O.G. Sidorova, N.V. Tomskaya, S.P. Oschepkova,
S.S. Prokopeva, A.N. Timofeeva

# PRENATAL DIAGNOSIS OF CAUDAL REGRESSION AT 15 WEEKS OF GESTATION

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A case of prenatal diagnosis of caudal regression syndrome at 15 weeks of gestation is presented. Ultrasound markers, the stages of prenatal ultrasound diagnostics - taking into account the involved external factors - are described. The diagnosis is based on the basic clinical signs characteristic of this syndrome. Due to the severe form of the caudal regression syndrome, the family decided to terminate the pregnancy. Pathomorphological and postmortem X-ray examination of the abortus confirmed the echographic changes detected in the prenatal period.

**Keywords:** fetus, caudal regression syndrome, ultrasound prenatal diagnosis, postmortem X-ray examination.

**Introduction.** Rare congenital malformation of the distal part of the spine and lower extremities in the fetus was first described by Hohl in 1852, and then by Duhamel in 1961 [10]. Caudal regression syndrome (CRS) occurs with a frequency of 1:60,000 to 1:100,000 pregnancies [3].

The defect develops sporadically in the embryo, up to the 28th day of pregnancy, and is associated with a developmental disorder of the main somatic vessels, with abnormal blood circulation in the caudal parts of the embryo, followed by a disorder in the development and layering of the organs of the lower body and the formation of combined anomalies of the cardiovascular, respiratory, gastrointestinal, genitourinary, nervous, musculoskeletal systems [1,2].

The vascular genesis of CRS is confirmed by the data of other authors [1,13]. Thus, fetuses with caudal regression develop a disorder of embryonic angiogenesis, which leads to the arterial steal syndrome, in which blood flow is redirected from the lower parts of the embryo to the chorion, which leads to the development of multiple malformations of the lower extremities. In the overwhelming majority of fetuses with CRS, the umbilical cord arteries connect directly with the superior mesenteric arteries, forming aberrant collateral vascularization [1,13]. Women with overweight, latent or explicit form of diabetes mellitus or who have been exposed to teratogenic factors (high radiation background, hyperthermia in early pregnancy and in the pre-pregnancy period, exposure to retinoids, sulfanilamides, organic solvents, cadmium, ochratoxin A, diethylpropion) during pregnancy have a high probability of developing embryos with caudal regression syndrome [4].

This congenital malformation in most cases is combined with a number of anomalies of the central nervous system (holoprosencephaly, Arnold-Chiari syndrome, secondary hydrocephalus, myelomeningocele), the cardiovascular system (ventricular septal defect), the gastrointestinal tract (tracheoesophageal fistula, duodenal atresia, anus atresia) and the genitourinary system (ureterohydronephrosis, bladder exstrophy, rectoureteral and rectovaginal fistulas, horseshoe kidney, hypospadias, urethral atresia, external genitalia transposition) [5-9].

In a mild case of spinal column involvement in the pathological process, the fetus may lack only the coccyx, or sacral and lumbar vertebrae - up to the absence of lower thoracic vertebrae - with a severe form of lesion. The specific change of individual vertebrae in the form of a "butterfly" or a "wedge" shape caused by an incomplete anterior or posterior cleft of the vertebral arch, which is due to insufficient fusion of individual ossification centers, is also described [6,9,11].

The prognosis for CRS depends on the degree of lesion and in its severe forms it is unfavorable.

The first and most complete classification of CRS was proposed by Renshaw in 1978, who described four variants of the defect [12]:

Variant I - a unilateral lesion, with the preservation of all joints with deformation and asymmetry of the pelvic ring, and lumbar scoliosis. There may also be clubfoot (equinovarus deformity of the feet) and neurological disorders in the form of loss of sensitivity.

Variant II is an incomplete bilateral lesion with an anomaly of the vertebrae ("butterfly-shaped", "wedge-shaped" and semi-vertebrae), with paresis and paralysis of the lower extremities.

Variant III is fragmentary lumbar and complete sacral agenesis, in which the iliac bones are connected to the lateral surfaces of the existing last vertebra, forming a "shield-like" fusion of the iliac bones. In this variant, dislocations of the femoral bones, contractures of the knee joints and clubfoot are observed.

Variant IV is selective lumbar and complete sacral agenesis, when the lower part of the present vertebra is installed above the "shield-like" articulation of the hypoplasized iliac bones, which causes complete instability of the pelvic spine. Movements in the hip joints are limited due to contractures, pterygiums are detected in the popliteal fossa, and pronounced clubfoot of the feet is observed. As a result of the described changes, the patient is constantly in the "frog pose" [12]

*Here is a description of the clinical case* of prenatal ultrasound diagnosis of an extremely rare fetal malformation.

Patient R., 32 years old. She was registered at the health center from the 5th week of pregnancy. This is her second pregnancy. Her husband is 32 years old, smokes. The married couple is not related. Spouses have no occupational hazards.

During the pre-gravidar period, the patient took medicine of the nitrofuran class and notes contact with organic solvents during the same period. Genealogical history is not burdened. Chronic diseases - obesity of the 1st degree, chronic cystitis. This pregnancy proceeded with the threat of termination of pregnancy in

**SIDOROVA Oksana Gavrilevna** – researcher, medical geneticist, diagnostic medical sonographer of the YSC CMP, okssi66@mail.ru, **TOMSKAYA Natalya Viktorovna** – obstetrician-gynecologist, diagnostic medical sonographer of the Yakutsk Republican Clinical Hospital; **OSCHEPKOVA Sardana Petrovna** – obstetrician-gynecologist, Yakutsk Republican Clinical Hospital; **PROKOPEVA Sargylana Sergeevna** – radiologist of the Republican Hospital 1 - National Medical Center; **TIMOFEEVA Anastasiya Nikolaevna** – Pathologist, Republican Hospital 1 - National Medical Center.

the 1st trimester due to a viral respiratory infection, also at 16 weeks the patient suffered a novel coronavirus infection COVID-19, on an outpatient basis, without complications.

The studies were carried out on the Mindrey-7 ultrasound device using C5-3, V10-4 MHz convexic sensors, and on the Voluson - E10 device, with RM6C, RIC 6-12 D sensors.

During ultrasound imaging at the age of 13 weeks of pregnancy, challenging due to the pronounced subcutaneous fat layer of the anterior abdominal wall, a slight increase in the echo-shadow of the fetal stomach and the absence of an image of the fetal kidneys in a typical place attracted attention. The coccygeal-parietal size of the fetus at the age of 13/2 weeks was 68.2 mm, which corresponded to the age of 13/0 weeks. An attempt at a detailed study using a transvaginal sensor did not clarify the picture due to the unfavorable position of the fetus and low motor activity, uncharacteristic for this period of pregnancy. The patient was invited for an additional examination.

According to the results of combined prenatal screening, in the 1st trimester of pregnancy, the risks of aneuploidy were distributed as follows: for Down syndrome - 1:6128, for Edwards and Patau syndromes - less than 1:20,000 (RARP - a - 0.71 Mom, b - hCG - 0.98 Mom).

During repeated examination, at the time of 15/6 weeks of pregnancy, the lumbar and sacral spine were not clearly defined, the dimensions of the fetal stomach were 17x8x10 mm compared to the normal size of up to 12x5x8 mm;(fig.1) it seemed that both kidneys were on the left (the right kidney was in heterolateral pelvic dystopia - Fig. 2). In the lower parts of the anterior abdominal wall, almost in the perineal region, a "low abdominal bulge" was detected - an exstrophed bladder, to the upper part of which the umbilical cord was attached. At the same time, biological sex of the fetus could not be clearly determined. The lower limbs were defined in a fixed, bent position. Motor activity in the lower extremities was not defined. Due to the bent position of the fetus, the area of the anterior abdominal wall could not be clearly visualized.

Based on the information above, with the conclusion that this echographic picture corresponds to the caudal regression syndrome, the pregnant woman was sent for consultation to the Medical genetics Center, where the initial diagnosis was confirmed at 17/2 weeks. Additionally, fetal VSD (ventricular septal defect), increased fetal gastric echo-shadow, heterolateral pelvic dystopia of the right kidney, a single umbilical artery, bilateral clubfoot were detected.

Without prenatal karyotyping and according to the collegial conclusion of the Prenatal consilium, taking into account the decision of the family, the patient is directed to termination of pregnancy due to severe malformations and an unfavorable prognosis, with mandatory pathoanatomic verification.

*Pathoanatomic data.* Male abortus, weighing 303 g, height 20 cm (Fig.3). An external examination revealed: the trunk is shortened, the lower extremities of the fetus are in the "frog pose", a defect of 18x17 mm is defined on the anterior abdominal wall under the umbilical ring, from where the bladder wall and intestinal loops are prolapsed (cloaca exstrophy). The lower limbs are bent at the hip and knee joints, the feet are rotated inward. The bilateral popliteal pterygium, more pronounced on the left, is determined (Fig.4)

Cardiovascular system: a defect of

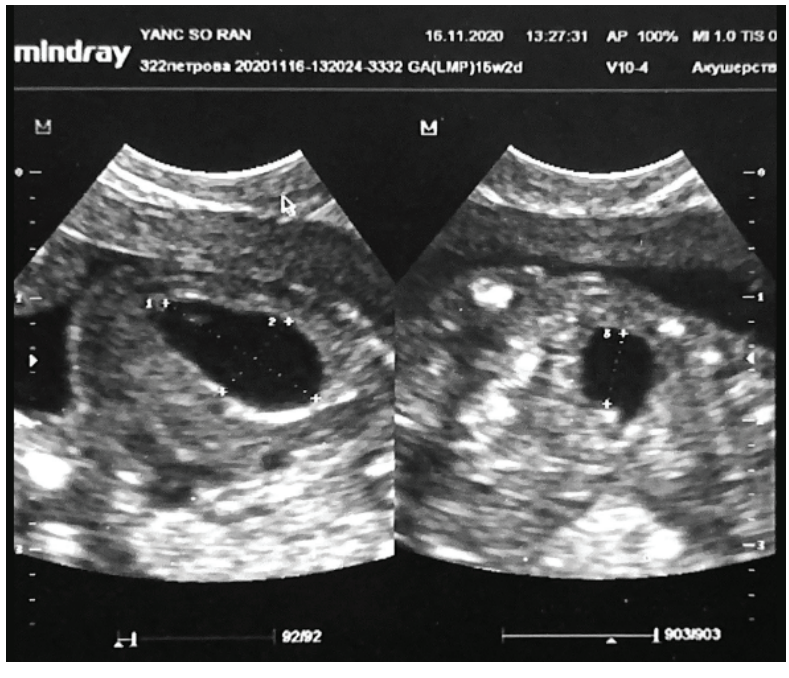


**Fig.1.** Enlarged echotene of the fetal stomach

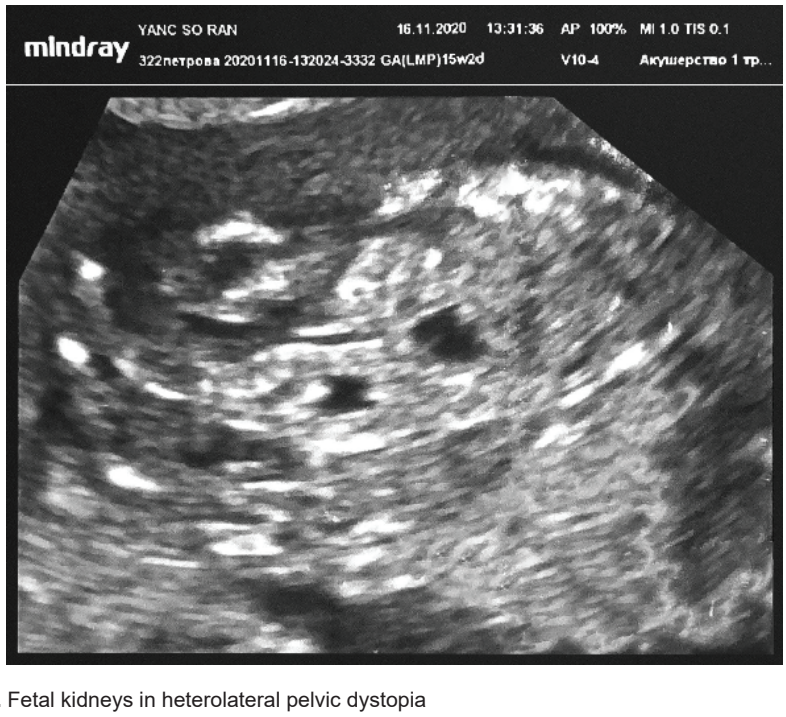


**Fig.2.** Fetal kidneys in heterolateral pelvic dystopia

the interventricular septum in the muscular part, 3 mm wide, is determined. The stomach is enlarged in size, duodenal atresia is determined. Both kidneys are located on the left, one of them in the pelvic cavity. Spine: the lumbar and sacral spine are not defined (Fig.5), the pelvic ring is not formed, the iliac bones are separate. Extraembryonic structures: placenta with signs of premature maturation, single artery of the umbilical cord.

Postmortem X-ray examination data: multiple bone anomalies are determined: 9 thoracic vertebrae, from the 6th to the 9th vertebrae of the "butterfly" shape, 9 thinned ribs on both sides. The lower thoracic, lumbar vertebrae, sacrum and coccyx are absent (Fig.6). The lower branches of the pubic bones and the rest of the pelvic bones are not clearly differentiated. Bones of the upper extremities are of the usual shape and size. The bones of the lower extremities - femoral and tibial are reduced in size, the fibulae are not differentiated. In both feet, 5 metatarsal bones are determined.

**Conclusion.** Prenatal ultrasound diagnosis of syndromic pathology is based on multiple systemic pathognomonic signs. In the case of caudal regression syndrome, it is the absence and change of vertebral bodies at the level of the lumbar and sacral divisions, the disturbed structure of the pelvic ring bones, characteristic disorders of the development of the lower extremities, malformations of the cardiovascular system, gastrointestinal tract and genitourinary system and concomitant disorders of the development of extraembryonic structures. The syndromic diagnosis is indirectly indicated by both the pre-pregnancy period and the course of pregnancy in the early stages: taking teratogenic drugs and exposure to organic solvent vapors.

In the case described by us, the diagnosis was suspected at the first screening study conducted at 13/2 weeks on an ultrasound machine of an average, non-specialized level, and finally formed and exposed at the first, outpatient, prenatal examination level, at 15/6 weeks of pregnancy. The changes described during ultrasound examination in the prenatal period and confirmed pathomorphologically and postmortem radiography fit into the IV variant of the caudal regression syndrome according to the Renshaw classification [12].

For a more complete verification of the syndromic diagnosis during pathoanatomic examination, additional participation of specialists - pediatricians, neurosurgeons, cardiologists, orthopedists, urologists is desirable.

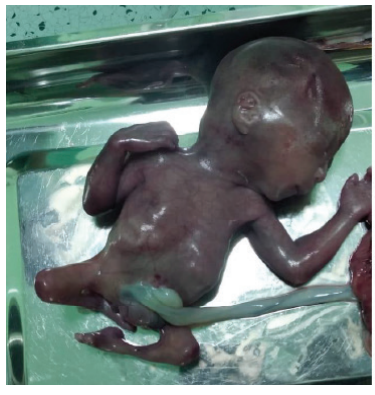

**Fig.3.** Male abortus, weighing 303 g, height 20 cm

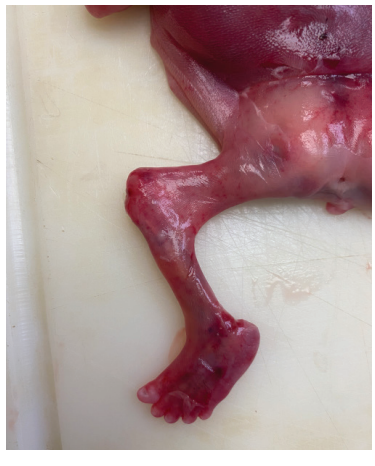

**Fig.4.** Popliteal pterygium

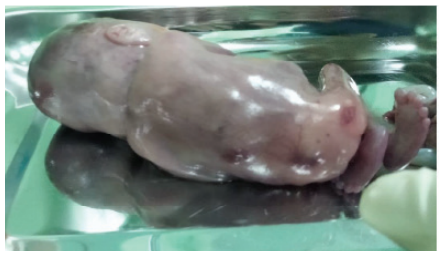

**Fig. 5.** View of abortus from the back

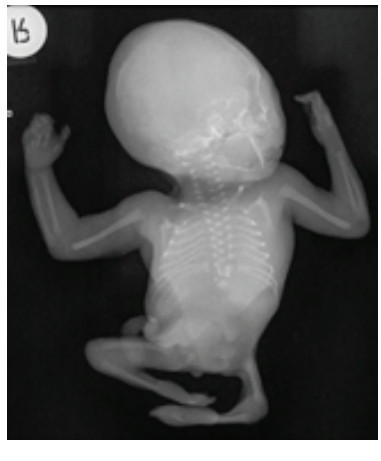

**Fig.6** Postmortem radiography in direct projection

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