SLEEP POSITIONING BY LEVINE'S CONSERVATION THEORY APPROACH CAN OPTIMIZE ENTERAL NUTRITION IN LOW BIRTH WEIGHT INFANTS

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Abstract

Sleep Positioning by Levine's Conservation Theory Approach Can Optimize Enteral Nutrition in Low Birth Weight Infants: Malnutrition which happens in the beginning period of life of low-birth-weight infants, will give long-term impact to cognitive, motoric, social-emotional, and behavioural function. The objective of this case study was to analyze the optimization of the fulfilment of enteral nutrition in low birth weight infants through sleep positioning with Levine's Conservation Theory. The case study was conducted with five low-birth-weight infants that experienced enteral feeding intolerance. Nursing interventions were applied based on evidence-based nursing done by sleep positioning during the enteral feeding process. Levine's Conservation Theory approach was applied by using principles of energy conservation, structural integrity conservation, personal integrity conservation, and social integrity conservation. Five cases were selected due to nursing problems in imbalanced nutrition: less than body requirements. The results showed that the implementation of sleep positioning with Levine's Conservation Theory could reduce the incidence of desaturation, abdominal distension, and frequency of vomiting. Nurses can apply sleep positioning by Levine's Conservation Theory approach as a standard of operational procedure in nursing intervention given to low-birth-weight infants that experience enteral feeding intolerance.

Keyword: Enteral Feeding Intolerance, Levine's Conservation Theory, Low-Birth-Weight Infants, Malnutrition, Sleep Positioning

Introduction

Malnutrition is a problem generally found to LBW infants during treatment in high-risk-infants' room (Balakrishnan et al., 2018). Malnutrition that happens in the beginning period of LBW infants' life will give long-term impact to cognitive, motoric, social-emotional, and behavioural function (Matsuda et al., 2017). Malnutrition in LBW infants can also increase the risk of stunting, delayed growth, communicable and non-communicable diseases (Vaivada, Gaffey, & Bhutta, 2017). One of the efforts to prevent malnutrition in LBW infants is by optimizing enteral nutrition in the beginning period of life of LBW infants (Georgieff, Ramel & Cusick, 2018).

The process of enteral nutrition to LBW infants is a challenge for nurses. In the beginning period of adaptation, LBW infants lose 15%-20% of body weight. This happens due to the increasing need for energy in respiration process, thermoregulation, tissue synthesis, and metabolism (Prado & Dewey, 2014). The growing demand for energy in LBW infants is also caused by brain maturation process, including neuronal proliferation, dendrite and axon connection, synapse formation, and myelination process (Brown, 2017).

One barrier most often experienced by LBW infants in enteral nutrition is feeding intolerance with 16%-29% of cases (Fanaro, 2013). Enteral feeding intolerance is indicated by gastric residue increase, vomiting, abdomen distention, bowel disorders, apnea, bradycardia, and body temperature instability (Khashana & Moussa, 2016). Enteral feeding intolerance makes the targeted weight gain in the second week not achieved and parenteral nutrition to be used longer, so that risk of getting sepsis for LBW infants gets increasing (Kumar et al., 2017).

Nurses contribute to nursing intervention in handling enteral feeding intolerance of LBW infants. The intervention is by sleep positioning during enteral feeding by applying

Levine's Conservation Theory approach (Dutta et al., 2018). Levine's Conservation

Theory focuses on adaptation improvement and self-integrity maintenance (wholeness) by applying the principles of energy conservation, structural integrity conservation, personal integrity conservation, and social integrity conservation (Mefford & Alligood, 2011).

The case study was aimed to analyze enteral nutrition compliance in LBW infants by sleep positioning by applying Levine's Conservation Theory approach. The novelty of the case study is the application of evidence-based nursing in the nursing intervention. The applied evidence-based nursing action is sleep positioning during the enteral feeding process.

Case Illustration

Case 1

The infant was born after 32-week gestation with 1,460-gram birth weight on November 23, 2015 by caesarean section. The mother got 3-day-preterm-premature rupture of membrane, and the APGAR score was 5 at the first minute and 8 at the fifth minute. The medical diagnosis included preterm appropriate for gestational age (AGA) infant, history of apnea of prematurity (AOP), and unproven sepsis.

The study result record on December 8, 2015, included: 15-day chronological age, 36.7oC temperature, 31oC incubator temperature, breathing frequency at the rate of 48 times per minute, heartbeats at the rate of 148 times per minute, 98% oxygen saturation, the absence of oxygen therapy, and 1,340-gram body weight. The infant got enteral nutrition of 8 x 25 ml of breast milk by gravitation. The infant had weak sucking reflex, vomited 5-10 ml at once, had strong bowel sound, had abdomen distention, had supple abdomen palpation, and had diaper rash. The medical therapy was by 4 mg of citrate caffeine and 1x 0.3 ml of apialys given orally.

The trophicognosis showed that there was imbalanced nutrition: less than body requirements, skin integrity impairment, risk of hypothermia, risk of infection, risk of delayed development, and family process disturbance. The given nursing intervention was done by observing the physiological function, applying developmental intervention, reviewing the feeding intolerance, applying sleep positioning during the enteral feeding process, minimizing calorie loss of the LBW infants, and doing Kangaroo Mother Care.

The organismic evaluation on December 18, 2015, showed that the infant weighed 2,050 gram, did not vomit, did not have abdomen distention, had strong bowel sound, had adequate sucking reflex, swallowing reflex, and breathing reflex. The laboratory check-up result on November 26, 2015, showed that the hemoglobin was 21.7 gram/dl, and the albumin was 4.23 mg/dl. The infant did not get an infection. The leukocyte was 28.640/ui, and the c-reactive protein (CRP) was 0.2 mg/l. The infant did not experience body temperature instability, did not have diaper rash, and risk for delayed child development could be minimized.

Case 2

The infant was born after 34-week gestation with 2,120-gram birth weight on March 10, 2016, by caesarean section due to placenta solution indication. The APGAR score was five in the first minute and seven at the fifth minute. The medical diagnosis included preterm AGA infant, AOP, respiratory distress history, early-onset neonatal sepsis, and bowel hypomotility.

The study result record on March 16, 2016, included 6-day chronological age, 36.7oC temperature, breathing frequency at the rate of 50 times per minute, heartbeats at the rate of 148 times per minute, 98% oxygen saturation, the absence of oxygen therapy, and 2,100-gram body weight. The infant got enteral nutrition of 8 x 25 ml of breast milk by gravitation and parenteral nutrition of glucose protein at 4.1 ml per hour and intralipid at 0.5 ml per hour. The sucking reflex was weak. The infant vomited four times, had soft bowel sound, had supple abdomen, and did not have abdomen distention. The oral medical therapy

was by 1x12 mg of citrate caffeine and 3x 22 mg of erythromycin.

The trophicognosis showed that there was imbalanced nutrition: less than body requirements, risk of skin integrity impairment, risk of hypothermia, risk of infection, risk of delayed development, and family process disturbances. The given nursing intervention was done by observing the physiological function, applying developmental intervention, applying sleep positioning during the enteral feeding process, minimizing calorie loss, and applying parenteral nutrition collaboratively.

Organismic evaluation on March 20, 2016, showed that the infant weighed 2,065 gram, did not vomit, did not have abdomen distention, had strong bowel sound, had adequate sucking reflex, swallowing reflex, and breathing reflex. Laboratory check-up result on March 14, 2016, showed that the hemoglobin was 17.1 gram/dl. The infant did not get an infection. The leukocyte was 11,060/ui and CRP was 0.4 mg/l. The blood culture was sterile. The infant did not experience body temperature instability, did not have skin integrity impairment, and risk for delayed child development could be minimized.

Case 3

The infant focuses on an infant born from Gemelli pregnancy. The infant was born after 34-week gestation with 1,570-gram birth weight on April 6, 2016, by caesarean section due to fetal distress indication. The mother's medical history showed that she had decompensation cordis, and the CRP was 6.8 mg/l. The APGAR score was nine in the first minute and ten at the fifth minute. The medical diagnosis included preterm AGA infant and necrotizing enterocolitis (NEC) stage 2.

The study result record on April 10, 2016, included 4-day chronological age, 36.5oC temperature, 33oC incubator temperature, the presence of hypothermia, heartbeats at the rate of 72 to 146-times per minute, breathing frequency at the rate of 44 times per minute, the presence of chest wall retraction, 82-100% oxygen saturation, the absence of oxygen therapy, and 1,540-gram body weight. The infant vomited had abdomen distention and had no bowel sound. There were 10 ml of reddish-brown orogastric tube residue and bloody stool. The infant was made not consume anything but parenteral nutrition of N4D10 + Ca Gluconas 10% + KCL at 6.5 ml/hour and amino acid 6% at 3.6 ml/hour. The USG check-up of the abdomen on March 8, 2016, showed NEC stage 2. The oral medical therapy was by 1 x 4 mg of citrate caffeine; while the intravenous therapy was by 2 x 110 mg of bactesyn and 6 mg of gentamicin given per 36 hours.

The trophicognosis showed ineffective breathing pattern, imbalanced nutrition: less than body requirements, ineffective thermoregulation, risk of infection, risk of skin integrity impairment, risk of delayed development, and risk of an ineffective latch. The nursing intervention was done by observing the physiological function, applying developmental intervention, doing gastric lavage, applying sleep positioning during the enteral feeding process, minimizing calorie loss, and applying parenteral nutrition collaboratively.

Organismic evaluation on April 19, 2016, showed that the infant weighed 1,524 gram, did not vomit, and did not have abdomen distention. The OGT residue was clear. The infant got trophic feeding. The laboratory check-up result on March 8, 2016, showed that the hemoglobin was 16.2 gram/dl, and the thrombocyte was 296,000/ui. The infant still had bradycardia and desaturation. The infant did not get an infection. The leukocyte was 1,750/ui, and the CRP was 0.5 mg/l. The blood culture was sterile. The infant did not experience body temperature instability, did not have skin integrity impairment, and risk for delayed child development could be minimized.

Case 4

The infant was born after 30-week gestation with 1,677-gram birth weight on March 4, 2016, by caesarean section due to solution placentae indication and oligohydramnios. The

APGAR score was eight at the first minute and nine at the fifth minute. The medical diagnosis included preterm AGA infant, post surfactant therapy for Hyalin Membrane Disease (HMD), gastroesophageal reflux disease (GERD) stage 1, history of Patent Foramen Ovale (PFO), and history of AOP.

The study conducted on March 28, 2016, showed 24-day chronological age, 36.7oC temperature, breathing frequency at the rate of 48-times per minute, 96% oxygen saturation, heartbeats at the rate of 148-times per minute, and the absence of oxygen therapy. The infant had desaturation and bradycardia during the enteral feeding process. The infant was 1,942 gram and got 10x35 ml of breastmilk as enteral nutrition by gravitation. The USG check-up result on March 10 showed that there was GERD stage 1. The oral medical therapy was by 2 x 0.6 mg of cisapride, 1x4 mg of citrate caffeine, 1 x 0.3 ml of Akta-vol, 1 x 0.3 ml of Ferlin, and 1x20 iu of Tocopherol. The intravenous therapy was by 3x130 mg of bactesyn and 1x7.5 mg of gentamicin.

The trophicognosis showed that there was imbalanced nutrition: less than body requirements, risk of infection, risk of hypothermia, risk of skin integrity impairment, risk of delayed development, and family process disturbances. The given nursing intervention was done by observing the physiological function, applying developmental intervention, reviewing the feeding intolerance, applying sleep positioning during the enteral feeding process, minimizing calorie loss, and giving counselling about home care.

The evaluation on March 31, 2016, showed that the infant weighed 2,044 gram. The infant did not get desaturation and bradycardia. The infant did not experience abdomen distention and vomiting and had strong bowel sound. The laboratory check-up result on March 28, 2016, showed that the hemoglobin was 12.7 gram/dl. The infant did not get an infection. The leukocyte was 1,039/ui and CRP was 0.1 mg/l. The blood culture was sterile. The infant did not experience body temperature instability, did not have skin integrity impairment, and risk for delayed child development could be minimized.

Case 5

The infant was born after 28-week gestation with 850-gram birth weight on February 5, 2016, by caesarean section due to 8-day-preterm-premature rapture of membrane and urinary tract infection. The APGAR score was two in the first minute and five at the fifth minute. The medical diagnosis included preterm AGA infant, respiratory distress, early-onset neonatal sepsis, AOP, and GERD.

The study result record on March 1, 2016, included 26-day chronological age, 36.7oC temperature, 33oC incubator temperature, heartbeats at the rate 148-198 times per minute, and breathing frequency at the rate of 53 times per minute. Nasal continuous positive airway pressure (NCPAP) was applied to the infant with positive end-expiratory pressure (PEEP) of 5, oxygen fraction of 21%, and oxygen saturation of 88-95%. The infant weighed 920 gram and got 6 x15 ml, 6 x16 ml of milk for premature infant as enteral nutrition by continuous pumping. The sucking reflex of the infant was weak. The intravenous medical therapy was by 2 x 3.5 mg of aminophylline, and the oral therapy was by 3 x 8.5 mg of erythromycin, 3 x 0.8 mmol of KPO4, and 1 x 0.8 mg of zinc.

The trophicognosis showed ineffective breathing pattern, imbalanced nutrition: less than body requirements, risk of infection, risk of hypothermia, risk of skin integrity impairment, risk of delayed development, and risk of an ineffective latch (trouble in bonding attachment). The given nursing intervention was done by observing the physiological function, reviewing the feeding intolerance, applying developmental intervention, applying sleep positioning during the enteral feeding process, minimizing calorie loss, giving aminophylline and supplements.

Organismic evaluation on March 16, 2016, showed that the infant weighed 1,525 gram and feeding 12 x 23 ml enterally by gravitation. The infant did not experience

bradycardia, desaturation, abdomen distention, and vomiting. The laboratory check-up result on February 16, 2016, showed that the hemoglobin was 10.9 gram/dl. The problem of ineffective breathing pattern was solved, and N-CPAP had been removed. The infant did not get an infection. The leukocyte was 14,990/ui and CRP was 0.4 mg/l. The infant did not experience body temperature instability, did not get skin integrity impairment, and risk for delayed child development could be minimized.

Table 1. The Evaluation of Enteral Feeding Intolerance at Cipto Mangunkusumo and Harapan Kita Hospitals March 14 to April 15, 2016

Case	Abdomen Distention	Vomiting	Hypo-thermia	Bradycardia	Desaturation	Fecal Elimination	Abdomen Signs and
I	No	No	No	No	No	Normal	Supple
II	No	Decreased frequency	No	No	No	Normal	Supple
III	No	No	No	Yes	Yes	Normal	Supple
IV	No	No	No	No	No	Normal	Supple
V	No	No	No	No	No	Normal	Supple

Discussions

Schema 1. describes the application of Levine's Conservation Theory in the nursing care of LBW infants that experience feeding intolerance. The application of Levine's Conservation Theory includes four principles which are energy conservation, structural integrity conservation, personal integrity conservation, and social integrity conservation. The steps of the nursing process, according to Levine's Conservation Theory are assessment, trophicognosis, hypothesis, intervention, and evaluation. The application Levine's Conservation Theory in nursing care is aimed to improve the adaptation ability of LBW infants so that wholeness can be reached (Mefford & Alligood, 2011).

The assessment in Levine's Conservation Theory evaluates environmental changes which are not only internal changes but also external changes. The environmental changes are influenced by gestational age, infant's birth weight, mother's medical history, and parturition history, which influence the adaptation of LBW infants to the gastrointestinal tract. The adaptation ability of LBW infants will determine the absence or the presence of enteral feeding intolerance (Mefford, 2011).

Nursing Care to Conserve Energy

The problem of energy conservation found in the five chosen cases was the nursing problem concerning imbalanced nutrition: less than body requirements. The characteristic of the nursing problem found in the selected cases was the presence of enteral feeding intolerance. The sign and symptom were weak, sucking reflex, vomiting, hypomotility, abdomen distention, desaturation, and bradycardia during the feeding process (Carter, 2012).

The third case showed signs and symptoms included brownish OGT residue, bleeding, bloody stool, and no bowel sound. In the third case, the signs and symptoms of NEC stage 2 were found following the USG check-up result of the abdomen. NEC is ischemia or inflammation with necrosis in gastrointestinal tract generally happens to premature infants (Gomella, Cunningham & Eyal, 2013).

The primary choice of the given enteral nutrition was breast milk. In the third case and the fifth case, formula milk was given to the babies because the mothers were still treated at the intensive care unit room, and the parents refused donors' breastfeeding. Breastfeeding for LBW infants has some benefits such as double faster rate of absorption compared to formula feeding. Breastfeeding for LBW infants can indirectly reduce the risk of enteral feeding intolerance (Underwood, 2013).

The other intervention done was nutrition feeding by continuous feeding method in the third and the fifth case. This was done because enteral feeding intolerance symptoms were still found in the LBW infants when the feeding process was done by gravitation method. Corvaglia (2013) stated that the

feeding process with continuous feeding method would reduce risk of abdomen distention and improve the competence of the lower sphincter. The downside of continuous

feeding method is the more nutrition loss, including 40% of fat, 33% of calcium, and 20% of phosphate (Dutta et al., 2015).

The other nursing problem regarding energy conservation was an ineffective breathing pattern, and such nursing problems happened in the third and the fifth case. Enteral feeding intolerance can cause nursing problems like an ineffective breathing pattern. Relaxation of esophageal sphincter leads to gastroesophageal reflux, causing the period of apnea and bradycardia (Carter, 2012).

The intervention based on evidence-based nursing implemented to handle energy conservation problems was by elevating the headboard of the bed by 30 degrees during enteral nutrition feeding and pronation sleeping position management after enteral feeding process done for 30-60 minutes. The result of evidence-based nursing actions in the cases showed improvement in enteral nutrition feeding intolerance. Table 1. indicates that sleep positioning can decrease vomiting frequency and reduce risk of abdomen distention and desaturation.

The result of the research conducted by Yayan et al. (2018) showed that pronation sleeping position management sped up gastric emptying, so the risk of enteral feeding intolerance decreases. Pronation sleeping position management also applied energy conservation principle by reducing energy consumption through increasing gas exchange process, so that pulse and oxygen saturation were stabilized (Bredemeyer & Foster, 2015). Another benefit of pronation sleeping position management is decreasing the risk of abdomen distention in LBW infants by increasing perfusion in the gastrointestinal tract (Pourazar et al., 2017).

The cases showed improvement in feeding tolerance. There was not desaturation and bradycardia, not body temperature instability. The feces colour was yellow, and there was no blood. The bowel sound was strong, the abdomen was supple, there was not abdomen distention, and there was no vomiting. The LBW infants started to show improvements in sucking, swallowing, and breathing coordination.

Nursing Care to Conserve Personal Integrity

The nursing problems dealing with structural integrity conservation in the four cases were risk of infection, risk of hypothermia, and risk of skin integrity impairment. In the first case, skin integrity impairment was found by the sign of diaper rash. The problems of structural integrity conservation are concerned with the immunity of body organs and their functions (Mefford, 2011).

The nursing problem concerning the risk of infection was the risk of pathogen organism to enter and multiply, which could disturb health stability (Herdman & Kanitsuru, 2014). The risk factor of disease concerns internal and external environments. The fact that immunoglobulins had not been produced in the premature infants led to an internal environmental condition that could increase the risk of infection. The external environmental condition that caused exposure to infection was an invasive procedure (Goedicke-Fritz et al., 2017).

The nursing problem concerning the risk of hypothermia was the failure risk of body temperature management that caused a lower temperature than normal temperature (Herdman & Kanitsuru, 2014). Hypothermia was caused prematurity, the thinness of brown fat, and the immaturity of the hypothalamus. Exposure to the cold external environment also became the risk factor of hypothermia in the fourth case (Knobel-Dail, 2015).

The prevention of hypothermia in the LBW infants is necessary to prevent enteral feeding intolerance. Hypothermia causes hypoperfusion and hypomotility in the gastrointestinal tract so that the absorption is disturbed. The prevention of hypothermia is done by minimizing calorie loss by

conduction, convection, evaporation, and radiation (Thornton et al., 2014).

The nursing problem concerning the risk of skin integrity impairment was the risk of disturbances in the epidermis and dermis (Herdman & Kanitsuru, 2014). LBW infants have immature vernix caseosa, thin stratum corneum, and a little skin protein. There was an increased risk of skin integrity impairment, skin hydration disorder, and increase of permeability to infectious agents (Visscher et al., 2015).

The nursing problem of the risk of infection and risk of skin integrity impairment is related to the prevention of enteral feeding intolerance. The prevention of pathogenic agent transmission in the nursing problems concerning the risk of infection and risk of skin integrity impairment will reduce microbiota colony in the gastrointestinal tract. The microbiota colony influences motility function and secretion of the enzyme in the gastrointestinal tract (Clarke et al., 2014).

The organismic evaluation of structural integrity conservation problem in the chosen case showed that there was no infection, hypothermia, and skin integrity impairment. The infants showed acral warmth and the time of capillary refill time was 3 seconds. There was not temperature instability. The infants showed adequate skin integrity indicated by the absence of diaper rash, elastic skin turgor, and reddish-brown, moist skin.

Nursing Care to Conserve Personal Integrity

The nursing problem concerning personal integrity conservation is the risk of delayed-growth. The individual risk factor of the case was brain cell development immaturity. Immaturity of the neuromuscular system also causes loss of muscle mass that further leads to oral motoric skill disorder (Mefford, 2011).

The nursing intervention of personal integrity is aimed to make the LBW infants have self-identification concept, self-regard, and self-esteem (Mefford, 2011). The nursing intervention is done by applying developmental intervention by providing a healing environment and sleeping protection to the infants. The nursing intervention is done by categorizing the intervention based on LBW infants' sleeping cycles and pain management (Altimier, Kenner, & Damus, 2015).

The intervention done by improving sleeping quality and pain management can prevent enteral feeding intolerance. The intervention can prevent excessive energy expenditure and lower cortisol hormone, so that brain maturity improves. Brain maturity is important in optimizing intrinsic neural function in the gastrointestinal tract (Altimier, Kenner, & Damus, 2015).

The organismic evaluation of personal integrity conservation problem showed that the infants did not show signs of stress or discomfort. The sleeping need of the infants was fulfilled. The infants showed a minimal response to pain in a minor invasive procedure.

Nursing Care to Conserve Social Integrity

The nursing problem concerning social integrity in the chosen case was the family process disturbance. Family process disturbance is a change of relation or function in a family (Herdman & Kanitsuru, 2014). The treatment of LBW infants in intensive care unit room causes disturbance to bonding attachment and grieving reaction to the family (Mefford, 2011). The handling of enteral feeding intolerance also needs the role of the family to form social integrity in babies, for example, by applying Kangaroo Mother Care. The research done by Valizadeh et al. (2015) showed that Kangaroo Mother Care could prevent feeding intolerance by reducing gastric residue of LBW infants.

The organismic evaluation of social integrity conservation problem showed that the parents could take care of the infants at home. This was shown by the active participation of the parent in the process of infant care, for example, by applying Kangaroo Mother Care

and recognizing the infants' cues when the infants were hungry. In the third and the fifth case, adequate social integrity had not been

achieved because the mothers were cared for in the intensive care unit room.

The strength of the case study is that pediatric nurse specialists directly give nursing care to LBW infants experiencing enteral feeding intolerance. The other strength is the application of nursing intervention based on evidence-based nursing by a systematic review of nursing research. The downside of the application of Levine's Conservation Theory is the difficulty in the evaluation of personal integrity, including self-regard, self-identity, and self-image of LBW infants.

Conclusions

The application of Levine's Conservation Theory can optimize enteral nutrition compliance in the five chosen cases by providing nursing intervention using principles of energy conservation, structural integrity conservation, personal integrity conservation, and social integrity conservation. The sleep positioning to LBW infants during enteral feeding process can decrease vomiting frequency and lower the risk of desaturation, and the risk of abdomen distention. Nurses can apply the interventions as a standard of the operational procedure of interventions given to LBW infants that experience enteral feeding intolerance.

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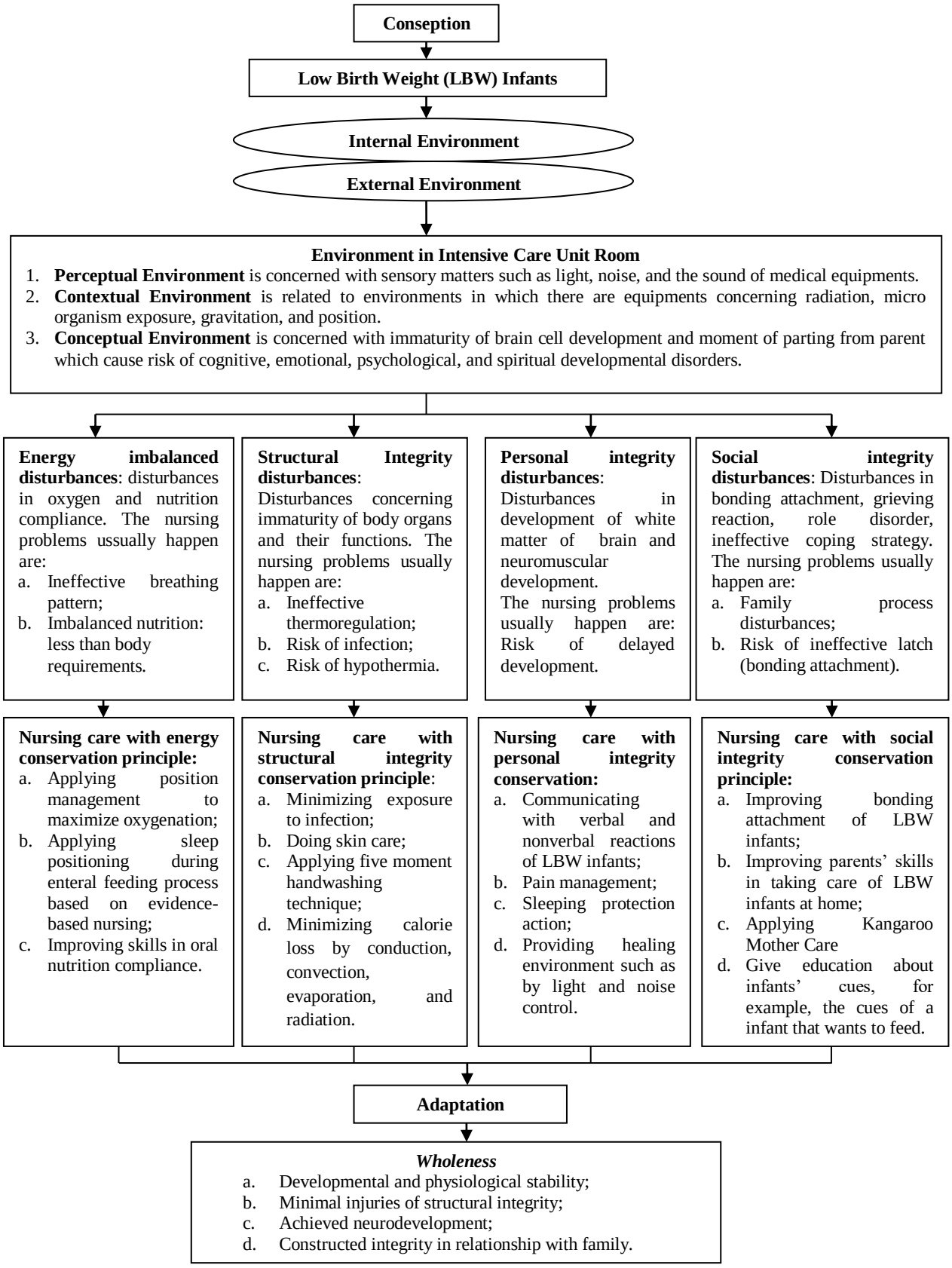

Schema 1. Application of Levine's Conservation Theory to Low Birth Weight (LBW) Infants
Source: Mefford (2011); Mefford & Alligood (2011)