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Etiology of patient-prosthesis mismatch in aortic valve surgery

Mano Thubrikar[1], Mahua Ghosh[2], Brett Fowler[3], Robert Gordon[4], Francis Robicsek[3]
[1]South Dakota School of Mines & Technology, Rapid City, SD, United States, [2]University of Saskatchewan, Saskatoon, Saskatchewan, Canada, [3]Heineman Medical Research Laboratory, Charlotte, NC, United States, [4]Heart Doctors, Rapid City, SD, United States

Objectives:
Etiology of patient-prosthesis mismatch was investigated in porcine hearts arrested by different methods.

Method:
94 porcine hearts, where pigs were killed by either a bullet shot in the head followed by volume depletion (V) or electrocution (E) were studied. The hearts were weighed and aortic annulus (Ann) and sinotubular junction (STJ) measured. In 16 human aortic roots, Ann and STJ were measured and age noted.

Results:
In porcine, Ann and STJ, respectively, were 18 – 28 mm and 17 – 27 mm in V group, and 16 – 23 mm and 18 – 25 mm in E group. STJ, unlike Ann, increased with heart weight in both groups. In V group, Ann was greater than STJ (Ann – STJ = 1.29 mm). In E group, it was greater, equal, or smaller than STJ (Ann – STJ = -0.85 mm). The difference (Ann-STJ) in the two groups was significant ($p < 0.0005$). In E group (Ann – STJ) was +2 to -3 mm. In humans (13 – 55 yrs), Ann was 18 – 28 mm, STJ 16 – 27 mm, and (Ann-STJ) 1.4mm.

Conclusions:
In volume depletion, the heart stops on its own in diastole, producing a dilated annulus, while in electrocution, it stops randomly during a cardiac cycle, producing a contracted or dilated annulus. During the valve surgery, the heart is stopped randomly by cardioplegia. If the heart stopped in systole, then the valve size measured would be small. Thus, stopping the heart in systole could be the most probable cause of patient- prosthesis mismatch.