MITRALSEAL: HYBRID TRANSCATHETER MITRAL VALVE REPLACEMENT
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Key Points
- MitralSeal is a hybrid surgical-transcatheter mitral valve replacement system
- MitralSeal prosthesis is self-expanding bioprosthesis with an atrial cuff and a ventricular tether anchoring system
- MitralSeal is deployed into a beating heart through the ventricular apex under fluoroscopic and transesophageal echocardiographic guidance

Degenerative mitral valve disease is the most important heart disease in dogs accounting for approximately 75% of heart disease in this species. Approximately 5 to 7 million dogs in the USA are affected by mitral valve disease. Currently the only effective treatment is open valve repair or replacement under cardiopulmonary bypass. This procedure is expensive and only available at a few centers. MitralSeal is a new catheter-deployed mitral valve prosthesis being developed specifically for dogs. The prosthesis is deployed into a beating heart through the left ventricular apex under fluoroscopic and transesophageal echocardiographic (TEE) guidance (Figure 1). The prosthesis is a self-expanding bioprosthesis with an atrial cuff and tethers on the ventricular side to secure the prosthesis to the ventricular apex (Figure 2). Access to the left ventricular apex is gained through a small (minimally-invasive) left thoracotomy. Thus the procedure is considered a hybrid surgical-transcatheter procedure requiring the skill sets of veterinary cardiologist and veterinary surgeon.

The procedure is performed under general anesthesia. A CRI of heparin is started 90 min before surgery with a goal of increasing the aPTT to 1.5 normal. The dog is placed in right lateral recumbency for surgery. A small left thoracotomy (5 to 6 cm) in performed in the 6th intercostal space close to the sternum. The pericardium is opened to expose the left ventricular apex and sutured to the thoracotomy. Two controlling pledget-buttressed mattress sutures are placed in the left ventricular apex and passed through Rommel tourniquets. An introducer needle is passed into the left ventricle at the proposed cardiology site. A guidewire is introduced into the left ventricle through the introducer needle and passed across the mitral annulus. The cardiology site is progressively dilated with obturators. The deployment catheter (20 Fr) is introduced in the left ventricle via the cardiology site and passed across the mitral annulus along the guidewire under fluoroscopic guidance (Figure 3). The prosthesis is “back-loaded” into the deployment catheter and pushed into the tip of the catheter with an obturator. The prosthesis is deployed into the left atrium and positioned into the mitral annulus using the tethers attached to the prosthesis. The deployment catheter is removed “externalizing” the tethers to the outside of the heart. The tethers are genitally tensioned under TEE guidance to anchor the prosthesis and minimize perivalvular leak. The cardiotomy is closed by tying the controlling buttressed mattress sutures. The tethers are tied over a pledget on the outside of the heart to secure the prosthesis. A thoracostomy tube is placed and the thoracotomy is closed. Heparin anticoagulation is continued after surgery until oral anticoagulation therapy is established. Oral anticoagulation therapy with targeted warfarin (INR 2 – 3) or dabigatran (direct thrombin inhibitor) is continued for 3 months.
Figure 1: Transapical deployment of MitralSeal prosthesis

Figure 2: MitralSeal prosthesis

Figure 3: Deployment of MitralSeal under fluoroscopic guidance