Mortality Abstract

Valve Repair for Mitral Insufficiency Without Stenosis

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References: (1) JW Kirklin, "Mitral Valve Repair for Mitral Incompetence." Mod Concepts of CV Dis, 56:7-11 (Feb. 1987).
(2) ALIMDA and Society of Actuaries, "Medical Risks 1987: Analysis of Mortality and Survival." In final preparation (1988).

Subjects Studied: A series of 210 patients diagnosed at the Medical Center of the University of Alabama at Birmingham, 1967-1985 as having mitral insufficiency without stenosis, and treated by surgical repair of the mitral valve (MVR) instead of mitral valve replacement. The largest group in the series consisted of 86 patients with isolated MVR, although a few of these also had tricuspid valve annuloplasty. The remaining patients had associated cardiac surgery: 63 patients with coronary bypass (CBPS); 31 patients with aortic valve replacement (AVR); 27 patients with repair of a congenital cardiac defect; two patients with pericardiectomy and one with removal of a myxoma. A long list of causes of the mitral insufficiency is given in reference 1. The insufficiency was considered as rheumatic in origin in only 26 patients; prolapse ascribed to myxomatous degeneration was found in 27 patients and isolated rupture of chordae in 39; "important" coronary artery disease was found in 39 patients, and insufficiency was ascribed to ischemic disease in 25 additional ones. Functionally, however, all patients were demonstrated to have mitral insufficiency without stenosis. Two additional series were reported for the period 1975-1983: 101 patients with MVR, and 389 with mitral valve replacement (survival curves in Figure 3).

Limitations of Study: No data for age and sex distribution were given for the total series or any of the subgroups. The usual socioeconomic and geographical limitations that pertain to patients referred to a tertiary care medical center.

Follow-up: The survival curve for the total series was carried to a maximum of 13 years (17 survivors at that duration), with no mention of methods used or cases lost to follow-up. Maximum follow-up of 5 or 8 years was reported for the two series started in 1975.

Results: Early mortality was defined as deaths prior to hospital discharge (HD). The average duration of hospitalization was not given, but has been assumed to be 3 weeks or 0.06 year. Overall perioperative mortality prior to HD was 6.7%, and appears from the survival curves to have been considerably lower than the early mortality in the patients subjected to mitral valve replacement (no tabular data given). As shown in Table A, the group of MVR patients with the lowest mortality rate of 3.7% consisted of those with isolated MVR, with or without tricuspid annuloplasty. The highest perioperative rate of 11.1% was experienced in the group with associated CBPS, and the rate was nearly as high when the associated surgery was aortic valve replacement.

Despite the complete lack of age/sex information, the author has provided an expected survival curve based on "an age-sex-race-matched general population," but the source tables are not cited. From this curve it has been possible to derive and graduate expected annual rates, q' or $\bar{q}'$, as shown in Table B. Although the derivation is reasonably accurate for the first year, the reader should be cautioned that the annual increase of about 8% per year in q' may be much too high as compared with an increase of about 1% per year found for q', all ages combined, from data by age group and sex for a series of patients with mitral valve replacement in one of the abstracts in reference 2. The matching appears to have been done only for the entry-year distribution of patients by age, sex and race, not for the distribution of survivors at each year of follow-up. Although each survivor does have an advance of one full year in attained age with each year of elapsed duration, this is not true of the mean age, because mortality rates are consistently much higher at the older ages, with resultant flattening of the mean age and the mean q' duration curves. Values of q' as derived from the survival curve have been used in the table, but q' would be smaller at durations beyond the first year or two, and both Mortality Ratio and EDR would be proportionately larger than the results in the table.

Another methodological feature of Table B is reconstruction of annual life table data to 10 years from biennial data on the survival graph (Figure 1 of the article) for distribution of the 52 late deaths, and the number of patients entering each biennium alive. This reconstruction, despite some random error, provides more detailed and more accurate results than it is possible to derive from geometric mean rates by estimate of the survival rate, P, at various durations on the observed survival curve. Tabular values of E, d, and d′ may therefore be regarded as close approximations to the actual observed and calculated values. Comparative experience as given in the table indicates highest excess mortality in the first year after discharge from the hospital, with an EDR of 72 extra deaths per 1000 per year, and a Mortality Ratio of 760%. EDR reached a minimum of 17 per 1000 per year at duration 3-5 years, but rose to 27 per 1000 as mean annual rate over the last 5 years shown in the table. The Mortality Ratio of 255% at durations 5-10 years would be about 360% if the annual q' had increased only to 12 per 1000, as I have reason to believe (see above).

From Figure 2 of the article I have thought it wiser to fall back on the 5-year survival rates (*most are given in the text*), to obtain the interval survival rate from HD to 5 years by dividing P by the discharge survival rate, P_O (Table A), and then to derive the geometric mean annual $\check{q}'$. This is a straightforward and reasonably accurate derivation. However, it would, on the basis of data in valve replacement series described in reference 2, be inaccurate to assume the same $\check{q}'$ for each group, as previously derived for the total series. The latter $\check{q}'$ has therefore been adjusted for an assumed age difference compatible with the age difference found in other series of patients with prosthetic replacement of a diseased mitral valve. Such crude approximations of 5-year late mortality by associated surgery group indicate the most favorable mortality in the isolated EDR group, with an EDR of 14 per 1000 per year; the highest EDR, 82 per 1000 per year, was found in the patient group in which aortic valve replacement was carried out in addition to MVR. However crude the actual Mortality Ratio and EDR results may be, it seems likely that the relative order for the groups is the actual one in each index of excess mortality. In contrast to these results for the various groups, the data for all MVR patients, on the bottom line, are much more accurate and do serve as a reliable basis for comparison.

Comment: In comparison with mitral valve replacement, repair of the mitral valve, where surgically feasible, offers a comparatively low perioperative and late mortality, a lower incidence of reoperation, and good functional results (74 of 111 survivors at end of follow-up were in NYHA Class I, 29 in Class II, and only 8 in Class III or IV). Another important advantage of valve repair is that there is no need for anticoagulation, which is needed for most types of prosthetic valve. Despite all of the changes in valve type and design, complication rates remain fairly high following valve replacement for severe hemorrhage, stroke and endocarditis (reference 2). Many of these complications are fatal, contributing to the high late mortality; even a nonfatal stroke may be severely disabling to the patient. For the minority of patients with mitral insufficiency but no stenosis, repair of the valve appears to offer many advantages over valve replacement, as emphasized by Kirklin, although repair is seldom used by most cardiac surgeons (reference 1).

From the underwriting standpoint it is my judgment that the better applicants with a history of valve replacement would be acceptable only at the highest rating levels, if acceptable at all. It appears reasonable to consider high but not the highest ratings for applicants with a history of isolated mitral valve repair who are doing well and free of complications. I use the term "high" rather than "moderate" because the expected mortality rates used here are based on population, not select insurance, tables. A method of translating mortality ratios from those based on population mortality to the familiar ones based on select insurance tables may be found in the panel discussion on the first volume of Medical Risks in the 1976 ALIMDA Proceedings.

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Experience of University of Alabama at Birmingham, 1967-1985

Table A. Early (In-Hospital) and Late Deaths by Associated Cardiac Procedure

Type of Cardiac Surgery	No. Pts. Operated ℓ_0	No. Early Deaths d_0	In-Hospital Mort. Rate $q_0=d_0/\ell_0(\%)$	Hospital Surv. Rate $P_0=1-q_0$	Pts. Discharged Alive $\ell=\ell_0-d_0$	No. Late Deaths d
Mitral Valve Repair (MVR) Isolated*	86	3	3.5%	.965	83	22
MVR+Coronary Bypass	63	7	11.1	.889	56	13
MVR+Aortic Valve Replacement	31	3	9.7	.903	28	13
MVR+Repair, Cong. Heart Defect	27	1	3.7	.963	26	4
MVR+Miscellaneous†	3	0	0	1.000	3	0
All Mitral Valve Repair	210	14	6.7	.933	196	52

*Includes some cases with tricuspid valve annuloplasty.
†1 case, removal of myxoma, 2 cases of pericardiectomy.

Table B. Mortality by Duration (Hospital Discharge to 10 Years) in All Patients with Mitral Valve Repair (Reconstructed Life Table Data from Survival Graphs and Other Results)

Interval	No. Alive	Exposure	No. of Deaths		Mortality	Mean Annual Mortality Rate per 1000		
Start-End t to $t+\Delta t$	at Start ℓ	Pt.-Yrs. E	Observed d	Expected $d'=(\bar{q}')(E)$	Ratio 100d/d'	Observed $\bar{q}$	Expected* $\bar{q}'$	Excess $\bar{q}-\bar{q}'$
HD-1 yr.	196	180	15	1.98	760%	83	11	72
1-3 yrs.	171	314	11	3.77	290	35	12	23
3-5	131	225	7	3.15	220	31	14	17
5-10	93	297	13	5.05	255	44	17	27

*Derived and graduated from cumulative survival curve of an "age-sex-race-matched general population" (Figure 1 in reference 1). Matching apparently done only for patients at entry, not for survivors at each duration, because progression of q' much higher by duration than in a mitral valve replacement series (2), with life table data by age group, sex and duration. The q' values derived for the table correspond closely to annual q' values in the 1979-81 U.S. Life Tables for the total population, starting at tabular age 57.

Table C. Mortality in Patients with Mitral Valve Repair (Hospital Deaths Excluded), Approximate Estimates by Associated Cardiac Surgery

Associated	Hosp. Dis.	Age	No. Alive	Survival Rates		Mean Ann. Mort. Rate per 1000			Mortality
Cardiac Surgery* MVR=Mitral Valve Repair	to Durt. Yrs.	Diff.† ΔX	at Start ℓ	From OP P	From Hosp. Dis. $Pi=P/p_0$	Observed** $\check{q}$	Est. Exp.†† $\check{q}'$	Excess $\check{q}-\check{q}'$	Ratio $100\check{q}/\check{q}'$
Isolated MVR±TVA	5	−1	83	0.84	0.870	28	12	14	235%
MVR+CBPS	5	+4	56	0.66	0.742	59	17	42	.50
MVR+AV Repl.	5	+1	28	0.55	0.609	96	14	82	685
MVR+Cong. Defect	3	−7	26	0.81	0.841	57	6	51	950
MVR+Miscell.	5	0	3	1.00	1.000	(0)	13	(−13)	(0)
All MVR Patients	5	0	196	0.738	0.791	46	13	33	355

*See categories in Table A.
†Difference assumed on basis of other series (2). See text.
**Derived from geometric mean of interval survival rate, P.
††Adjusted from $\check{q}'$ for total series according to assumed age difference.