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# LEFT VENTRICULAR SIZE FOLLOWING SHUNT OPERATION IN TETRALOGY OF FALLOT*

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**SUMMARY: Özkutlu S, Saraçlar M, Öztunç F, Bozer AY, Özme Ş. (Cardiology Unit, Department of Pediatrics and the Department of Cardiovascular and Thoracic Surgery, Hacettepe University Faculty of Medicine, Ankara, Turkey). Left ventricular size following shunt operation in tetralogy of Fallot. Turk J Pediatr 1995; 37: 1-5.**

**This study was performed in 24 patients with tetralogy of Fallot in whom shunt operation was performed instead of total correction because of small left ventricular end-diastolic dimension. Left ventricular end-diastolic dimension was measured using M-mode and two-dimensional echocardiography pre-and at least one year postoperatively.**

**There was no change in the postoperative left ventricular size in two patients. However, in the other 22 patients, the left ventricular dimension was increased to 70 to 103 percent of normal left ventricular size.**

**According to the findings of this study, we can conclude that the patients in whom shunt operation was performed would most likely have an increased left ventricular size over time.** *Key words: echocardiography, left ventricular size, tetralogy of Fallot, shunt procedure.*

In tetralogy of Fallot (TOF) it has been demonstrated that the left ventricle is smaller in size than normal, and it is believed that a small left ventricle indicates a somewhat greater risk for complete repair[1-8]. Some centers consider this to be an indicator for a shunt operation rather than open-heart repair, with the expectation being that the resulting increase in pulmonary venous return will improve the capacity of the left heart over time[1-13].

Studies have been performed to evaluate the left ventricular size that might affect the operative mortality in TOF[6-8,12,14,15]. There are, however, only a few reports of increase in left ventricular size after shunt operation[10,15].

In order to evaluate the effect of shunt operation on the left ventricular size preoperatively and at least one year postoperatively, echo-cardiographic measurements were obtained.

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## Material and Methods

This study was performed on 24 patients with TOF in whom shunt operation was applied because their left ventricular end-diastolic dimension was small (less than 66 percent of normal). Eleven of the patients were female and 13 were male. Their ages ranged from six months to seven years (mean three years eight months).

Echocardiography was performed in all of the cases. A Toshiba Sonolayer-S SSH 60 echocardiograph with 3.75 and 5 mHz transducers was used. Additionally, cardiac catheterization was performed in 16 patients.

The left ventricular end-diastolic dimensions were measured on M-mode echocardiographic recordings obtained in the standard two-dimensional cursor position.

Evaluation was made from the septal surface to the posterior wall endocardium of the left ventricle at the time of ventricular depolarization as indicated by the Q or R wave of the simultaneous electrocardiogram. Measurements were obtained in at least three cardiac cycles, and their mean values were compared with the normal values of left ventricular end diastolic dimensions determined by Gutgesell and Paguet[16].

## Results

Pre-and postoperative left ventricular end-diastolic dimension, the percentage comparison with the normal, and the time interval between the date of the operation and the postoperative echocardiographic evaluation are shown in Fig. 1.

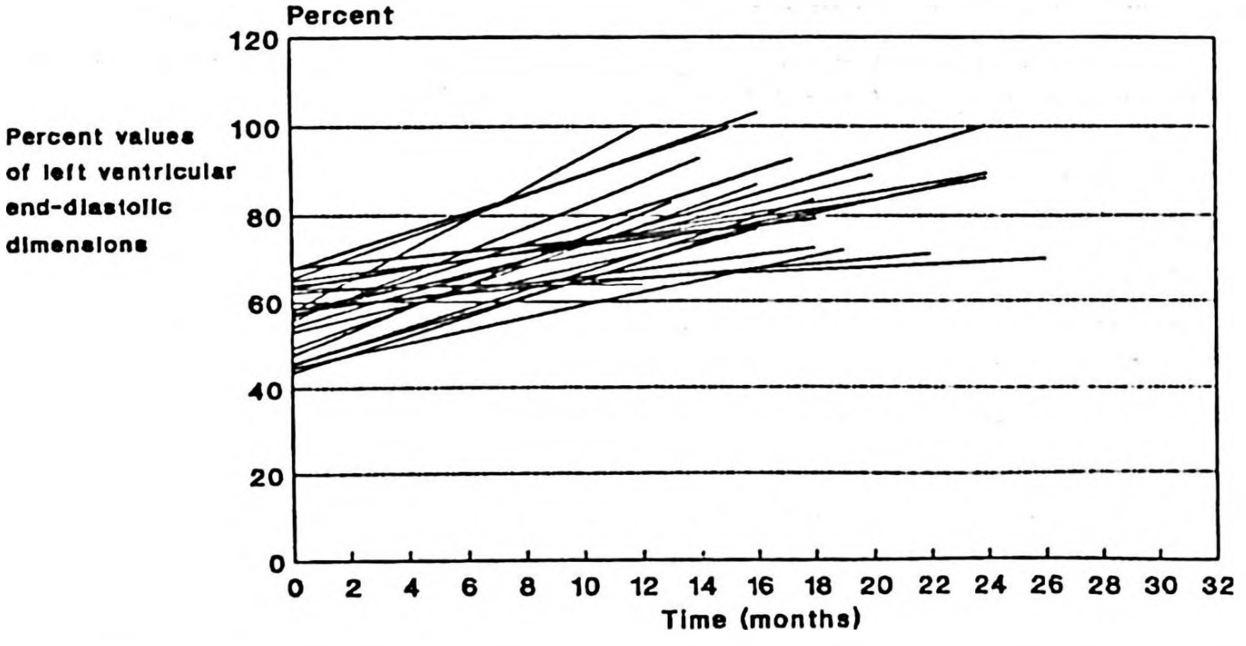


Fig. 1: Percent values of the left ventricular end-diastolic dimensions obtained by the comparison between those of normal and patients; and their changes following shunt operation are shown.

The left ventricular end-diastolic dimension did not change in two patients. However it increased (8%-45%) in 22 patients.

Seventeen of the 24 patients underwent total correction. In no cases were early postoperative death or low cardiac output syndrome observed.

When anlayzed by using paired sample t test, the difference between pairs of observations was found to be statistically significant ($P < 0.05$).

## Discussion

The presence of a decreased left ventricular end-diastolic volume has been reported in patients with TOF both in cineangiographic and echocardiographic studies and anatomical specimens[1-6]. Although some authors[17,18] have reported that a small-sized left ventricle is not associated with surgical mortality, this theory has not been accepted by most others[1-14].

Graham et al. proposed that the shunt operation be carried out on cases whose angiographic left ventricular volume was less than 55 percent of the normal[7,8].

Oberhansli and Friedli[15] recorded that young children with severe left ventricular hypoplasia have a higher corrective surgery mortality. They proposed that a left ventricular size of at least 65 percent of normal measured by M-mode technique would be a criterion for successful total correction[15]. Miller et al.[4] found that left ventricular size was about 70 percent of normal in most of their cases. However, they noticed that if the size is less than 60 percent of normal, the case would be severe.

Naito et al.[11] recommended that in cases with an end-diastolic volume index of less than 30 ml/m$^2$, palliation by the systemic to pulmonary arterial shunt procedure is indicated. Setsuie et al.[14] suggested an initial shunt procedure in patients with an end-diastolic volume index of less than 40 ml/m$^2$. Nomoto et al.[12] reported that a left ventricular end-diastolic volume of 60 percent of the normal values is a safety limit for total correction in patients under two years of age.

According to our previous study in which left ventricular size was measured by M-mode echocardiography, 70 percent of the cases whose dimensions were less than 66 percent of normal died following total correction due to left heart failure[6]. Given these results, we suggested that the limit line for the left ventricular dimension be 66 percent of the normal values for the decision of corrective surgery, or shunt operation[6]. After this criterion was incorporated in our institution, 24 patients whose left ventricular end-diastolic dimension was below 66 percent of normal underwent shunt operation, and their left ventricular end-diastolic dimensions were measured one to two years (mean 18.4 months) after surgery.

Among the echocardiographic methods, M-mode measurement of left ventricular end-diastolic dimension on two-dimensional image of parasternal long-axis view was arbitrarily preferred in our study since it has been accepted to be simple and reproduceable[15,19].

All patients, excluding two whose left ventricular end-diastolic dimension did not increase displayed significant development in left ventricular size following shunt operation. This enabled the patients to have total correction more safely.

Oberhansli and Friedli[15] showed in five patients who had undergone a previous palliative procedure before total correction, that left ventricular dimensions approached or exceeded normal values (range 81 to 105 percent). Jarmakani et al[10], reported that preoperative left ventricular end-diastolic volume was less than normal in cyanotic children more than two years of age. This variable increased significantly after either a functioning shunt procedure or complete correction. In eight patients who had undergone a shunt procedure, while the preoperative left ventricular end-diastolic dimension was 95 ± 13 percent of normal, postoperatively these values reached 144 ± 12%[10]. In our study, although left ventricular end- diastolic dimensions were between 70 and 103 percent of normal (mean 28.7%) in 22 patients, in the remaining two cases the values did not change one year after surgery.

Kirklin et al.[18] and Malm et al.[17] concluded that the left ventricle would not be small if the patients were over four or five years of age. Contrary to these reports, in our previous study, 13 patients who died after total correction operation and whose ventricular end-diastolic dimensions were below the 66 percent limit line, ranged in age from three to 16 years. In addition, in the present study the age of seven patients was above four years. Those findings do not support Kirklin[18] and Malm[17]'s report. Furthermore, data obtained from our three and seven-year-old patients whose left ventricular end-diastolic dimension did not show any increase following shunt operation over time is against their belief.

In conclusion, we can suggest shunt operation in patients with a small left ventricle. Thus, left ventricular size is expected to be enlarged over time to enable an increased chance for total correction.

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