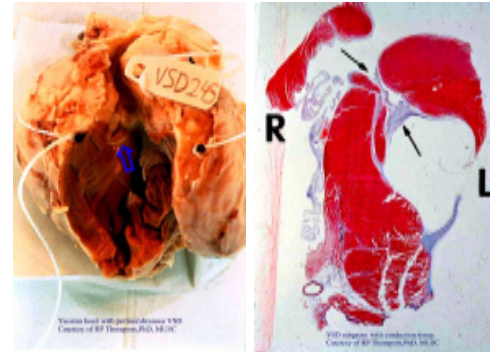


By selective breeding techniques a heritable ventricular septal defect (VSD) has been produced in Yucatan miniature swine which can be utilized as an animal model of the condition in humans. The model shares many important similarities to human VSD.¹⁻⁵

Anatomy/Pathology

Most of the defects are located in the membranous septum below the crista supraventricularis.² In a study of 15 consecutive litters, VSD was diagnosed in 57/81 neonates. In descending order of incidence the defects were classified as perimembranous (approximately 65%), muscular, and doubly committed juxtaarterial types.⁴ Perimembranous defects have an area of fibrous continuity between the leaflets of the aortic, tricuspid and mitral valves.⁴ (See figures right)



Photos courtesy of RP Thompson, PhD, MUSC

Clinical History

Pedigree analysis indicates that the defect is probably polygenic.¹

Animals born with VSD can be diagnosed by auscultation of a typical mid to holosystolic murmur best auscultated over the 4th to 5th intercostal space near the sternal border. Animals with significant left to right shunts can develop pulmonary hypertension with respiratory distress and histological changes in the pulmonary vasculature.¹ Some animals will die with symptoms of acute respiratory distress if untreated. Smaller defects may close spontaneously. A failure to thrive syndrome associated with the defect has been described.⁵

Hemodynamics/Angiography/Echocardiography

Affected swine have been studied by angiography, echocardiography and cardiac catheterization techniques.¹⁻⁵ Left to right shunts are consistently demonstrated and a subset of the animals develop pulmonary hypertension over time. Some animals develop a failure to thrive syndrome associated with reduced stroke volume due to failure of end-diastolic volume to increase adequately. The same pathogenesis was found in a clinical trial which compared the Yucatan VSD with the human condition.⁵ The defect may be diagnosed with echocardiography either in utero or postnatally.³

Research uses

The VSD model may be useful in preclinical treatment applications, including diagnosis and treatment of the condition in the fetus or closure of the defect with interventional catheter devices.⁶ Other applications may include the study of environmental and genetic interactions with the occurrence of the defect as well as studies that require manipulation of cardiac function. Technical aspects of anesthetizing and working with the animals have been published.⁶

Selected References

- Swindle MM, Thompson RP, Carabello BA, et al.: Heritable ventricular septal defect in Yucatan miniature swine. *Lab Anim Sci* 40: 155-161, 1990.
- Swindle MM, Thompson RP, Carabello BA, Smith AC, Green CT, Gillette PC: Congenital cardiovascular disease, in Swindle MM (ed), *Swine as Models in Biomedical Research*, Ames, IA: Iowa State University Press, 176-184, 1992.
- Johnson TB, Fyfe DA, Thompson RP, Kline CH, Swindle MM, Anderson RH: Echocardiographic and anatomic correlation of ventricular septal defect morphology in newborn Yucatan pigs. *Am Ht J* 125: 1067-1072, 1992.
- Ho SY, Thompson RP, Gibbs SR, Swindle MM, Anderson RH: Ventricular septal defects in a family of Yucatan miniature pigs. *Intl J Cardiol* 33: 9-426, 1991.
- Corin WJ, Swindle MM, Spann JF Jr, et al.: Mechanism of decreased forward stroke volume in children and swine with ventricular septal defect and failure to thrive. *J Clin Invest* 82: 544-551, 1988.
- Swindle MM: *Surgery, Anesthesia and Experimental Techniques in Swine*. Ames, IA: Iowa State University Press, 1998.