

## CASE SERIES

## PEER REVIEWED | OPEN ACCESS

## Amniotic band syndrome: A case series

Meghan Kathleen Munisteri, Veronica Gonzalez-Brown,  
Diana Villazana-Kretzer

## ABSTRACT

**Introduction:** Amniotic band sequence (ABS) is a constellation of congenital anomalies that can be seen in infants without any known genetic mutations. Amniotic band syndrome is thought to be responsible for 1/70 still births. There are two leading theories for proposed pathogenesis of ABS, commonly referred to as “extrinsic” and “intrinsic” models.

**Case Series:** Our case series depicts four deliveries at two large military hospitals. Each of our patient case demonstrates the spectrum of ABS and supports the extrinsic theory as the primary mechanism. The first case resulting in lateral encephalocele with a complex facial cleft and subsequent intrauterine fetal demise. The second patient case resulting in fetal unilateral lower extremity limb reduction. The third patient case resulting in premature prelabor rupture of membranes and delivery at 29 weeks with pedal amputation. The fourth and final patient case resulted in a lethal limb-body-wall defect with extravasation of visceral organs and a sacral myelomeningocele.

**Conclusion:** All four of our cases lend support to the extrinsic theory as the primary pathological mechanism. Each of our patients had risk factors for potential hypoxic injury and subsequent amniotic band formation.

**Keywords:** Amniotic band syndrome, Ectopic cordia, Fetal anomaly

## How to cite this article

Munisteri MK, Gonzalez-Brown V, Villazana-Kretzer D. Amniotic band syndrome: A case series. J Case Rep Images Obstet Gynecol 2022;8(1):33–38.

Article ID: 100122Zo8MM2022

\*\*\*\*\*

doi: 10.5348/100122Zo8MM2022CS

## INTRODUCTION

Amniotic band sequence (ABS) is a constellation of complex congenital anomalies that can be seen in infants without any known genetic mutations. It is said to be responsible for 1/70 stillbirths [1] and its estimated prevalence varies widely from 1/1200 to 1/15000 live births [2]. It affects both sexes equally. The extent of anomalies can range from single digit amputations to complex craniofacial clefts that are ultimately incompatible with life [3]. There are two leading theories for the proposed pathogenesis of ABS, commonly referred to as the “extrinsic” and “intrinsic” models. The first proposed theory is the Intrinsic theory, described by Streeter in 1930 [4], which suggested that the anomalies were caused by an intrinsic defect in the embryo during early development and partial perturbation of the germ disc. This process can lead to early development of amniotic bands.

The extrinsic model as described by Torpin in 1965 [5] suggested that birth defects are caused by a disruption in the amnion–chorion interface, leading to the formation of multiple loose bands. These bands are comprised of extraembryonic celom between the amnion in the chorion. The bands then adhere to and entangle the embryo leading to constriction rings that result in vascular compromise leading to hypoxic tissue damage

Meghan Kathleen Munisteri<sup>1</sup>, Veronica Gonzalez-Brown<sup>2</sup>, Diana Villazana-Kretzer<sup>3</sup>

**Affiliations:** <sup>1</sup>DO, CPT, MC, US Army, PGY4, Brooke Army Medical Center, Obstetrics & Gynecology, San Antonio, Texas, USA; <sup>2</sup>MD, Col, USAF, Brooke Army Medical Center, Chief of Obstetrics and Gynecology, Maternal Fetal Medicine, San Antonio, Texas, USA; <sup>3</sup>DO, LtCol, USA, Carl R. Darnall Military Medical Center, Chief of Obstetrics, Maternal Fetal Medicine, Killeen, Texas, USA.

**Corresponding Author:** Meghan Kathleen Munisteri, 605 W Hollywood Ave, San Antonio, TX 78212, USA; Email: Megmunisteri@gmail.com

Received: 03 February 2022

Accepted: 28 April 2022

Published: 30 June 2022

[6]. The following four cases presented from two military medical centers support the extrinsic theory as the likely mechanism.

## CASE SERIES

### Case 1

A 19-year-old gravida 1 para 0 diagnosed and treated for positive chlamydia at her new obstetric visit at 9w6d but had an otherwise uncomplicated medical and surgical history. The patient's family history was negative for any congenital anomalies, paternal consanguinity, and previous uterine procedures.

A routine fetal ultrasound assessment performed at 19 weeks' gestation revealed right lateral encephalocele (Figure 1), large right cleft lip and palate with the defect expanding to the right eye socket, left lower extremity edema, and bilateral rocker-bottom feet (Figures 2–4). The patient underwent an amniocentesis at 20 weeks gestation that revealed normal male karyotype and normal microarray, without any maternal cell contamination. Repeat ultrasound at 23 weeks gestation showed previous anomalies with appearance of a thick right lateral amniotic band spanning the full length of the skull and facial defects as well as bilateral clenched fists (Figure 5). Fetal echocardiogram done at that time was without any evidence of structural cardiac abnormalities. She underwent extensive consultation in regard to ABS and outcomes, with plans for close follow-up. She presented at 26 weeks gestation for her scheduled growth scan reporting decreased fetal movement. She was diagnosed with intrauterine fetal demise measuring in the 9th percentile with an estimated fetal weight of 768 grams. She was admitted for induction of labor and went on to have an uncomplicated vaginal delivery. After delivery, fetal examination revealed profound midfacial deformities, brachydactyly, and placental adhesions. Placental pathology significant for a 20.7 cm long three vessel, peripherally inserted, umbilical cord with amnion constriction near placental insertion. Fetal membranes displayed features of amnion/chorion disruption as well as thickened bands of chorionic connective tissue and extraembryonic celom between the amnion and the chorion. These findings were somewhat difficult to fully

discern due to the breakdown of fetal tissue after the intrauterine fetal demise.



Figure 2: Coronal view of facial cleft and lateral encephalocele.



Figure 3: Transverse view of amniotic band contact with fetal cranium.

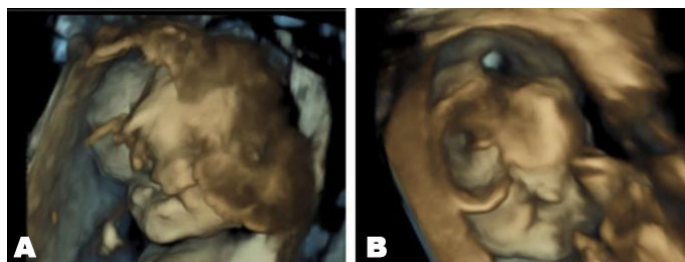


Figure 1: (A and B) 3D views of facial cleft and lateral encephalocele.

### Case 2

A 21-year-old gravida 2 para 1 with uncomplicated pregnancy presented for anatomical survey at 19 weeks 2 days based on last menstrual period. The patient had no family history of congenital defects, uterine procedures, or paternal consanguinity. The patient's anatomy scan was significant for a swollen right foot wrapped by thin "wispy" amniotic bands other fetal anomalies were noted on the ultrasound. The patient continued to have an otherwise uncomplicated pregnancy until premature



Figure 4: Transverse view of lateral encephalocele.



Figure 5: Addition amniotic band contact area.

prelabor rupture of membranes at 23 weeks 1 day. She was expectantly managed inpatient until 29 weeks at which time she had a primary low transverse cesarean section for breech presentation in the setting of chorioamnionitis. Pathology evaluation of the placenta revealed acute funisitis and acute chorioamnionitis. Further evaluation of the amputated left foot revealed extensively autolyzed skin, soft tissue, bone, and cartilage. The fetal pedal tissue did not appear viable and the autolysis appeared to represent chronic changes. Neonatal exam revealed a left lower extremity below the knee limb reduction defect as well as evidence of amniotic banding to various digits on both hands. Infant was discharged home at a corrected gestational age of 35 weeks and three days at 2215 grams with pediatric orthopedics follow-up.

### Case 3

A 34-year-old gravida 1 para 0 with uncomplicated pregnancy presented for routine anatomical survey at 21 weeks 5 days based on last menstrual period. This patient also had no history of uterine procedures, familial birth defects, or paternal consanguinity.

The patient's anatomy scan was significant for complete absence of the left foot and ankle, without any identifiable amniotic band, however with slight swelling and shortening of the tibia and fibula. The patient had serial ultrasounds throughout her pregnancy, which progressed to term without complication. The patient ultimately delivered via primary cesarean for suspected fetal macrosomia. Her surgical operative report was significant for macrosomic infant as well as an arcuate shaped uterus. Radiology imaging at newborn visit is significant for absent left foot as well as an absent left distal tibia and fibula. The infant had normal male karyotype on chromosomal microarray without any other associated anomalies.

### Case 4

The fourth and final patient case was noted in a 21-year-old G3P1011 during a routine anomaly scan at 21 weeks 4 days. The patient had an antepartum course complicated by anemia with otherwise uncomplicated history. The fetal anomaly scan was significant for a complex limb body wall defect. Specific defects included ectopia cordia, open abdominal wall defect with bowel stomach, and liver extraperitoneally. Amniocentesis noted normal chromosomal microarray.

Spinal anatomy was significant for type 1 sacrococcygeal teratoma and myelomeningocele with associated dandy walker malformation. The patient underwent an emergency cesarean section for placental abruption at 31 weeks. The infant received comfort care and ultimately succumbed to multiple anomalies shortly after delivery. Placental pathology was significant for a short 2 cm, three vessel cord, placental membranes opaque with avascular and necrotic villi.

## DISCUSSION

Amniotic band sequence (ABS) deformities are likely caused by early rupture of the amnion leading to the formation of mesodermic strands. These strands form both tight constrictive tissue bands as well as wispy amniotic adhesions. Initially the bands adhere and entangle loosely to the fetus, however over time the bands become constrictive rings and lead to an acute and later chronic hypoxic state. The presence of hypoxia and the constrictive bands result in complex anomaly patterns leading to an array of fetal malformations [5, 7]. Clinical manifestations can range from minor digit amputations to fatal complex anomalies. There are numerous risk factors that predispose a pregnancy to the development of ABS.

These risk factors include obesity, nulliparity, nicotine usage, history of uterine procedures, intrauterine infections, Mullerian anomalies, residing in high altitudes and pre-existing maternal diabetes [3].

The cases presented in this case series all exhibit some of the risk factors stated above. Each case demonstrates the wide spectrum of severity seen in patients affected by amniotic band sequence.

Case 1 had a known diagnosis of chlamydial infection in early pregnancy. Chlamydial infections are known to lead to the formation of intrauterine and extrauterine adhesive disease as well as early rupture of membranes. This likely accounts for the early rupture of the amnion and formation of the amniotic bands. In case 2 the findings of amniotic band syndrome were seen during her fetal anomaly scan with unclear etiology; however, she ruptured less than two weeks later and was subsequently diagnosed with an intra-amniotic infection.

Vaginal and uterine infections can be associated with preterm previable rupture of membranes and as well the formation of amniotic bands [8]. Finally, the patient in case 3 was noted to have an arcuate shaped uterus intraoperatively. The presence of an arcuate uterus as well as other uterine Mullerian anomalies increases the risk for earlier rupture of membranes, abnormal placentation, and placental mal-perfusion [8]. In addition, all these patients were nulliparous, differences in vascularity in nulliparous women versus multiparous women have been noted. Nulliparous women were found to have the less vascularity in early development. These changes in blood flow can lead to abnormalities in the development of the amnion–chorion interface further predisposing to early rupture [9]. The mechanism through which amniotic band sequence occurs is related to the level of vascular compromise seen in the tissues affected. The early separation of the amnion from the chorionic membrane creates remnants of fibrous bands that constrict the fetus's ability to grow. The constrictive bands can be superficial resulting in skin indentations or can be deep leading to severe vascular compromise. The severity of vascular compromise can result in simple digit amputation or complex fetal anomalies such as encephaloceles and large facial clefts [10]. In the four cases presented above the complexity of fetal injury was directly related to the level of vascular injury with case 1 and case 4 having the most severe vascular insults [11, 12]. The presence of amniotic bands was noted in ultrasound imaging and in the placenta pathology of all the cases presented, though the visualization of amniotic bands on ultrasound is not required to make the diagnosis [13]. These cases support the vast array of fetal damage that can result from ABS. Currently there are few options for treatment, however, some literature cites the potential for intrauterine lysis of adhesions via fetoscopic surgery [6, 11, 13–18].

## CONCLUSION

Further investigations are needed to understand the formation of amniotic bands and for the potential for intrauterine treatments. For now serial ultrasound examination, artery Doppler assessment of affected fetal parts, and mode and place of delivery should be based on obstetrical indications as well as severity of the fetal abnormalities.

## REFERENCES

1. Kalousek DK, Bamforth S. Amnion rupture sequence in previable fetuses. *Am J Med Genet* 1988;31(1):63–73.
2. Hunter AGW, Seaver LH, Stevenson RE. Limb-body wall defect. Is there a defensible hypothesis and can it explain all the associated anomalies? *Am J Med Genet A* 2011;155A(9):2045–59.
3. Ossipoff V, Hall BD. Etiologic factors in the amniotic band syndrome: A study of 24 patients. *Birth Defects Orig Artic Ser* 1977;13(13D):117–32.
4. Streeter GI. Focal deficiencies in fetal tissues and their relation to intrauterine amputations. *Contrib Embryol Carnegie Inst* 1930;22:1–44.
5. Torpin R. Amniochorionic mesoblastic fibrous strings and amniotic bands: Associated coconstricting fetal malformations or fetal death. *Am J Obstet Gynecol* 1965;91:65–75.
6. Merrimen JLO, McNeely PD, Bendor-Samuel RL, Schmidt MH, Fraser RB. Congenital placental-cerebral adhesion: An unusual case of amniotic band sequence. Case report. *J Neurosurg* 2006;104(5 Suppl):352–5.
7. Kahramaner Z, Cosar H, Turkoglu E, et al. Amniotic band sequence: An extreme case. *Congenit Anom (Kyoto)* 2012;52(1):59–61.
8. Cignini P, Giorlandino C, Padula F, Dugo N, Cafà EV, Spata A. Epidemiology and risk factors of amniotic band syndrome, or ADAM sequence. *J Prenat Med* 2012;6(4):59–63.
9. Garite TJ, Freemon RK. Chorioamnionitis in the preterm gestation. *Obstet Gynecol* 1982;59(5):539–45.
10. Lekovich J, Stewart J, Anderson S, Niemasik E, Pereira N, Chasen S. Placental malperfusion as a possible mechanism of preterm birth in patients with Müllerian anomalies. *J Perinat Med* 2017;45(1):45–9.
11. Durga R, Renukadevi TK. Amniotic band syndrome – A dreaded condition. *J Clin Diagn Res* 2016;10(1):QD04–5.
12. Obdeijn MC, Offringa PJ, Bos RRM, Verhagen AAE, Niessen FB, Roche NA. Facial clefts and associated limb anomalies: Description of three cases and a review of the literature. *Cleft Palate Craniofac J* 2010;47(6):661–7.
13. Seeds JW, Cefalo RC, Herbert WN. Amniotic band syndrome. *Am J Obstet Gynecol* 1982;144(3):243–8.
14. Küchler EC, Silva LAD, Nelson-Filho P, et al. Assessing the association between hypoxia during craniofacial development and oral clefts. *J Appl Oral Sci* 2018;26:e20170234.

15. Merrimen JLO, McNeely PD, Bendor-Samuel RL, Schmidt MH, Fraser RB. Congenital placental-cerebral adhesion: An unusual case of amniotic band sequence. Case report. J Neurosurg 2006;104(5 Suppl):352–5.
16. Hüsler MR, Wilson RD, Horii SC, Bebbington MW, Adzick NS, Johnson MP. When is fetoscopic release of amniotic bands indicated? Review of outcome of cases treated in utero and selection criteria for fetal surgery. Prenat Diagn 2009;29(5):457–63.
17. Derderian SC, Iqbal CW, Goldstein R, Lee H, Hirose S. Fetoscopic approach to amniotic band syndrome. J Pediatr Surg 2014;49(2):359–62.
18. Nardoza LMM, Araujo Júnior E, Caetano ACR, Moron AF. Prenatal diagnosis of amniotic band syndrome in the third trimester of pregnancy using 3D ultrasound. J Clin Imaging Sci 2012;2:22.

\*\*\*\*\*

## Acknowledgments

We always grateful for the mentorship of Dr. Gonzalez-Brown and Dr. Villazana-Kretzer.

## Author Contributions

Meghan Kathleen Munisteri – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Veronica Gonzalez-Brown – Design of the work, Analysis of data, Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all

aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Diana Villazana-Kretzer – Acquisition of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

## Guarantor of Submission

The corresponding author is the guarantor of submission.

## Source of Support

None.

## Consent Statement

Written informed consent was obtained from the patient for publication of this article.

## Conflict of Interest

Authors declare no conflict of interest.

## Data Availability

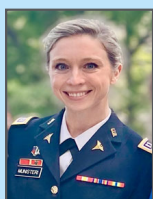
All relevant data are within the paper and its Supporting Information files.

## Copyright

© 2022 Meghan Kathleen Munisteri et al. This article is distributed under the terms of Creative Commons Attribution License which permits unrestricted use, distribution and reproduction in any medium provided the original author(s) and original publisher are properly credited. Please see the copyright policy on the journal website for more information.

## ABOUT THE AUTHORS

**Article citation:** Munisteri MK, Gonzalez-Brown V, Villazana-Kretzer D. Amniotic band syndrome: A case series. J Case Rep Images Obstet Gynecol 2022;8(1):33–38.



**Meghan K Munisteri** is Chief Resident in Obstetrics and Gynecology at Brooke Army Medical Center, San Antonio, Texas, USA. She earned the undergraduate degree of Bachelor of Sciences from The State University of New York at Geneseo. She commissioned as an officer in the United States Army and achieved a postgraduate degree Doctor of Osteopathic Medicine from Lake Erie College of Osteopathic Medicine. She has published research papers in national and international academic journals in the fields of maternal trauma, alloimmunization, and graduate medical education. Her research interests include graduate surgical education, resident wellness, and complicated obstetrics. She intends to pursue Maternal Fetal Medicine in future.  
Email: megmunisteri@gmail.com

Access full text article on  
other devices



Access PDF of article on  
other devices





INTERNATIONAL JOURNAL OF  
CASE REPORTS AND IMAGES



VIDEO JOURNAL OF  
CLINICAL RESEARCH



VIDEO JOURNAL OF  
BIOMEDICAL SCIENCE



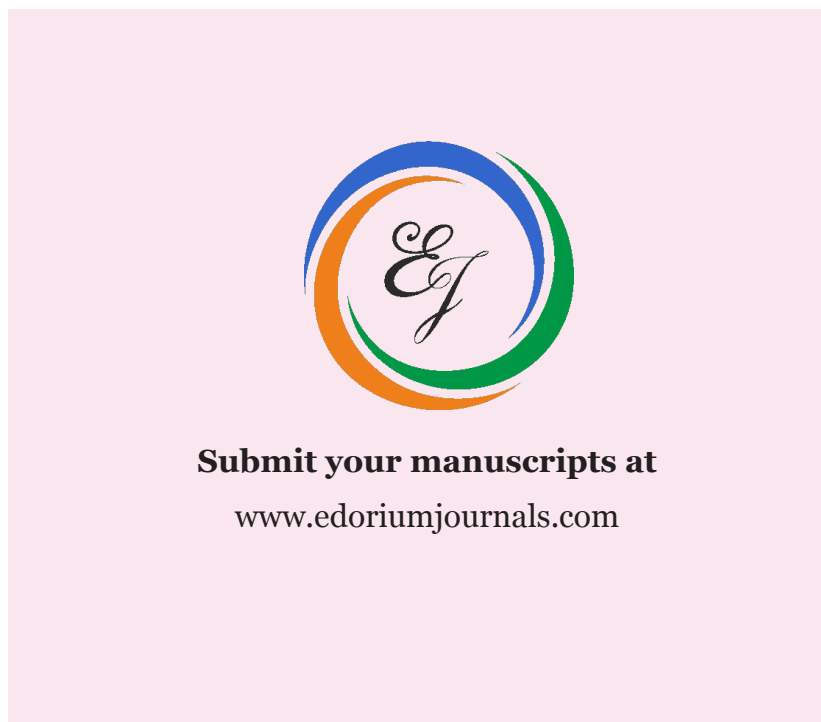
INTERNATIONAL JOURNAL OF  
HEPATOBIILIARY AND  
PANCREATIC DISEASES



INTERNATIONAL JOURNAL OF  
BLOOD TRANSFUSION AND  
IMMUNOHEMATOLOGY



EDORIUM JOURNAL OF  
OPHTHALMOLOGY



EDORIUM JOURNAL OF  
MEDICINE



EDORIUM JOURNAL OF  
CARDIOTHORACIC AND  
VASCULAR SURGERY



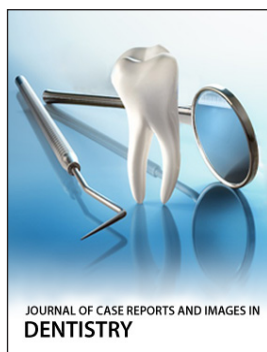
JOURNAL OF CASE REPORTS  
AND IMAGES IN ORTHOPEDICS  
AND RHEUMATOLOGY



EDORIUM JOURNAL OF  
PSYCHOLOGY



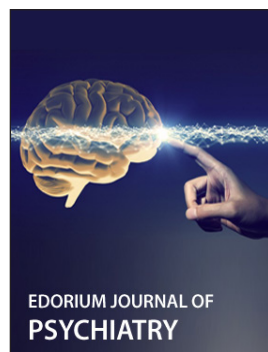
EDORIUM JOURNAL OF  
CELL BIOLOGY



JOURNAL OF CASE REPORTS AND IMAGES IN  
DENTISTRY



EDORIUM JOURNAL OF  
CANCER



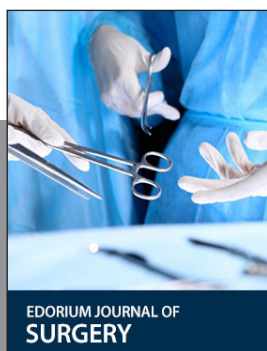
EDORIUM JOURNAL OF  
PSYCHIATRY



JOURNAL OF CASE REPORTS AND  
IMAGES IN INFECTIOUS DISEASES



EDORIUM JOURNAL OF  
ANATOMY AND EMBRYOLOGY



EDORIUM JOURNAL OF  
SURGERY



JOURNAL OF CASE REPORTS  
AND IMAGES IN PATHOLOGY



EDORIUM JOURNAL OF  
ANESTHESIA