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## Original Article

### The distribution of congenital malformations in adolescent pregnancies: A single tertiary center experience in Turkey

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#### ABSTRACT

**Objective:** Adolescent pregnancies are more severe and dangerous for both mother and baby than adult pregnancies. Low birth weight, infections, intrauterine growth restriction, sudden infant death syndrome, and death risk are higher in neonates of adolescent pregnant women. Besides, anomalies of central nervous, gastrointestinal, and musculoskeletal systems are also seen frequently. The purpose of this study is to investigate congenital malformations of infants born from adolescent mothers.

**Material and methods:** In this retrospective study, 166 pregnant women aged 18 and under who had fetal anomaly were included in the study and their charts reviewed. Descriptive information about the adolescents and information about the fetuses and anomalies were recorded. Maternal and neonatal characteristics were calculated as frequency and percentage. Malformations were grouped according to the systems.

**Results:** The most common anomalies were the central nervous (40.5%), cardiovascular (15.8%), and urinary (10.8%) system. The anomalies related to the skin and phalanges, including the face, accounted for 8.1% of the cases. Ventricular dilatation (10.4%), neural tube defect (7.2%), and hydrocephalus (7.2%) were the most common abnormalities of the central nervous system. Ventricular septal defect (5.9%), pulmonary artery anomaly (2.7%), and tricuspid valve anomaly (2.3%) were the most common cardiovascular system anomalies. Intrauterine growth restriction (3.6%), pleural effusion/hydrothorax (3.2%), pes equinovarus (2.7%), diaphragmatic hernia (2.3%), cystic hygroma (2.3%), oligohydramnios (2.3%), polyhydramnios (2.3%), and cleft palate/lip (2.3%) were the most common anomalies among the other system and organ anomalies.

**Conclusion:** Adolescent pregnancy was partially associated with an increased risk of severe neonatal anomalies especially in the central nervous, cardiovascular, and urinary systems. Pediatric health care providers should have a low threshold for suspecting pregnancy in adolescents.

**Keywords:** adolescent pregnancy; congenital malformation; infant

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## Introduction

According to the definition of the World Health Organization, adolescence is between 10 and 19 years of age. Therefore, adolescent pregnancy is defined as "any pregnancy that occurs in adolescent girls aged 19 and under" [1]. An estimated 23 million adolescent girls are pregnant and approximately 18,5 million of them give birth in the adolescent period each year in developing countries [2]. The most common cause of death among girls aged 15 to 19 worldwide is maternal conditions. In 2018, the estimated global birth rate was 4.4% for girls aged between 15 and 19. This rate was the highest in the West and Central Africa at 11,5% [3,4].

The main risk factors of adolescent pregnancy are mostly socioeconomic. Low socioeconomic conditions such as poverty, low education, unemployment, disadvantaged neighborhood, ethnic minority membership, poor school outcomes, and mental deficits increase adolescent pregnancy. Maternal mental disorders, early sexual intercourse, and unprotected sex are among the maternal medical and behavioral risk factors [5]. Also, there is a strong relationship between sexual and physical abuse and early pregnancy [6].

The younger the adolescent girl, the worse the consequences.

Adolescent pregnancies are more severe and dangerous for both mother and baby than adult pregnancies. For example, preterm delivery, pre-eclampsia, eclampsia, urinary tract infections, anemia, depression, school dropout, unqualified jobs, social security needs, and early death are higher in adolescent pregnant women [5].

Low birth weight, infections, intrauterine growth restriction, sudden infant death syndrome, and death risk are higher in neonates of adolescent pregnant women. Besides, central nervous system anomalies (anencephaly, spina bifida, hydrocephalus, microcephaly), gastrointestinal anomalies (congenital anomalies such as gastroschisis, omphalocele), and musculoskeletal anomalies (cleft lip, cleft palate, polydactyly, syndactyly) are also seen frequently [7,8]. The young girl's body and genital organs continue to grow and do not reach adequate maturity; nutritional deficiencies and low body mass index, short cervix, and small pelvis are among the main risk factors for adolescent pregnancy.

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Besides, a physiological event such as the growing mother and fetus competing for food is one of the reasons for low birth weight babies [5].

Compared to adults, smoking, drug addiction, and alcohol abuse during pregnancy are more common among adolescent mothers [9,10]. Prenatal exposure to substance abuse might cause harmful effect to pregnancy, fetus (intrauterine growth restriction, preterm delivery, and miscarriages, etc.) and newborn (sudden infant death syndrome, low body length, and weight, low motor ability, urogenital, skeletal, central nervous system and cardiac anomalies) [5,11].

The purpose of this study is to investigate congenital malformations of infants born from adolescent mothers.

## Material and methods

### Study design and data collection

In this retrospective study, pregnant women aged 18 and under who were referred to the Perinatology Clinic of Kanuni Sultan Suleyman Health Training and Research Hospital between 2013-2019 and who had fetal anomaly were included in the study. Hundred and sixty-six patients' charts were reviewed retrospectively. The first ultrasonography (USG) examination of the patients was performed by a maternal-fetal medicine (MFM) specialist with the GE Voluson E6 device, and the perinatology council decided the definitive diagnosis.

### Study population

The study population in this study was limited to mothers aged 18 years or younger who gave birth to a baby with congenital malformation and pregnancy that resulted in birth or termination. Infants with missing maternal age, gestational age at birth, and birth weight were excluded from the study.

### Primary outcomes and malformations

Descriptive information about the adolescents (name, age, gravity, parity, birth, abortion, dilatation, and curettage) and information about the fetuses (birth week and delivery method) and anomalies (central nervous system, heart, GIS, urinary system, other systems, pregnancy week at the diagnosis, and genetic termination) were recorded. Malformations were grouped according to the systems.

### Ethical approval

Ethical approval for the study was obtained from the ethics committee of Kanuni Sultan Suleyman Training and Research Hospital (2020.07.161). During the study, the Helsinki Declaration 2008 rules were respected.

### Statistical analysis

Maternal and neonatal characteristics were calculated as frequency and percentage.

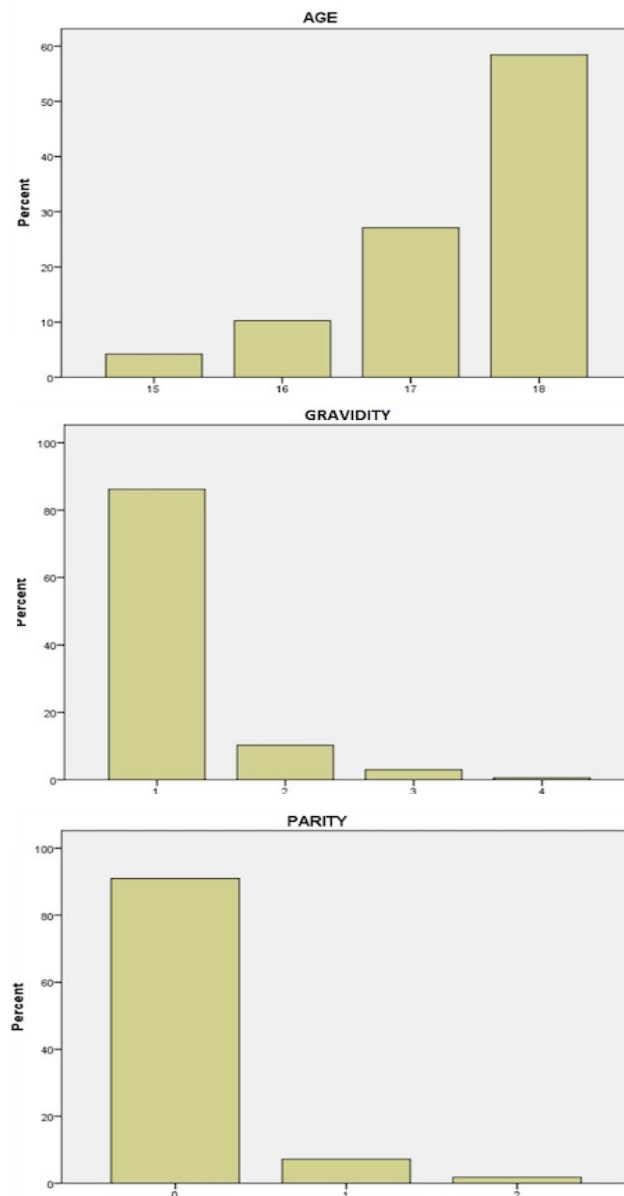
## Results

### Descriptive findings of the mother

The average age of 166 pregnant adolescents included in the study was  $17.40 \pm 0.84$  years. Information on the age distribution, gravity, and parity percentage rates of pregnant women is shown in Figure 1. According to this table, more than half of the women (58.4%) were 18 years old. The lowest rate (4.2%) belonged to 15-year-old pregnant women. The gravity distribution of pregnant women was as follows: one gravity 86.1%, two gravity 10.2%, three gravity 3%, and four gravity 0.6%. The parity distribution of the pregnant women was as follows: 0 parity 91%, one parity 7.2%, and two parity 1.8%. The number of abortions was as

follows: 1 abortion in 7 women, two abortions in one woman, and three abortions in one woman.

Figure 1. Age, gravity, and parity percentages of pregnant women

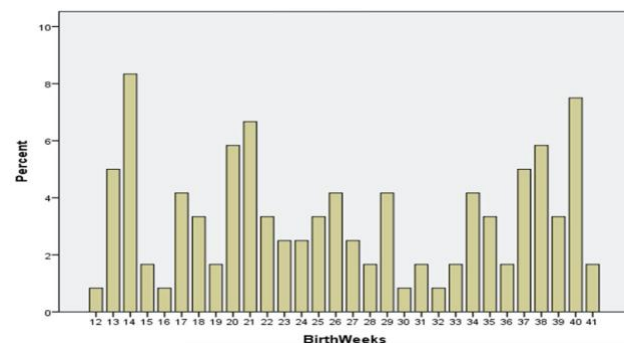


### Fetal and neonatal findings

As a result of the clinical process, termination was applied to 75 pregnant women (45.2%).

In 91 pregnant women (54.8%), termination was not required. Hundred and twenty of neonates' birth weeks was obtained. Birth weeks of the fetuses are shown in Figure 2.

Figure 2. Birth weeks of the fetuses



Accordingly, the birth weeks ranged from 12 to 41 weeks, and the mean was  $26.48 \pm 9.17$  weeks. The highest abortion rate was at the 14th (8.3%) weeks, and the highest birth rate was at the 40th (7.5%) and 21st (6.7%) weeks. When we examine the delivery mode, 103 of the fetuses were delivered with spontaneous vaginal delivery (87.3%) and 15 with cesarean section (12.7%).

When we examine the congenital anomalies, 134 fetuses had isolated single congenital malformation, and 32 fetuses had multiple congenital malformations. The anomalies observed in infants are shown in Table 1. According to this table, the most common anomalies were the central nervous system (40.5%), cardiovascular system (15.8%), and urinary system (10.8%). The anomalies related to the skin and phalanges, including the face, accounted for 8.1% of the cases. The mean time to diagnosis of the anomalies was  $22.41 \pm 7.58$  (median: 21; min: 9; max: 38) weeks.

Ventricular dilatation (10,4%), neural tube defect (7,2%), and hydrocephalus (7,2%) were the most common abnormalities of the central nervous system. Ventricular septal defect (5,9%), pulmonary artery anomaly (2,7%), and tricuspid valve anomaly (2,3%) were the most common cardiovascular system anomalies. The most common urinary system anomalies were polycystic kidney (2,3%), lower urinary tract obstruction (1,8%), hydronephrosis (1,8%), and megacystis (1,8%). The most common gastrointestinal anomalies were omphalocele 1,8%) and anal atresia or lower gastrointestinal obstruction (1,8%).

Pleural effusion/hydrothorax (3,2%), pes equinovarus (2,7%), diaphragmatic hernia (2,3%), cystic hygroma (2,3%), oligohydramnios (2,3%), and polyhydramnios (2,3%) were the most common anomalies among the other system and organ anomalies. The most common anomalies related to the skin and phalanges including the face were cleft palate/lip (2,3%), abdominal anterior wall defect (0,9%), dysmorphic facial appearance (0,9%), and limb body wall complex (0,9%) were observed.

## Discussion

In our study, we evaluated the data of 166 adolescent pregnant patients and their infants and the anomalies. In the study, the infants' birth weeks ranged from 12 to 41 weeks ( $26.48 \pm 9.17$  weeks) and the highest birth rate was at 21st and 40th weeks. Besides, the majority of babies (87.3%) were born with spontaneous vaginal delivery. The most common anomalies in infants were related to the central nervous system (40.5%) followed by anomalies of the cardiovascular system (15.8%) and urinary system (10.8%). The anomalies related to the skin and phalanges, including the face, accounted for 8.1% of the cases. The most common anomalies were ventricular dilatation (n=23), neural tube defect (n=16), hydrocephalus (n=16), and ventricular septal defect (n=13).

Adolescents appear to be at increased risk for adverse pregnancy outcomes, such as pre-eclampsia, preterm birth, fetal growth restriction, and infant deaths [12,13]. Whether these outcomes are the result of biologic immaturity or sociodemographic factors related to adolescent pregnancy (e.g., non-white race, less well educated, unmarried, lower economic status) remains unclear. However, in a multi-country study that included 124,446 mothers  $\leq 24$  years, the risk of adverse outcome remained increased in adolescent ( $\leq 19$  years) compared with young adult mothers (i.e., 20 to 24 years) after controlling for country, marital status, educational attainment, and parity [14].

Table 1. Abnormalities observed in infants

Systems	Number	Anomalies
central nervous system	90	ventricular dilatation (23), neural tube defect (cerebral and lumbosacral, lemon-banana sign) (16), hydrocephalus (16), acrani (9), anencephaly (7), corpus callosum agenesis (total or partial) (7), encephalocele (6), closed posterior fossa (6), exencephaly (5), meningomyelocele (lumbosacral) (5), spina bifida (5), iniencephaly (4), absence of cavum septum pellucidum (4), cerebellar hypoplasia (3), Chiari type 2 (2), Dandy walker malformation (2), microcephaly (2), sacrococcygeal teratoma (2), holoprosencephaly (1), craniorachisis (1), macrocephaly (1), micrognathia (1), anophthalmos (1), tethered cord (1)
cardiovascular system	35	ventricular septal defect (muscular, septal, inlet, subaortic etc.) (13), pulmonary artery anomaly (atresia, hypoplasia, dilated) (6), tricuspid valve anomaly (atresia, dysplasia, stenosis, insufficiency) (5), atrioventricular septal defect (4), aberrant right subclavian artery (2), aorta anomaly (hypoplasia, stenosis) (2), ductus venosus anomaly (agenesis) (2), cardiomegaly (2), right atrium dilatation (2), right heart hypoplasia (2), left heart hypoplasia (2), double outlet right ventricle (1), Fallot tetralogy (1), heart dextro-rose (1), cardiomyopathy (1), major aortopulmonary collateral arteries (1), portal system anomaly (1), pulmonary valve anomaly (atresia) (1), right ventricular dilatation (1), umbilical vein anomaly (opening to VCI) (1), umbilical artery anomaly (single umbilical artery) (1)
urinary system	24	polycystic kidney (5), lower urinary tract obstruction (4), hydronephrosis (4), megacystis (4), renal agenesis (3), renal pelvic ectasia (3), multicystic dysplastic kidney (MKDB) (2), uretero-pelvic junction stenosis (UPJ) (2), polycystic kidney (1)
gastrointestinal system	11	omphalocele (4), anal atresia - lower GIS obstruction (4), cloacal anomaly (1), gastro-schizis (1), hypoplastic bowel (1), microcolon (1)
Other	54	pleural effusion - hydrothorax (7), congenital crooked foot (pes equinovarus) (6), diaphragmatic hernia (5), cystic hygroma (5), oligohydramnios (5), polyhydramnios (5), cleft palate / lip (5), common ascites in the abdomen (4), hydrops fetalis (4), single umbilical artery (3), abdominal anterior wall defect (3), scoliosis-kyphoscoliosis (2), dysmorphic facial appearance (2), fetal ovary cyst (2), limb body wall complex (2), absence of lower extremity (1), ambiguous genitalia (1), amniotic band syndrome (1), Flat nasal root (1), narrow thorax (1), duodenal atresia (1), fetal hemochromatosis (1), hypospadias (1), twin wife mole pregnancy (1), short neck (1), short femur (1), short cord - ectopia cordis (1), extension of the arms with flexion deformity in the arms and hands deformity (2), Meckel Gruber syndrome (1), monozygotic diamniotic (MKDA) twin and twin to twin transfusion syndrome (TTTS) (1), osteogenesis imperfecta (1), esophageal atresia (1), claw hand (1), polydactyly (1), prenatal thickness increased (1), conjoined twin (1)

One of the main problems of adolescent pregnancies is preterm delivery (<37 weeks of gestational age) and intrauterine growth restriction.

Pregnant teens have a higher risk of preterm delivery (<37 weeks), very preterm delivery (<32 weeks), and extremely preterm delivery (<28 weeks) [9,14]. In a World Health Organization multi-country study, Ganchimeg et al. [7] found that the risk of preterm delivery was significantly higher in infants of adolescent pregnant women compared to adult mothers. In terms of chronological and gynecological age, the younger the adolescent, the higher the rate of preterm birth. In pregnant adolescents, low birth weight babies (<2500 g), very low birth weight babies (<1500 g), intrauterine growth restriction (<3 percentile for gestational age), stillbirths, neonatal intensive care unit admissions, and newborn deaths are higher compared to adults [9,14]. Ganchimeg et al. [7] reported that the rates of low birth weight and stillbirths were increased in infants of adolescent pregnant women between the ages of 16-17 when compared with infants of adult mothers. Besides, In a study between 2014 and 2017 held in Turkey preterm delivery rates in early-middle adolescence (between 13 and 16 years of age) and late adolescence (between 17 and 19 years of age) groups were found to be 37.2% and 12.8% [15].

In our study, the rate of preterm delivery is 76.6% (n=92/120). One of the reasons why our preterm delivery rate is so high is that our case series consisted of infants with only congenital anomalies born from adolescent pregnant women. Consistent with previous studies, our preterm delivery rate was significantly higher. It has been suggested that these risks among adolescent mothers are associated with poor biological maturation regardless of poor socioeconomic status, smoking, and inadequate prenatal care [7,16,17]. Also, the competition for nutrients between the fetus and young mother increases the risk of low birth weight babies [18]. Gynecological immaturity (i.e., short cervix [25 mm] and small uterine volume) and susceptibility to subclinical infections increase the risk of preterm birth among adolescent mothers [19].

In our study, the cesarean rate in adolescents was found to be 12.7%. Also, the incidence of vaginal delivery (87.3%) of adolescent mothers was higher, and this result was consistent with the literature [20,21]. Unlike our study, Ganchimeg et al. [7] found the cesarean section rate higher in young adolescents than in adult mothers (23.5% and 27.9%, respectively). Also, problems such as pre-eclampsia, eclampsia, puerperal endometritis, and systematic infections (which have cesarean section indication) were significantly more severe in adolescents than in adult mothers. One of the reasons for the higher cesarean rate in adolescents than in adults may be cephalo-pelvic disproportion due to immature pelvic bones.

The majority of congenital anomalies are of unknown etiology. Young maternal age is associated with numerous known risk factors for congenital malformations, including drug or substance use, lack of prenatal care, and insufficient use of essential prenatal vitamins. The increased prenatal testing rate in older mothers leads to an increased number of terminations. However, younger mothers are more likely to carry fetuses with congenital malformations to term (22).

In a study conducted in Chile between 2002 and 2011 in adolescent pregnant women, there were 1174 newborns from adolescent mothers, 82 of them had one or more congenital malformations. The most common fetal anomalies were found in skin and phalanges (34.35%), skeletal (18.9%) and cardiovascular (11.1%) systems. In this study, the digestive and central nervous system anomalies were only 6.7% and 4.3%, respectively [20]. In a study conducted in northern Germany between 2001 and 2011, the incidence of teenage pregnancies (n=638) was found to be 4.4%.

In this study, a total of 51 (8.3%) fetal malformations were detected in ultrasonographic examinations. The most common malformations were fetal heart defects (2.6%) (hypoplastic left heart syndrome (1.5%)), gastroschisis (1.5%), urogenital malformations (1.6%), skeletal malformations (1%), neural tube defects including central nervous system and spina bifida occurred (0.7 %), and multiple defects (1.1%) [23]. Besides, Chen et al. showed that adolescent pregnancies have a higher incidence of central nervous system anomalies, gastrointestinal anomalies, and musculoskeletal/integumental anomalies [24]. In our study, the central nervous system (40.5%), cardiovascular system (15.8%), and urinary system (10.8%) anomalies were the most common. The anomalies related to the skin and phalanges, including the face, accounted for 8.1% of the cases. Our findings were very different from the studies mentioned above.

### *Limitation*

This study has several limitations. The first one is the descriptive information (marital status, socioeconomic status, education level) and detailed medical history (pregnancy-related complications, smoking, drug and substance abuse) of mothers were not obtained in this study. The second limitation of the study is that this study was conducted in an extensive training and research hospital located in the metropolitan area. However, it is known that in the majority of low- and middle-income countries, adolescent pregnant follow-up and births take place in smaller health institutions and rural areas [25]. Therefore, it may not be right to generalize our results to the whole society. The absence of a control group is another limitation of this study.

### **Conclusion**

Our results showed that adolescent pregnancy was partially explained to be associated with an increased risk of preterm birth, and severe neonatal anomalies especially in the central nervous, cardiovascular, and urinary systems. Pediatric health care providers should have a low threshold for suspecting pregnancy in adolescents. A pregnant adolescent may complain of missing her periods or of irregular periods. Pediatric health care providers also must be aware that a pregnant adolescent may present with vague complaints and may or may not have considered the possibility of pregnancy. Physical and laboratory examinations of pregnant adolescents should be performed more carefully and followed up more frequently because of its possible harmful effects on the mother and the baby. Besides, since complications related to the mother and the infant are higher during delivery, adolescents should deliver at high-level hospitals. Besides, early marriage (<18 years) and sexual debuts are determinants of adolescent pregnancy. Therefore, government policies to control marriage age and early education on gender and birth control are a need to prevent adolescent pregnancies.

### **Disclosure**

Authors have no potential conflicts of interest to disclose.

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