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## Overview

### Abstract

In this presentation, we describe the first known case study of a multi-organ congenital malformation disorder, Vertebral Defects, Anal Atresia, Tracheo-Esophageal Fistula/ Atresia, Renal and Limb Anomalies (VACTERL) Syndrome, occurring in a newborn with prolonged in-utero exposure to opioids. This case heralds the consideration that opioids may be a contributing or a causal factor in VACTERL. The potential public health implications are compelling considering the current opioid epidemic in the United States. Possible future ramifications that such a proposed association could have for public health in the areas of practice, research, and policy development are remarkable. Opportunities exist for improved education, screening, research, access to substance abuse treatment, expansion of public health policy, and advocacy efforts.

## Introduction

### Definition of VACTERL

VACTERL association/ syndrome is the random co-occurrence of vertebral, cardiac, tracheal/ gastrointestinal (GI), genitourinary (GU), and limb malformations.

First described in the early 1970's; Estimated frequency ranges from 1 in 10,000 to 1 in 40,000 infants.

Has not been adequately explained from a causation or embryogenesis standpoint.

Multiple embryological processes are interrupted in VACTERL including:

- Abnormal segmentation of vertebrae
- Mal-migration of tissues in GI tract and trachea;
- Failure to develop skeleton in limbs
- Abnormal development of kidneys
- Incomplete development of cardiac septi in common cardiac abnormalities

Babies diagnosed as having VACTERL association usually have at least three or more of these individual anomalies.

## Case Study

**Case Study Summary:** The patient was a premature infant born at 36 weeks, via Non-Spontaneous Vaginal Delivery (NSVD) (pronouns: they, them, theirs) with concomitant Neonatal Abstinence Syndrome (NAS) and VACTERL association.

**Chief Complaint:** The infant was born prematurely, via NSVD, with a maternal history of no prenatal care, chronic opioid (OD) use and viral hepatitis, and Intrauterine Growth Retardation (IUGR), who presents with NAS and irregular fecal voiding at birth.

**Presentation:** The infant presented to the Neonatal Intensive Care Unit (NICU) shortly after birth with irritability, sleep difficulty, high-pitched crying, tight muscle tone, yawning, sneezing, and other symptoms and signs of NAS. The patient was monitored and given treatment for NAS and prophylactic seizure medications.

**NICU and Hospitalizations:** During the patient's NICU stay, their physical exam also revealed significant findings including a heart murmur, anal dimpling, and irregular fecal voiding. Diagnostic workup ensued and it was discovered that the infant had both an imperforate anus and a rectoperineal fistula. The infant also underwent cardiac echocardiogram, kidney ultrasounds, and an Magnetic Resonance Imaging (MRI) of the spine was diagnosed with a Patent Foramen Ovale (PFO), Hyperechogenic Kidneys/ Medical Renal Disease, and a Tethered Spinal Cord. The infant underwent a successful Posterior Sagittal Anorectoplasty and Surgical Laminectomy and was eventually discharged from the NICU. The patient also experienced spontaneous resolution of the PFO and renal disease. The patient viral hepatitis profiles were negative at 24 months.

**Family History:** With respect to the infant's family history, there was no known history of familial/hereditary, or genetic diseases. No known family history of Diabetes Mellitus (DM) or personal maternal history of DM was noted. In addition there were no known significant or chronic maternal- fetal exposures to retinoic acid, anti-cancer agents, or teratogens during pregnancy other than the chronic exposures to OD drugs and viral hepatitis.

## Epidemiological Review

### Causes of VACTERL are Unknown

Potential Causes = Genetic, Familial, Environmental agents/ Teratogens. Genetic mutations in several different single genes have been seen in VACTERL cases; but often they have other features which distinguish themselves from VACTERL.

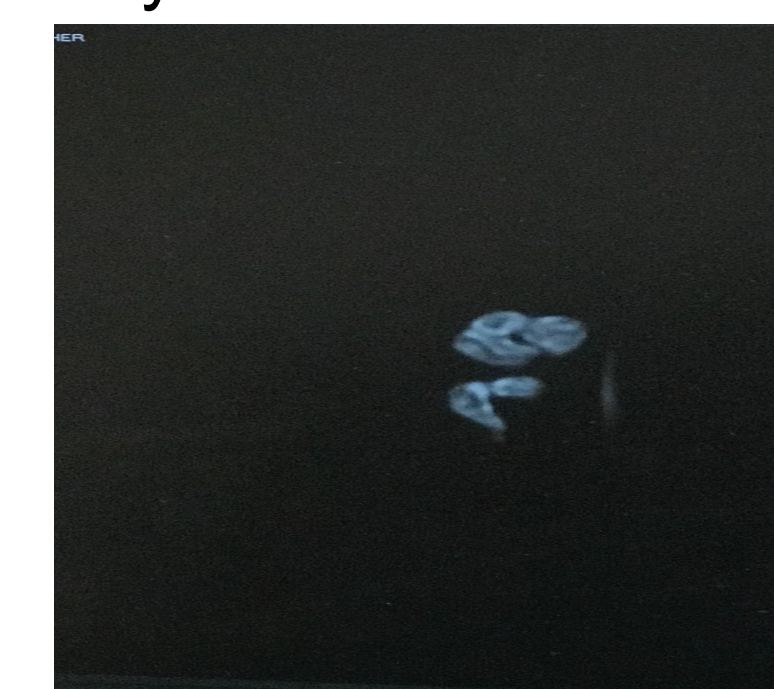
Potential environmental agents in VACTERL would involve chronic exposure during the first trimester – (various malformations develop at different periods embryologically). Cases of VACTERL are observed in infants with gestational exposures to DM, Thalidomide, Retinoic Acid, and other drugs such as anti-cancer agents.

This case report heralds one of the first known patients with chronic OD exposure as a hypothesized contributing or causal factor for VACTERL.

### The Current OD Epidemic

In 2017, the US Department of Health and Human Services declared the current OD epidemic to be a Public Health Emergency. In 2018, 10.3 million people abused opioids and 47,600 died from OD overdose.

A significant increase in Maternal OD use in pregnancy has resulted in dramatic increases in NAS. In 2014, there were 320,000 babies born with NAS, a 10-fold increase in the past 10 years. NAS can cause long and very costly hospital stays.



MRI of the Spine: Revealed a low position of the conus medullaris



MRI of Spine: Low position of conus medullaris extending to L3 vertebral body level.

## Conclusions

### Public Health Practice Recommendations

Recommends the medical and public health research communities fund and perform future research to further analyze potential clinical associations between (Maternal Substance Abuse) MSA/OD use during pregnancy and VACTERL.

Urges Public Health (PH) and PH Policy education programs to prioritize and implement evidence-based (EB) community and provider trainings on MSA/OD use, and enhanced medical care, screening, treatment, and overdose prevention for pregnant women with MSA/OD use.

Urges federal and state legislators to prioritize resources for development and continued support of EB MSA/OD use treatment programs, EB MSA/OD use pregnancy health care programs, and supportive counselling.

Encourages state governments leverage resources that may be available through the Affordable Care Act towards EB community-based drug treatment, harm reduction, and medical / mental health services for pregnant women with MSA/OD use.

## References

For more information on references:

<http://jclarkvacterl.weebly.com>

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## Acknowledgements

I would like to thank R.E. Clark, H.B. LoCascio, and M. LoCascio for their ongoing support.