Prenatal Diagnosis of Arhinia

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Abstract

Arhinia is a rare congenital anomaly that is not typically associated with known genetic mutations and is usually discovered after an affected infant is born. Prenatal diagnosis is important because neonates with arhinia often require specialized respiratory support with creation of an artificial airway. We present a case of isolated arhinia diagnosed on second-trimester ultrasound. A patient presented for routine ultrasound at 18 weeks gestation, and nasal tissues were absent in an otherwise morphologically normal appearing fetus. Cell free fetal DNA was unremarkable. The patient elected to undergo termination of pregnancy by dilation and evacuation. Subsequent genetic analysis confirmed a normal fetal karyotype and microarray, and no examination of fetal structural anatomy was possible. Antenatal diagnosis of arhinia is important to guide maternal–fetal care decisions and requires methodical sonographic evaluation to identify this malformation prior to delivery.

Keywords
- arhinia
- Bosma arhinia microphthalmia syndrome
- prenatal ultrasound
- 3D ultrasound
- prenatal genetic testing

Arhinia is an extremely rare congenital malformation characterized by total absence of the soft tissues of the nose, with 84 reported cases in the literature. Perhaps due to its rarity, this diagnosis is seldom made in the prenatal setting. The first reported case of a prenatal diagnosis of arhinia occurred in 2000. With the absence of nasal passages, affected neonates are at increased risk of respiratory compromise at birth and usually require invasive methods of airway support. Additionally, knowledge of this condition at an early gestational age allows for the option of prenatal genetic testing and for discussions regarding pregnancy termination. We present a case of arhinia that was discovered during routine second-trimester imaging with the use of real-time three-dimensional (3D) ultrasound technology.

Case

The patient was a 22-year-old previously healthy primigravida whose pregnancy was complicated by acute cystitis and first trimester nausea and vomiting during pregnancy. Her daily medications consisted of a prenatal vitamin in addition to as needed use of pyridoxine-doxylamine, promethazine, and prochlorperazine. She and the father reported no family history of intellectual disabilities, congenital malformations, or genetic conditions and the patient denied use of alcohol or illicit substances.

In her first trimester, a subchorionic hematoma was noted on ultrasound examination after an episode of vaginal bleeding. She subsequently presented to care at our institution for her routine second-trimester ultrasound at 18 weeks gestational age. Her ultrasound revealed absence of the nasal bone and external soft tissues of the nose. Nares could not be identified with the use of two-dimensional (2D) real-time coronal imaging, 3D multiplanar reconstruction, or 3D surface rendering of the face. Detailed anatomical survey was otherwise unremarkable except for a marginal umbilical cord insertion. No other midline anomalies were observed, with any evidence of cleft lip or palate. Orbital
spacing, ear placement, and brain structure were sonographically normal.

Cell free fetal DNA was normal for the common aneuploidies and common microdeletions (15q11.2, 1p36, 22q11.2, 4p, and 5p). The patient elected to undergo therapeutic dilation and evacuation, which was performed without complications. The products of conception were sent for genetic evaluation and were deemed free from maternal tissue contamination. Chromosomal analysis revealed a 46, XY karyotype consistent with the cfDNA findings and a normal microarray. An assessment of the fetal face could not be performed.

Discussion

Arhinia is an extremely rare inborn error of craniofacial development defined as the absence of external nasal tissues and nasal passages. When arhinia is combined with complete absence of the olfactory system, it is termed total arhinia. The largest series reported 80 cases of arhinia worldwide, and review of the literature revealed four additional case reports published subsequently. The majority of reported cases were diagnosed after delivery and occurred in the context of otherwise uncomplicated pregnancies. Most cases are sporadic, but there are reports of families that have two affected individuals. Neonates with arhinia typically have associated anatomic anomalies including microphthalmia or anophthalmia, cataracts, coloboma of iris, high arched or cleft palate, absent paranasal sinuses, hypoplastic maxilla, nasolacrimal duct stenosis or atresia, choanal atresia, or microtia. This condition frequently coexists with hypogonadotropic hypogonadism (97% in one series), and when arhinia is paired with...
Arhinia is an uncommon condition that has historically been diagnosed in the neonatal period. Despite widespread use of prenatal ultrasound in resource-rich nations, the first documented report of arhinia diagnosed perinatally was reported in 2000.\(^2\) Even among cases published in the last five years, the diagnosis was not made until delivery and not identified on antenatal ultrasound.\(^3,6,11\)

Establishing this diagnosis prior to delivery allows for multidisciplinary planning with neonatology, pediatric otorhinolaryngology, and plastic surgery subspecialists to optimize the postnatal management of affected infants. Furthermore, prenatal genetic testing can be undertaken to rule out more commonly encountered genetic abnormalities associated with midline facial defects such as trisomy 13.\(^2\) Although this test was not performed with our patient due to planned termination, single-gene sequencing of SMCHD1 with methylation profiling can be considered.

Perhaps most importantly, the early diagnosis of arhinia allows the mother to take ownership of her health care and decide how she wishes to proceed with the pregnancy. In our case, the use of 3D ultrasonography confirmed our findings on 2D imaging and provided a more direct and easily interpretable representation of the anomaly that guided our counseling with the patient. Indeed, the patient and her partner had difficulty conceptualizing the fetal anomaly until presented with 3D reconstructions and surface rendered images of the fetal face. Our case therefore serves to exemplify the utility of detailed anatomic assessment via fetal ultrasound for facial anomalies broadly and arhinia more specifically. It additionally showcases a novel application of real-time 3D and post-processing of 3D volume datasets to augment clinical decision making and provide more easily digestible information to patients unfamiliar with 2D ultrasound imaging.

### Video 1


### Video 2

Conflict of Interest
A.E.S. reports personal fees from GE Healthcare outside the submitted work.

References
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