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DERLEME

Konjenital Kalp Hastalığı Olan Çocuklarda Büyüme ve Gelişme: Beslenme

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ÖZ

Konjenital Kalp Hastalığı (KKH) terimi kardiyovasküler sistemdeki, doğuştan olan veya daha sonra tanımlanabilen yapısal veya fonksiyonel anomalileri içerir. Kalpteki yapısal bir kusur konjenital kalp defekti, konjenital kalp anomalisi veya kardiyovasküler malformasyon olarak adlandırılmaktadır. Yenidoğanda en sık görülen doğumsal anomalileri KKH oluşturmaktadır. KKH anamolisi her 1000 canlı doğumun 8-12'sinde ortaya çıkmaktadır ve görülme sıklığı %1'dir. KKH anomalisi olan çocukların da %10-15'i kritik KKH grubuna dahil olup, sıklığı 1000 canlı doğumda 1.2-1.7'dir. KKH bulguları arasında beslenme güçlüğü, anoksi, kalp yetersizliği, taşipne, pulmoner hipertansiyon, anormal endokrin fonksiyonlar ve üst solunum yolu enfeksiyonları yer almaktadır. KKH olan çocuklarda hastalığın karakteristik bulgularının yanında beslenme eksiklikleri ile büyüme ve gelişme gerilikleri görülmektedir. KKH olan çocuklar normal yaşıtlarına göre nöromotor ve dil gelişiminin zayıfladığı daha düşük ağırlığa sahip olmakla beraber bu çocuklarda boy kısalığının eşlik ettiği büyüme geriliği de görülmektedir. KKH olan çocukların %25-55' inde malnütrisyon gözlenmekte ve bunların %80'inin hastaneye yattığı bildirilmektedir. Büyümenin doğrudan etkilenmesi nedeni ile kalp hastalığı olan çocukların beslenmelerinin önemi vurgulanmaktadır. KKH olan çocukların beslenmesinin ve buna bağlı olarak büyüme ve gelişmelerinin takibini sağlamak için çocuk hemşireleri ve diyetisyenler iş birliği halinde çalışır. Çocuğun yaş grubuna uygun bireyselleştirilmiş rejimi için, enerji alımını desteleyen beslenme planı oluştururlar. Devam eden süreçte çocuğun günlük kilo takibini yaparak büyüme ve gelişme düzeylerini takip ederler. Bu sayede KKH olan çocukların ameliyat sonrası iyileşmelerini hızlandırarak, mortalite ve morbidite oranlarının düşmesini hedeflerler.

Anahtar Kelimeler: Beslenme; Büyüme ve gelişme; Çocuk sağlığı ve hemşireliği; Konjenital kalp hastalığı

Growth and Development of Children with Congenital Heart Disease: Nutrition

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ABSTRACT

The term; Congenital Heart Disease (CHD) encapsulates congenital or post identified anomalies in cardiovascular system. A structural defect in the heart is classified as a congenital heart defect, congenital heart anomaly, or cardiovascular malformation. CHD constitutes the most common congenital anomalies in newborns. CHD emerge 8-12 of every 1000 births, making the occurrence frequency 1%. Amongst children, CHD anomaly is on critical level for 10-15 % and occurrence frequency is 1.2-1.7 CHD findings may be listed as; feeding difficulty, anoxia, heart failure, tachypnea, pulmonary hypertension, abnormal endocrine functions and upper respiratory tract infections. Besides the characteristics findings of the disease, children additionally observed of having malnutrition and growth and development deficiency. Children with CHD have a lower weight compared to their normal peers, and their neuromotor and language development is weaker along with that, growth retardation accompanied by short stature is also observed in these children. Malnutrition is observed in 25-55% of children with CHD, and 80% of them are reported to have been hospitalized. Due to the direct impact on growth, the importance of nutrition for children with heart disease is emphasized. Pediatric nurses and dietitians work in collaboration to monitor the nutrition and, accordingly, growth and development of children with CHD. They create a nutrition plan that supports energy intake for the child's individualized regime appropriate to their age group. In the ongoing process, they monitor the child's daily weight and growth and development levels. In this way, they aim to reduce mortality and morbidity rates by accelerating the post-operative recovery of children with CHD.

Keywords: Child health and diseases nursing; Congenital heart disease; Growth and development; Nutrition

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INTRODUCTION

CONGENITAL HEART DISEASE (CHD)

Congenital Heart Diseases (CHD) are anatomical disorders present at birth that cause structural or functional disorders of the heart (1). In the intrauterine period, the development of the heart and related vessels takes place between the 14th and 60th days of CHD. Therefore, disorders related to structural anomalies of the heart pose a risk in this period (2).

These anomalies may be in the form of anomalies that cause stenosis or insufficiency in the atrium or ventricles of the heart, heart valves, anomalies in the coronary vessels, developmental disorders of the right or left atrium and ventricle, or cardiac developmental disorders in which one or more of the anomalies are combined (1-3). A structural defect in the heart can be named as CHD, congenital heart anomaly or cardiovascular malformation (2,3).

Incidence and Etiology of CHD

CHD occurs as a result of incomplete or irregular development of the chambers, valves and vessels of the heart. It is one of the most common congenital anomalies in newborns. The incidence of CHD in children has been evaluated as 1% in the world. One out of every three children born with CHD dies from heart disease, and one third of these deaths occur in the first year of life (2). In a study conducted in Türkiye, the frequency of CHD was found to be 5 per 1000 live births in the first week, while in another study conducted in the Central Anatolian region, it was found to be 7.7 per 1000 live births (4).

While the most common acyanotic congenital heart disease among CHD is Atrial Septal Defect (ASD) and Ventricular Septal Defect (VSD), the most common among cyanotic diseases is Great Artery Transposition and Tetralogy of Fallot (TOF) (2,5). In a study examining the frequency of CHD in neonatal wards; the most common acyanotic congenital heart disease was ASD and VSD; Greater Artery Transposition and TOF were the most common cyanotic diseases. According to the same study, the frequency of CHD among newborn babies was 4.9% (6).

It is thought that CHD develops with the interaction of genetic and environmental factors (1,2). Some intrauterine environmental factors increase the frequency of cardiac defects in the fetus. Diseases such as maternal diabetes, and phenylketonuria; the

use of drugs such as retinoic acid, lithium or hydantoin cause CHD (3,4,6). In addition, infections, maternal factors (maternal age over 40 years alcohol consumption and tobacco smoking rubella in the first months of pregnancy, exposure to teratogens or radiation), fetal risk factors (hydrops fetalis, intrauterine growth retardation), extracardiac anomalies (omphalocele, diaphragmatic hernia, duodenal atresia, single umbilical artery, tracheoesophageal fistula) family history of cardiac anomaly in one of the parents or a sibling also increases the risk of CHD (1-7).

Clinical Signs and Findings in CHD

Symptoms of heart disease may appear in newborns as bruising, feeding difficulties, fatigue when sucking, rapid breathing, shortness of breath, inability to gain weight, or frequent respiratory tract infections (pneumonia, bronchitis). It is seen in older children as fatigue, palpitation, chest pain and fainting (1-3). In newborns, the defect is usually asymptomatic, and electrocardiography is used when diagnosing since no murmur is heard (6). A murmur in newborn babies is the most important sign of CHD. Since hemodynamic changes are rapid especially in the neonatal period, serious findings such as cyanosis and shock are accompanied by nonspecific findings such as restlessness and malnutrition in CHD (6,7).

Classification of CHD

1. Defects that increase pulmonary blood flow

a. Atriyal Septal Defekt (ASD): There is a congenital opening between the atria that allows the passage of blood from left to right. The foramen ovale, which is open at birth in all babies, closes shortly after birth. If this opening is not closed, ASD will develop (1).

b. Ventricular Septal Defect (VSD): It occurs as a result of the incomplete development of the septum between the right and left ventricles (3).

c. Patent Duktus Arteriozus (PDA): In PDA, the opening between the pulmonary artery and the aorta, which is active during the fetal period, does not close after birth (8).

d. Atrioventriküler Septal Defekt (AVSD): It is a disease characterized by the absence or deficiency of the atrioventricular septum

and characterized by a common atrioventricular connection (1-3).

2. Defects that reduce pulmonary blood flow

a. Tetralogy of Fallot (TOF): The cases where VSD, Pulmonary Stenosis and right ventricular hypertrophy are accompanied by ASD are called TOF (8).

b. Tricuspid Atresia: Tricuspid atresia is a disease characterized by the absence or closure of the tricuspid valve, which provides the connection between the right atrium and the right ventricle (7,8).

3. Obstructive defects

a. Aortic Stenosis: Stenosis of the aortic valves.

b. Pulmonary Stenosis: It is a narrowing of the pulmonary valve in the pulmonary artery or the pulmonary artery entrance above or below the valve.

c. Coarctation of the Aorta: It is the stenosis in the lumen of the descending aorta where systemic blood flow is provided (1,8).

4. Defects involving blood flow

a. Transposition of the Great Arteries: The aorta arises from the right ventricle and the pulmonary artery arises from the left ventricle. It is usually seen together with ASD, VSD and PDA (3).

b. Truncus Arteriosus: A single great truncal vessel emerges from both ventricles superimposed on the VSD. There are 4 types. Pulmonary blood flow increased in type I, increased in type II, and III, normal in type IV, type decreased. Coronary artery anomalies are common and cause high mortality (1,8).

GROWTH AND DEVELOPMENT RETARDATION IN CHD

A healthy child is defined as a child who does not show signs of illness, and demonstrates body growth, physiological maturation, and mental and intelligence development in accordance with her/his chronological age. Since childhood is in the process of continuous growth and development, any factor that harms their health can slow down or

even stop the growth and development processes (9,10).

Monitoring growth and development is one of the important components of child health monitoring. The growth and development characteristics of children can be monitored to assess whether they are healthy or not (10). For this reason, it is important to know the growth and development characteristics. Growth and development generally follow a parallel course (11). Therefore, growth and development is a process that includes many events such as the formation of tissues, growth of the body, increase in muscle strength and control, social relations, thought, language development and personality formation (12).

The most important feature that distinguishes children from adults is that they are in constant growth and development. While physical and mental change processes are observed in children in growth and development, their body sizes increase, cell structure and functions, motor and cognitive abilities, sensory and social behaviors change and develop (13).

Children with CHD; if they survive the risk of death and disability, intensive invasive interventions and long-term intensive care treatments, they should with poor prognosis and neurological disorders (14). In children with heart disease, besides the characteristic findings of the disease, secondary problems brought about by the disease are also of great importance. The most important of these problems are nutritional deficiencies, anemia and growth retardation. Inadequate nutrient and energy intake, heart failure, anoxia, pulmonary hypertension and recurrent upper respiratory tract infections cause growth retardation (14-16).

In literature studies, it has been reported that feeding difficulties cause lower weight gain in children with CHD compared to their normal peers, and that neuromotor and language development is weakened in these children and growth difficulties are accompanied by short stature (17-21). In this process, the slowdown in growth is affected by the type of CHD, the transition to pre- and post-operative nutrition, and the duration of stay on mechanical ventilation (22). In a retrospective study, it was found that the average weight and height of children with congestive heart failure were lower than healthy children (23).

Another study, the body weight of cyanotic patients was slightly lower than that of ionic patients, and both height and body weights were lower than healthy children. Genetic malformations accompanying CHD may also cause retardation in the child's cognitive, language and motor skills (24).

Due to the increase in metabolic needs in children who have undergone heart surgery, their energy needs may increase by approximately 30% (18). Weight gain decreases due to the difficulties experienced postop feeding. In children with CHD, not only growth but also neurodevelopment slows down due to hypermetabolic causes such as insufficient calorie intake, swallowing dysfunction, malabsorption, and gastroesophageal reflux (25).

The fetal and neonatal periods are important for brain growth and maturation, myelination, and the development of neural networks. Changing cerebral blood flow during these sensitive developmental periods affects brain development. Therefore, children with CHD are at risk of mental and psychomotor developmental disorders, disability or developmental delay (26-29). Growth and developmental retardation continues to be an important problem in children with CHD. It is possible for children to reach their genetic growth and development potential and to live longer, healthy, strong and productive individuals by evaluating and following the growth and development of children (10,13).

NUTRITION in CHD

Nutrition; It is the ability of the body to take all the nutrients needed by the body in required amounts and use them in the body according to the age, sex and health situation and genetic characteristics of the person for growth, development, maintenance of life and protection of health (30). Since growth and development are continuous processes from infancy to adulthood, the main purpose of nutrition in childhood is to ensure the healthy growth and development (13,30).

There are features that distinguish child nutrition from adult nutrition. In children, energy expenditure per unit of body size is higher than in adults. In addition, the construction of new tissues in childhood increases protein, mineral and vitamin requirements (30,31). Children in Türkiye cannot develop healthily due to malnutrition and

infections. In addition, congenital anomalies caused by consanguineous marriages can lead to death in children. (32,33).

Malnutrition; it is a condition in which body structure and functions are adversely affected due to insufficient, unbalanced or low intake of energy, protein and other nutrients. (30,31). Malnutrition is observed in 25-55% of children with CHD, and it is reported that 80% of them are hospitalized. (34). Causes such as tachypnea, tachycardia, and respiratory distress in children with heart disease affect their nutrition negatively. The importance of nutrition in children with heart disease is emphasized because growth is directly affected (8,16). Postoperative swallowing dysfunction, edema, digestion, absorption, and gastrointestinal disorders can be seen in children with CHD. Chronic cyanosis affects nutritional disorders due to the age of the child, the need for cardiopulmonary pypass, the length of hospital stay, and the prolongation of life due to mechanical ventilation (35). Studies on the nutrition of infants who underwent surgery for CHD have reported that malnutrition causes poor growth, cardiac recovery, and complications that affect post-surgical morbidity and growth (36-38).

Preoperative malnutrition of children with CHD also affects the postoperative rehabilitation process of CHD cases in children (39). Therefore, initiation of enteral nutrition in the preoperative period of children with CHD may also reduce the need for nasogastric nutrition after surgery (40).

PARENTERAL AND ENTERAL FLUID ELECTROLYTE AND NUTRIENT REQUIREMENTS OF TERM AND PREMATURE INFANTS

The amount of fluid to be chosen first varies according to the baby's birth weight, gestational week and age (40). In term babies, it can be started with a more limited amount of fluid such as 60-70 ml/kg/day, and as the kidney functions mature, it can be increased to 130-150 ml/kg/day by increasing 10-20 ml/kg/day to allow growth and to replace water loss. A dynamic follow-up is required for fluid and electrolyte balance in preterms. Since especially unnoticed fluid losses are high, it is started with a higher fluid amount such as 80-100 ml/kg/day on the first day and

increased to 120-180 ml/kg/day with daily 10-20 ml/kg/day increments (41).

Enteral Nutrition in Children with CHD

Ensuring adequate enteral nutrition in children with CHD is very difficult. Children with systemic hypoperfusion and Necrotizing Enterocolitis (NEC) are at risk of malnutrition (42). Enteral nutritional support can be made by reaching different parts of the gastrointestinal tract (GIS) between the mouth and the jejunum. In choosing the enteral feeding route; evaluation of the patient's disease status, GIS anatomy, previous surgery history, gastric and intestinal motility and function, and duration of treatment should be considered (43).

When starting enteral nutrition, the gestational week is taken as a basis. In babies with low risk and gestational age >32 weeks, feeding can be started with 30-60 ml/kg. However, infants at risk and younger than 32 weeks are started to be fed with Minimal Enteral Nutrition (MEN) (42). The first choice is breast milk (colostrum). Breast milk can be expected for 24-48 hours. The second option is pasteurized donor breast milk. If not, it is started with the premature formula without dilution. In infants with CHD, MEN should be 10-20 ml/kg/day. Enteral nutrition is increased after 3-7 days of MEN is tolerated. It is usually increased to 15-30 ml/kg/day (44).

In a meta-analysis study, enteral nutrition at rated of 15-20 ml/kg/day and 30-35 ml/kg/day were compared in infants weighing less than 1500 grams, and NEC and mortality did not increase in rapidly increasing infants. Weight gain was slower and transition to full enteral nutrition was delayed in those who were increased slowly (45). It has been observed that nutritional supplements given to support preoperative nutrition of infants with CHD improve growth (46). The growth and development of infants with CHD who are supported by enteral nutrition product due to malnutrition is supported by providing energy intake by additional enteral nutrition product (46,47).

Total Parenteral Nutrition in Children with CHD

Conditions in which early enteral nutrition cannot be performed in term and premature infants or the amount taken enteral can not meet the required calorie and nutritional needs require Total Parenteral Nutrition (TPN) (48). It is preferred to

cope with major congenital anomalies accompanying CHD and to prepare and support the nutritional and metabolic status at the highest level before surgery. TPN support should be started immediately from the first hour in the hospital, especially for all premature babies younger than 32 weeks or with limited enteral intake (41,43,48).

The energy requirement of infants fed with parenteral way is lower than the requirement of infants fed enterally and is 75-85 kcal/kg/day until the end of the first week. TPN can be stopped when at least 75% of the total energy and protein needs are provided with enteral nutrition (100 ml/kg/day). When the baby can take more than 50% of the daily fluid, enterally, the lipid infusion can be stopped first, and when it reaches 75%, the protein infusion can be stopped (49,50).

Fortified Breastfeeding

The targeted amount of breast milk/formula to be given enterally in premature infants with CHD who cannot be breastfed is the usual target: 150-180 ml/kg/day. It is usually given when enteral nutrition of 50-100 ml/kg per day is reached. However, after reaching full enteral nutrition, the amounts can be increased up to 200 ml/kg/day on an individual basis in infants who can not achieve adequate weight gain. In special cases, the amount, calorie and protein requirement may vary (44,47).

Premature babies grow faster on breast milk, which contains more calories, fat and protein than artificial formula. Calorie density can be increased to meet nutritional needs, breast milk can be strengthened with (radıcal amınoacıd) Oprotin R. Breast milk can also be strengthened by expressing it. Fortified breast milk contains glucose polymers, protein, calcıum, potassium, magnesium, sodium, phosphorus and vitamins (A,C,E,K) (47). Thus, low birth weight babies are protected from osteopenia and hypoalbuminemia. It is predicted that infants fed with fortified breast milk may support weight gain, accelerate recovery, and shorten the hospitalization period (46,51).

Nutritional dysfunction may continue in children after heart surgery. One study reported that 22% of 2-year-old children with CHD surgery had nutritional disorders. These children are fed by tube after surgery and their percentile values were below 32% (52). The growth and development process is rapid in the newborn period. Mothers should be encouraged to breastfeed their babies, as babies

have chronic diseases in the growth and development process, their immune systems are not fully developed, and they are more open to infections (31,53,54). In studies, it was reported that children with CHD showed improvement with postoperative nutrition and support of maternal education and breastfeeding (23,55,56).

NURSING CARE OF A CHILD WITH CHD

It is important for the pediatric nurse to determine the family's needs well in order to care for the child. Evaluation of growth and development of healthy infants is necessary for nursing practice (54). The purpose of the nursing care of the child with CHD; making a careful physical assessment of the child, improving heart functions, conserving and supporting energy, and helping parents cope with this crisis until the child's condition improves (10,57).

Pediatric nurses play an important role in preventing diseases and promoting health. At the same time, she/he can use a combination of these roles while entering many roles such as therapeutic, supportive, counseling, advocacy, caregiver, and educator (57-59). Some considerations should be made to protect children and families at risk.

These;

- Providing genetic counseling to parents who have a congenital heart defect or a child with a CHD,
- Screening the babies of mothers with rubella and insulin-dependent diabetes,
- Evaluation of premature babies in terms of heart defects,
- Screening of babies with other congenital anomalies or chromosomal problems (60).

Evaluation of the child's condition in children with CHD includes monitoring of vital signs and assessment of cardiovascular, pulmonary, nutritional, and fluid-electrolyte status. The nurse should define the signs of failure in the early period, tachycardia, tachypnea, malnutrition, increased irritability and fatigue should be evaluated. Careful monitoring of the amount of fluid taken by the child and daily weight control are also important in the evaluation (57,60,61).

In addition, the nurse monitors the child with CHD; SPO2, respiratory rate and quality should be evaluated. Oxygen is given when necessary (62).

Daily capillary refill control should be performed for signs and symptoms of decreased cardiac output. To improve the child's venous flow, the extremity is elevated above the level of the heart. During the patient's activity, chest pain, dyspnea, decrease in pulse rate, decrease in systolic blood pressure, increase in diastolic pressure and decrease in respiratory rate are evaluated. If these findings are present, the activity is not continued. By monitoring daily weight, meals are planned to be rich in calories and protein. Eating with other children should be supported (60-63). In addition, lung auscultation is performed with the help of a stethoscope. The nasal canal is evaluated for respiration, retraction and cyanosis. The semifawler position is given. Position changes are made frequently. For this, an activity plan suitable for the child is made. Children are encouraged to participate in games and activities appropriate for their age (62,63).

One aspect of preventive care is that nurses provide parents with information on the characteristics of normal growth and development according to different age levels of children and provide forward-looking guidance. Providing appropriate family centered care for children with CHD and meeting their nutritional needs, supporting their growth and development, gives the opportunity to plan and implement a holistic nursing care (10,59). While giving nursing care to the child, the aim is not only to care for the child; the child should be considered as a part of the family and family centered care should be applied. The aim of family centered care is to help families with their anxiety and support their participation in the child's care. Nurses should cooperate with the family in order to reduce the family's anxiety and provide the most effective care for the child (59).

Nutritional physical findings and the patient's medical history are essential components of the nutritional assessment. The dietitian is the key member of the multidisciplinary healthcare team in managing these processes accurately and completely. The pediatric dietitian should organize the growth and development periods, nutritional requirements and physical needs of the child and adolescent (64).

CONCLUSION

According to the results of the literature research, significant weight loss and developmental delay are observed in children with CHD. In these patients, insufficient calorie intake, increased energy demand, malabsorption, severity of the disease and hypoxia are the most important causes of growth retardation in growth failure. Due to the ongoing malnutrition problems before and after the operation, the necessary energy needs can not be met. Growth retardation and malnutrition in these patients increase the risk of postoperative morbidity.

Deviations from normal should be detected at an early stage by monitoring the growth and development of children with CHD through periodic developmental surveillance, screening, and regular follow-up of height and weight in childhood. In this way, significant deficiencies can be identified by re-evaluation.

Children whose deficiencies are identified can support their neurodevelopment, academic, behavioral and psychosocial functionality, through appropriate therapy and training. In addition, weight gain can be supported by supporting enteral nutrition in the preoperative period and by providing the nutritional content appropriate for the energy deficit in the postoperative period.

Multidisciplinary studies should be carried out in maintaining the nutrition of a child who has undergone surgery in a hospital environment.

Pediatric nurses and dietitians play an important role in preventing and finding solutions to children's nutritional problems. They create a nutrition plan that supports energy intake for the child's individualized regime appropriate to their age group. In the ongoing process, they monitor the child's daily weight and growth and development levels. In this way, they aim to reduce mortality and morbidity rates by accelerating the post-operative recovery of children with CHD.

Expert dietitians should determine children who need nutritional supplements by making energy and calorie calculations. Thus, postoperative recovery of children with CHD will be accelerated and mortality and morbidity rates will decrease.

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