

VACTERL Association

VACTERL association is a term applied to a specific group of abnormalities involving structures derived from the mesoderm. Although the defects of this disorder are clearly linked, VACTERL is called an association rather than a syndrome because the exact genetic cause is unknown. "VACTERL" is an acronym, each letter standing for one of the defects associated with the condition: V for vertebral anomalies, A for anal atresia, C for cardiovascular anomalies, T for tracheoesophageal fistula, E for esophageal atresia, R for renal anomalies, and L for limb defects. In order to be classified as having this association, an individual must exhibit at least three of the seven aforementioned phenotypes. Because of this, individuals affected with VACTERL are usually vastly different from one another.

Historically, VACTERL was known as VATER and did not include cardiovascular or limb defects within the range of the disorder. However, due to significant research and case studies these defects have been included in the association. The name VATER was originally used in 1972 by David Smith, considered the father of dysmorphology, and Linda Quan, an emergency room physician, to describe babies born with seemingly related multiple defects.

Vertebral anomalies (V) such as hypoplastic (small) vertebrae or hemivertebrae (wedge shaped) are seen in VACTERL patients. These types of vertebrae may lead to instability, pain, or other conditions such as scoliosis, lordosis, and kyphosis. According to the Cincinnati Children's Hospital Medical Center, 70% of VACTERL cases involve a patient with vertebral anomalies. These individuals may also have rib or limb anomalies that are directly related to the affected vertebra. Spinal problems that arise from this condition may require physical therapy, external back supports, or in severe cases, surgery.

Anal atresia (A) is a defect in which the opening to the anus is closed off, misplaced, or absent. Atresia can manifest in several different forms; the rectum may end in a pouch that does not connect with the colon or it may connect with another internal organ such as the urethra, bladder, penis in males, or vagina in females. Because of this, an individual affected with anal atresia must be checked for other problems, especially those related to the genitals, urinary tract, and spine. Fifty-five percent of VACTERL patients have anal atresia (Cincinnati), requiring surgery within the first days of life and in many cases a temporary colostomy. If the rectum connects to another internal structure, surgery to repair that organ may also be necessary.

Cardiovascular anomalies (C) associated with VACTERL include, but are not limited to, congenital heart disease, ventricular septal defects (VSD), atrial septal defects (ASD), truncus arteriosus, transposition of arteries, and teratology of Fallot. Because heart defects are not obvious at birth, an infant born with any of the other related symptoms must be given an echocardiogram to examine the heart's condition. In seventy-five percent of VACTERL cases, the individual has some type of cardiovascular anomaly noted (Cincinnati).

Tracheoesophageal fistula (T) and esophageal atresia (E) are defects of the digestive system in which the esophagus, the organ that carries food and nutrients from the mouth to the stomach, does not properly develop. In tracheoesophageal fistula, the top of the esophagus connects to the trachea (windpipe), whereas in esophageal atresia, the upper esophagus is closed off and does not connect with the lower esophagus and stomach. Seventy percent of individuals with VACTERL are born with either tracheoesophageal fistula or esophageal atresia (Cincinnati). These defects can lead to the breathing in of saliva or secretions into the lungs causing pneumonia, choking, and even death. Both conditions require immediate surgery after birth to ensure that the infant is able to feed and that there is no damage to the lungs.

Renal anomalies (R), including kidney and urological problems, are associated with VACTERL. Kidneys are responsible for producing urine, and in the womb urine is essential for amniotic fluid production. Amniotic fluid is vital for limb and lung development, both of which become affected if the kidneys are absent, a condition known as bilateral renal agenesis. Unilateral renal agenesis is a disorder in which one of the kidneys fails to form. An individual with one kidney is still considered healthy so long as the intact kidney carries out normal function. VACTERL patients may also have hypoplastic (small) or dysplastic (faulty) kidneys, a condition that may require dialysis and/or transplantation. Another renal defect associated with VACTERL is horseshoe kidney, in which the lower regions of the two kidneys are fused. Horseshoe kidney does not usually cause any problems but it can be associated with vesicoureteric reflux (in which urine flows backwards from the bladder). The kidneys may also form on the same side of the body in a condition known as crossed renal ectopia. Cystic dysplastic kidney (not to be confused with polycystic kidney) is a condition in which the kidney contains cystic structures such as cartilage. Renal anomalies are noted in 50% of individuals with VACTERL (Cincinnati). Fortunately, many of these conditions are not life threatening and require no surgery; only in severe cases is a kidney transplant necessary.

Limb defects (L) such as absent or displaced thumbs, polydactyly (extra digits), syndactyly (fusion of digits), and radial aplasia are common in VACTERL patients. In radial aplasia, the most severe of these defects, the radius bone fails to form. Without a radius, the forearm is extremely small and deformed, or it appears as though the hand is directly connected to the upper arm. Limb defects are usually found directly related to renal defects; for instance, if an individual is affected with radial aplasia on their right side, they will most likely have kidney defects on the right side as well.

VACTERL association includes numerous severe birth defects, all of which can independently and negatively affect an individual's life. The birth prevalence for this nonrandom association of birth defects ranges from 1:3,500 to 1:6,250 and the condition is rarely seen more than once in a family. Infants born with VACTERL are usually small and have trouble gaining weight. The condition is also associated with hydrocephalus (water on the brain), cleft palate, and agenesis of the corpus callosum. Some research suggests that the incidence increases with diabetic mothers, that it is X-linked, or that it is an autosomal recessive disorder. In 2009, Charles Shaw-Smith, a clinical geneticist, researched several transcription factors that he hypothesized were linked to VACTERL. His study suggested that FOXF1 and 16q24.1 play significant roles in the development of VACTERL.

Sources

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