, enhancing coping mechanisms, and providing counseling are crucial. The Roy adaptation model (RAM) addresses biological, psychological, and social challenges of pregnancy, supporting adaptation. Studies show its effectiveness in managing pregnancy-related anxiety, fostering maternal adaptation, and promoting mother-infant attachment postpartum (Roy, 2009; DeSanto-Madeya, Fawcett, 2009). Gynecology nurses play a critical role in using this model to improve maternal and fetal outcomes through individualized care.

This study evaluates the application of the RAM in managing primary CMV infection during pregnancy and its impact on maternal and fetal health outcomes.

ROY ADAPTATION MODEL (RAM)

The RAM, developed by Sister Callista Roy in 1964 and applied in 1968, integrates theories from Harry Helson's adaptation theory, Bertalanffy's general systems theory, Selye's adaptation theory, and other interdisciplinary concepts. The model posits that humans are bio-psychosocial beings who adapt to environmental stimuli that evolve throughout life (Roy, 2009).

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Stimuli

Environmental stimuli are classified into three types:

- **Focal stimuli:** An event or object that captures immediate attention, such as high blood pressure in pregnancy, drawing focus to health concerns (Roy, 2009).
- **Contextual stimuli:** Personal or environmental factors that amplify the focal stimulus, such as stress or lack of support worsening hypertension in pregnancy (Roy, 2009).
- **Residual stimuli:** Influences shaped by past experiences or cultural beliefs, like persistent anxiety in a woman with a history of miscarriage (Roy, 2009).

Responses

Individuals respond to stimuli through internal and external behaviors. Turning toward a sound is an external response, while an increased heart rate caused by the sound is internal. These responses are categorized into Functional and Effector subsystems (Roy, 2009).

Functional subsystem coping mechanism:

- **Regulatory:** Neuro-chemical-endocrine responses. For example, increased heart rate or adrenaline levels in an individual experiencing anxiety (Roy, 2009; DeSanto-Madeya, Fawcett, 2009).
- **Cognitive:** Cognitive responses to stimuli such as attention, memory, learning, problem solving, decision making, defense. By analyzing the source of anxiety, a pregnant woman can decide to practice relaxation techniques (Roy, 2009; DeSanto-Madeya, Fawcett, 2009).

Effector subsystem adaptation: According to the RAM, there are four adaptations (Roy, 2009).

- **Physiological adaptation domain:** Focuses on protecting physical integrity and meeting basic needs, including oxygenation, nutrition, elimination, movement, rest, fluid-electrolyte balance, and neurological/endocrine functions (Roy, 2009; DeSanto-Madeya, Fawcett, 2009).
- **Self-concept adaptation domain:** Reflects behaviors and beliefs aligned with the individual's philosophy of life, such as adopting a positive outlook during illness (Roy, 2009; DeSanto-Madeya, Fawcett, 2009).
- **Role function domain:** Covers societal and familial roles, including preparing a pregnant woman for motherhood (Roy, 2009; DeSanto-Madeya, Fawcett, 2009).
- **Mutual commitment adaptation domain:** Encompasses behaviors and social support in relationships, where spousal and family support aid in stress management during pregnancy (Roy, 2009; DeSanto-Madeya, Fawcett, 2009).

Behavioral responses: Behavioral responses, according to Roy, can be;

- **Adaptive:** For example, adhering to dietary guidelines and treatment plans following a diabetes diagnosis (Roy, 2009).
- **Maladaptive:** Such as delaying treatment by refusing the diagnosis (Roy, 2009).

CASE

The study data were collected on August 15, 2019, at the perinatology outpatient clinic of a training and research hospital in İstanbul. A 29-year-old pregnant woman, married for 4 years and a university graduate, was referred to the clinic for follow-up due to elevated AST, ALT, and LDH levels detected at 12 weeks of gestation.

Acknowledgments

Written informed consent was obtained from the patient for the publication of this case report.

Past Health History

The patient has no history of alcohol or smoking. Her blood group is A-Rh (+). She has Hashimoto thyroiditis, migraine, and allergic asthma, and is on Euthyrox (50 mg daily) and Miflonide (2 inhalations daily). Menarche occurred at 14, and her menstrual cycles were regular (26-28 days). She is not consanguineous with her husband. In 2018, she underwent a dilation and curettage at 8 weeks of gestation due to absent fetal heart tones. Pathology revealed a partial mole. Beta-hCG levels decreased steadily over 6 months of follow-up, with no increase observed.

Current Health History

At the 12th week of pregnancy, Doppler evaluation was within normal limits. Blood tests revealed positive results for anti-rubella IgG, anti-toxoplasma IgG, anti-HBS, and anti-HAV IgG. Elevated levels of AST (88), ALT (85), and LDH (334) were observed. Anti-CMV IgM and anti-CMV IgG tests were positive, with low avidity noted at the 13th-week control. CMV PCR in maternal blood was negative. The patient was diagnosed with primary CMV and informed that low avidity and anti-CMV IgM positivity indicated primary infection with potential fetal sequelae risks.

The need for amniocentesis at 21 weeks for fetal evaluation was explained, along with possible pre- and postnatal sequelae, follow-up and treatment options (e.g., hyperimmunoglobulin, ganciclovir). The patient was also counseled on confidence intervals and the option of termination. However, the patient decided to continue the pregnancy. At the 16th week, hyperechogenic bowel appearance was detected. Amniocentesis performed at 21 weeks showed no evidence of prenatal CMV. Karyotype analysis and DNA isolation were normal, while cystic fibrosis gene screening revealed a combined heterozygous gene mutation. The patient received genetic counseling.

The oral glucose tolerance test (OGTT) was within normal limits. Subsequent ultrasound findings did not indicate CMV-related abnormalities. The patient delivered at 39 weeks and 2 days via cesarean section. The newborn showed no CMV symptoms. CMV PCR in newborn urine was negative. Hearing and eye screenings, as well as neonatal cranial ultrasonography, were all within normal limits.

Nursing History

At the 12th gestational week, the pregnant woman, diagnosed with primary CMV, was referred to us for counseling. It was noted that this was her second pregnancy (following one missed abortion), and she expressed significant anxiety due to the diagnosis. The woman reported feelings of detachment from her baby and uncertainty about the future.

CASE EVALUATION ACCORDING TO ROY ADAPTATION MODEL

Physiological Adaptation Domain

NIC initiatives: Relaxation techniques (NIC 6040): The pregnant woman was taught regular breathing exercises and various relaxation techniques. With the effect of these techniques, it was observed that the pregnant woman achieved physical and psychological relaxation, decreased muscle tension and improved sleep quality. This approach supported the general well-being of the pregnant woman by reducing her stress-induced physiological reactions (Bulechek, Butcher, Dochterman, & Wagner, 2017).

Anxiety control (NIC 5820): The pregnant woman was taught how to recognize anxiety, manage stressors and calm down (e.g., positive thinking, mental reframing). During the interventions, the pregnant woman received regular counseling on self-awareness and stress management (Bulechek, Butcher, Dochterman, & Wagner, 2017).

NOC results:

- **Anxiety level (NOC 1210):** It was stated that the pregnant woman's anxiety level was visibly reduced, she felt calmer and her ability to cope with stress improved (Moorhead, Johnson, Maas, & Swanson, 2018).
- **Physiological health level (NOC 2002):** It was determined that the blood pressure, heart rhythm and other physiological parameters of the pregnant woman were in balance, and that this state of well-being reflected positively on daily life activities (Moorhead, Johnson, Maas, & Swanson, 2018).

Self-Concept Adaptation Domain

NIC initiatives:

- **Role support (NIC 5400):** Psychological support was provided to the pregnant woman to develop a positive perspective on preparing for the role of motherhood. In addition, the reasons for her negative thoughts about motherhood were emphasized and she was informed about these issues (Bulechek, Butcher, Dochterman, & Wagner, 2017).
- **Fear management (NIC 5380):** Fears related to the birth process and the postpartum period were identified and special strategies were developed to cope with these fears. For example, visualization techniques and examples of positive experiences were shared (Bulechek, Butcher, Dochterman, & Wagner, 2017).

NOC results:

- **Role performance (NOC 1501):** It was observed that the pregnant woman developed a positive attitude towards her role as a mother, her self-confidence increased and she was more prepared for the process (Moorhead, Johnson, Maas, & Swanson, 2018).
- **Confidence level (NOC 1212):** It was stated that the pregnant woman's sense of self-confidence about the motherhood process increased significantly. This confidence manifested itself especially in her decisions about prenatal and postnatal processes (Moorhead, Johnson, Maas, & Swanson, 2018).

Role Function Compliance Area

NIC initiatives:

- **Social support (NIC 5440):** The pregnant woman was supported to establish a stronger communication with her family, partner and social environment. The importance of social ties that will make the pregnant woman feel that she is not alone in this process was explained (Bulechek, Butcher, Dochterman, & Wagner, 2017).
- **Nursing counseling (NIC 5280):** Regular counseling was provided during pregnancy and successful strategies for anxiety management were developed. In addition, the participation of the pregnant woman in the counseling process was encouraged and the process was individualized (Bulechek, Butcher, Dochterman, & Wagner, 2017).

NOC results:

- **Social support (NOC 1504):** It was observed that the pregnant woman's social support network was strengthened, family members were more active in the process and the pregnant woman's feeling of loneliness decreased (Moorhead, Johnson, Maas, & Swanson, 2018).
- **Compliance with treatment (NOC 1603):** It was observed that the pregnant woman showed high compliance with nursing interventions and applied the recommended techniques and strategies to her daily life (Moorhead, Johnson, Maas, & Swanson, 2018).

Mutual Interdependence Harmony Space

NIC initiatives:

- **Providing emotional support (NIC 5270):** The pregnant woman was offered activities to strengthen her emotional bonds with her partner, family and close friends. For example, recommendations like spending time together and sharing activities were given. The role of these bonds in stress management was emphasized (Bulechek, Butcher, Dochterman, & Wagner, 2017).
- **Enhancing the family process (NIC 7140):** By focusing on the role of the pregnant woman in the family, she was enabled to communicate more effectively with other family members. Communication techniques and problem solving methods were worked on to strengthen family ties (Bulechek, Butcher, Dochterman, & Wagner, 2017).

NOC results:

- **Family support (NOC 2202):** The pregnant woman stated that the emotional and physical support she received from her family members increased and that she felt stronger with this support (Moorhead, Johnson, Maas, & Swanson, 2018).
- **Emotional well-being (NOC 1205):** Expectant mothers reported feeling more peaceful, valuable and powerful psychologically and emotionally. This positively supported the overall mental health of the pregnant woman (Moorhead, Johnson, Maas, & Swanson, 2018).

CONCLUSION

To ensure successful adaptation to pregnancy and motherhood, individualized and holistic care training for pregnant women

is essential. These trainings enhance women's psychological, physiological, and social adaptation to pregnancy and support the healthy progression of the process. Nurses and midwives play a critical role in identifying factors influencing adaptation, diagnosing risky situations early, and implementing necessary interventions (Alligood, 1994; Mercer RT, Ferketich, Trisyani M, Rachmawati, 2019). By planning preventive practices, nurses and midwives can help minimize or prevent adaptation problems that may arise during pregnancy. Additionally, training provided to family members significantly contributes to meeting the psychosocial needs of pregnant women by ensuring they receive sufficient support. These trainings not only create a healthier and more supportive environment for women during pregnancy but also contribute to safeguarding and improving the overall health of both mother and baby (Ferketich, Trisyani M, Rachmawati, 2019). The RAM provides a structured framework for offering individualized and holistic care to pregnant women. Addressing both physiological and psychological challenges, this model helps pregnant women navigate the complexities of adaptation to pregnancy and motherhood. By emphasizing the integration of environmental factors and coping mechanisms, the model further empowers nurses and midwives to implement targeted interventions, thereby improving maternal and fetal outcomes in high-risk pregnancies (Ferketich, Trisyani M, Rachmawati, 2019).

ETHICAL DECLARATIONS

Informed Consent

The patient signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

- Alligood, M.R. (2013). Nursing theorists and their work (8th ed.). St. Louis, MO: Mosby Elsevier.
- Barton, M., Forrester, A.M., & McDonald, J. (2020). Infectious diseases and immunization committee. *Paediatr Child Health*, 25(5),395. doi:10.1093/pch/pxaa095
- Bulechek, G.M., Butcher, H.K., Dochterman, J.M., & Wagner, C.M. (2017). Nursing interventions classification (NIC) (7th ed.). St. Louis, MO: Elsevier.
- Centers for Disease Control and Prevention (CDC). (2024, November 20). About cytomegalovirus (CMV). Retrieved from <https://www.cdc.gov/cytomegalovirus/about/index.html>
- DeSanto-Madeya, S., & Fawcett, J. (2009). Application of Roy's adaptation model in the care of pregnant women experiencing anxiety. *Nurs Sci Quarter*, 22(1),59-65. <https://doi.org/10.1177/0894318408329335>
- Khalil, A., Heath, P., Jones, C., Soe, A., & Ville, Y. G., on behalf of the Royal College of Obstetricians and Gynaecologists. (2018). Congenital cytomegalovirus infection: update on treatment. *Int J Obstetr Gynaecol*, 125,(e1-e11). doi:10.1111/1471-0528.14836
- Melender, H. L., & Lauri, S. (1999). Fear and coping during pregnancy: birth preparation and maternity care. *J Advanc Nurs*, 29(4),995-1003. doi:10.1046/j.1365-2648.1999.00978.x
- Mercer, R. T., & Ferketich, S. (1994). Predictors of parenting stress in adolescent mothers with an 18-month-old child. *Res Nurs Health*, 17(6), 423-430. doi:10.1002/nur.4770170605
- Moorhead, S., Johnson, M., Maas, M. L., & Swanson, E. (2018). Nursing outcomes classification (NOC): measurement of health outcomes (6th ed.). St. Louis, MO: Elsevier.
- National Health Service (NHS). (2022). Cytomegalovirus (CMV)-congenital infection guidelines. NHS neonatology clinical guidelines. Retrieved November 20, 2024, from <https://www.clinicalguidelines.scot.nhs.uk/nhsggcguidelines/nhsggcguidelines/neonatology/cytomegalovirus-cmv-congenital-infection/>
- Roy, C. (2009). The Roy adaptation model (3rd ed.). Upper Saddle River, NJ: Pearson.
- Trisyani, M., & Rachmawati, P. D. (2019). Roy's adaptation model application in nursing care for pregnant women with preeclampsia: a literature review. *Strada J Health Sci*, 8(2),123-130. doi:10.30994/sjhs.v8i2.226