



**Supplementary fig 1:** Surgical procedure of mitral regurgitation model

a. Left anterolateral thoracic incision to expose left atrial appendage; b. Measurement of left atrial pressure before operation. The arrow indicates piezometric pipe. c. Epicardial ultrasound monitoring with esophageal ultrasound probe; d. Cutting operation of mitral chordae tendineae; e. Intraoperative display of atrial and ventricular pressure waves; f, Experimental animal after operation.