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Valve: Short Report

Clinical Outcomes After Mitral Valve Replacement With Epic and Mosaic Bioprosthetic Valves

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ABSTRACT

BACKGROUND Comparative studies of outcomes between different biological mitral valve prostheses are scarce. This study compares the late clinical results of valve replacement with the Epic and Mosaic bioprostheses.

METHODS Patients undergoing isolated elective mitral valve replacement (MVR) between 2005 and 2019 were eligible for inclusion. Primary outcomes were freedom from mitral valve reintervention and overall survival. Inverse probability of treatment weighting and competing risk analyses were performed.

RESULTS MVR was performed in 247 (73.7%) patients with the Epic prosthesis and in 88 (26.3%) patients with the Mosaic prosthesis. The median follow-up was 3 (interquartile range, 0.20-5.64) years. At 10 years postoperative, the estimated survival rates were 86.1% (95% CI, 80.5%-91.9%) and 73.5% (95% CI, 60.6%-89.3%) for the Epic and Mosaic groups, respectively ($P = .40$). On inverse probability of treatment weighted analysis, no significant intergroup difference was found (hazard ratio, 1.20; 95% CI, 0.54-2.66; $P = .70$]. At 10 years, the cumulative incidence functions of mitral valve reintervention with death as competing risk were 34.4% (95% CI, 32.7%-36.1%) and 17.6% (95% CI, 16.2%-18.9%) for the Epic and Mosaic groups, respectively. On multivariable Fine-Gray analysis, the type of implanted mitral valve prosthesis just failed to reach a statistically significant difference in mitral valve reintervention (hazard ratio, 0.43 for Mosaic valve; 95% CI, 0.18-1.06; $P = .067$). Structural valve deterioration was an uncommon indication for reintervention in the first 10 years postoperative.

CONCLUSIONS Clinical results of MVR with the Epic or Mosaic prosthesis are satisfactory. Our results suggest that the Mosaic bioprosthesis might offer better freedom from reintervention.

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Mitral valve replacement (MVR) is a valuable treatment option for patients when valve repair is not feasible or after an unsuccessful repair attempt. In recent years, there has been a growing preference for biological prostheses, driven by the desire to avoid long-term complications and life style adjustments associated with oral anticoagulation. Among the available biological prostheses, the Mosaic (Medtronic)

IN SHORT

- Elective mitral valve replacement is a safe procedure.
- Structural valve degeneration is an uncommon cause of reintervention within 10 years after mitral valve replacement with a biological prosthesis.
- The Mosaic biological prosthesis might offer better freedom from reintervention than the Epic prosthesis.

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TABLE Early Postoperative Outcomes

Outcome	Epic (n = 247)	Mosaic (n = 88)	*P* Value
In-hospital mortality	10 (4.0)	2 (2.3)	.12
Postoperative atrial fibrillation	92 (37.2)	33 (37.5)	.14
Reexploration for bleeding	30 (12.1)	12 (13.6)	.60
Stroke	9 (3.6)	3 (3.4)	.12
New permanent pacemaker implantation	19 (7.7)	10 (11.4)	.21
Mean gradient, mm Hg	4.8 (3.6-6.4)	5.0 (3.6-7.0)	.35
Maximum gradient, mm Hg	11.6 (9.0-15.0)	11.6 (9.4-15.3)	.78

Data are presented as number (percentage) or median (interquartile range).

and Epic (Abbott) prostheses have emerged as popular choices. Whereas initial single-arm studies have demonstrated favorable clinical outcomes, data on long-term results are relatively scarce, and a direct comparison of their late clinical results has yet to be conducted.[1] Hence, this study aimed to assess and to compare the early hemodynamic performance and long-term clinical outcomes associated with MVR with either the Mosaic or Epic prosthesis.

PATIENTS AND METHODS

STUDY POPULATION. Adult patients undergoing MVR between January 2005 and December 2019 at the Leipzig Heart Center were eligible for the study. The inclusion criterion was isolated MVR with either the Epic or Mosaic prosthesis. Exclusion criteria were active endocarditis, emergent/urgent surgical procedure, preoperative shock, and preoperative mechanical ventilation.

ETHICAL STATEMENT. This study was approved by the ethics committee of the University of Leipzig (476/19-ek). Individual patient informed consent was waived because of the retrospective nature of this study.

DATA COLLECTION AND STUDY END POINTS. Patient information was prospectively collected into a computerized institutional database and retrospectively analyzed. Follow-up was conducted by phone communication with patients or close family members. The primary study end point was mitral valve reintervention. The secondary study end point was overall survival.

STATISTICAL ANALYSIS. Continuous data are presented as mean ± SD for normally distributed data and median with interquartile range (IQR) for skewed data and compared by Student *t*-test or *U*-test of Wilcoxon-Mann-Whitney, respectively. Categorical data are presented as counts and percentages compared by the χ^2 test or Fisher exact test, as appropriate. The Kaplan-Meier method was used for time-to-event analysis, and intergroups were compared by the log-rank test.

Inverse probability of treatment weighting was used to address the bias related to the nonrandom assignment of treatment. Briefly, a propensity score was built using multiple logistic regression, taking the type of implanted prosthesis (Epic or Mosaic) as a binary end point. Variables included in the model are presented in Supplemental Figure 1. Second, each patient was weighted by the inverse probability of treatment. The balance between the treatment groups was assessed by weighted standardized mean difference. A standardized mean difference value ≤10% was considered acceptable. The association of treatment allocation with time-to-event end points was analyzed by weighted Cox proportional hazards regression to calculate weighted hazard ratios (HRs).

The cumulative incidence function was computed for valve reintervention, with death as a competing risk. The Fine-Gray model for competing risk analysis was used to identify predictors of reintervention. First, a univariable analysis was performed, including all variables in the propensity score model. Covariates with a *P* value of < .10 at univariable analysis were included in the multivariable model. The type of implanted prosthesis was forced into the multivariable model.

A *P* value of < .05 was considered statistically significant. Statistical analysis was performed with SPSS version 25.0 software (SPPS) and R version 2023.03.0 (R Foundation for Statistical Computing).

RESULTS

STUDY POPULATION. There were 335 patients who met the inclusion criteria (Supplemental Figure 2). Of the patients included, 247 of 335 (73.7%) underwent MVR with the Epic prosthesis and 88 of 335 (26.3%) underwent MVR with the Mosaic prosthesis. Preoperative characteristics of the patients are presented in Supplemental Table 1.

INTRAOPERATIVE DETAILS AND EARLY RESULTS. Larger prostheses were implanted in the Epic group, with most patients undergoing size 31-mm (83/247 [33.6%]) or 33-mm (61/247 [24.7%]) prosthesis implantation (Supplemental Table 2). The frequency of postoperative complications, including early death, did not differ between groups (Table). On predischarge echocardiography, the median and maximal gradient did not differ between groups.

LATE RESULTS. Median follow-up duration was 3 (IQR, 0.20-5.64) years, 2.95 (IQR, 0.20-5.09) years and 3.48 (IQR, 0.49-6.78) years for the Epic and Mosaic prostheses, respectively. During follow-up, 26 patients died. At 10 years, the estimated survival rates were

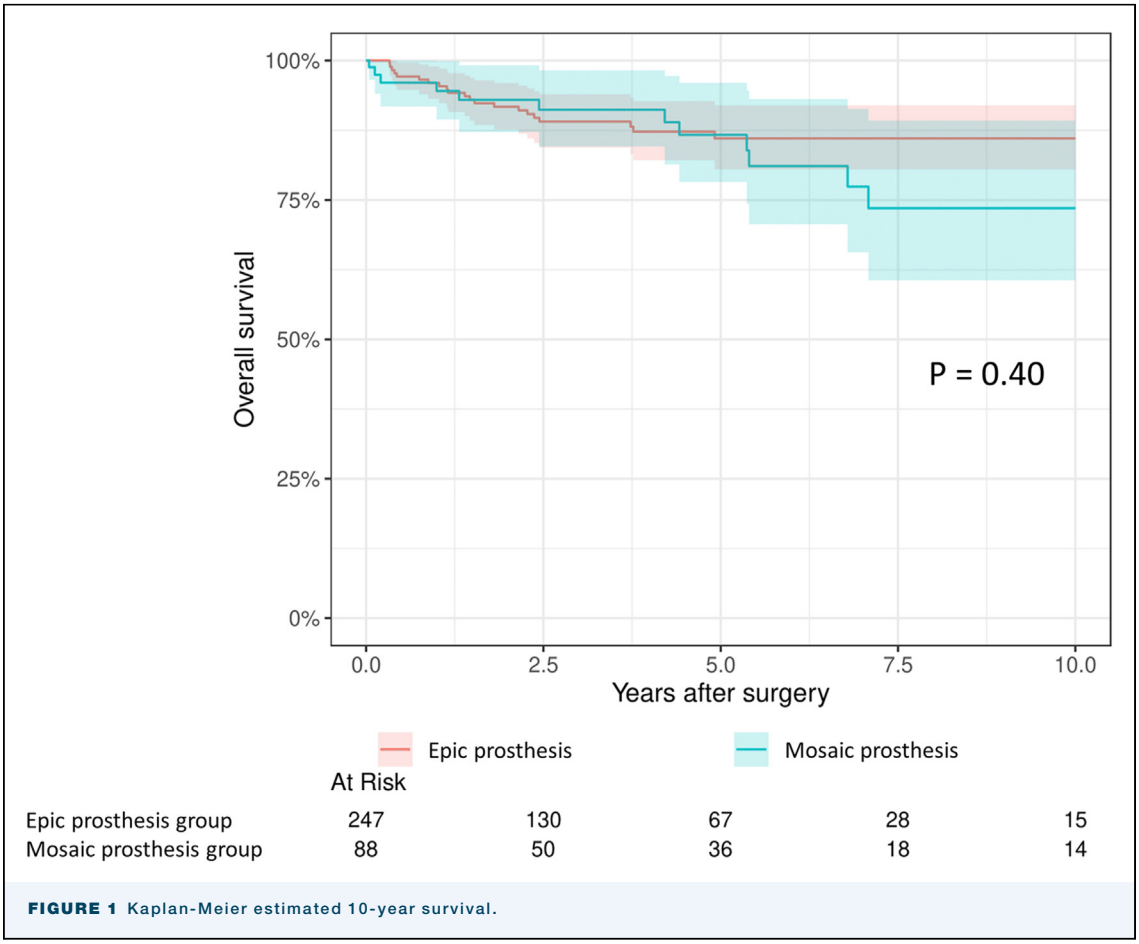

FIGURE 1 Kaplan-Meier estimated 10-year survival.

86.1% (95% CI, 80.5%-91.9%) and 73.5% (95% CI, 60.6%-89.3%) for the Epic and Mosaic groups, respectively (P = .40; Figure 1). In addition, no significant difference was found after inverse probability of treatment weighted analysis (HR, 1.20; 95% CI, 0.54-2.66; P = .70).

During follow-up, 26 reinterventions were performed in 20 of 247 (8.1%) patients from the Epic group and 6 of 88 (6.8%) patients from the Mosaic group. The cause of reintervention was endocarditis in 10 patients (8 from the Epic group and 2 from the Mosaic group), valve thrombosis in 5 patients (4 from the Epic group and 1 from the Mosaic group), paravalvular leakage in 2 patients (1 from the Epic group and 1 from the Mosaic group), and unknown in 7 patients (all from the Epic group). Structural valve deterioration (SVD) requiring reintervention occurred in 2 patients (9.2 and 10 years) from the Mosaic group and in 3 patients from the Epic group (6.1, 9.8, and 10.9 years).

At 10 years, the estimated freedom from reintervention rates were 62.2% (95% CI, 42.8%-84.5%) and 79.1% (95%, CI 62.1%-100%) for the Epic and Mosaic groups, respectively, with no statistically significant differences between groups (P = .10; Figure 2), but an evident trend was observed. On inverse probability of treatment weighted analysis, the difference in freedom from reintervention failed to reach statistical significance (HR, 0.46; 95% CI, 0.17-1.21; P = .10). The 10-year freedom from definite (confirmed on reoperation) SVD was 89.4% (95% CI, 74.9%-100%) in the Epic group and 91.7% (95% CI, 77.3%-100%) in the Mosaic group (P = 1; Figure 2).

COMPETING RISK ANALYSIS. At 10 years postoperative, the cumulative incidence functions of reintervention with death as competing risk were 34.4% (95% CI, 32.7%-36.1%) and 17.6% (95% CI, 16.2%-18.9%) for the Epic and Mosaic groups, respectively (Figure 3). On multivariable analysis, the type of implanted mitral valve prosthesis just failed to reach statistical significance (HR, 0.43; 95% CI, 0.18-1.06; P = .067; Supplemental Table 3).

COMMENT

Our study findings support the safety and satisfactory outcomes of MVR. The risk of reexploration for bleeding was high earlier in our experience, partially related to

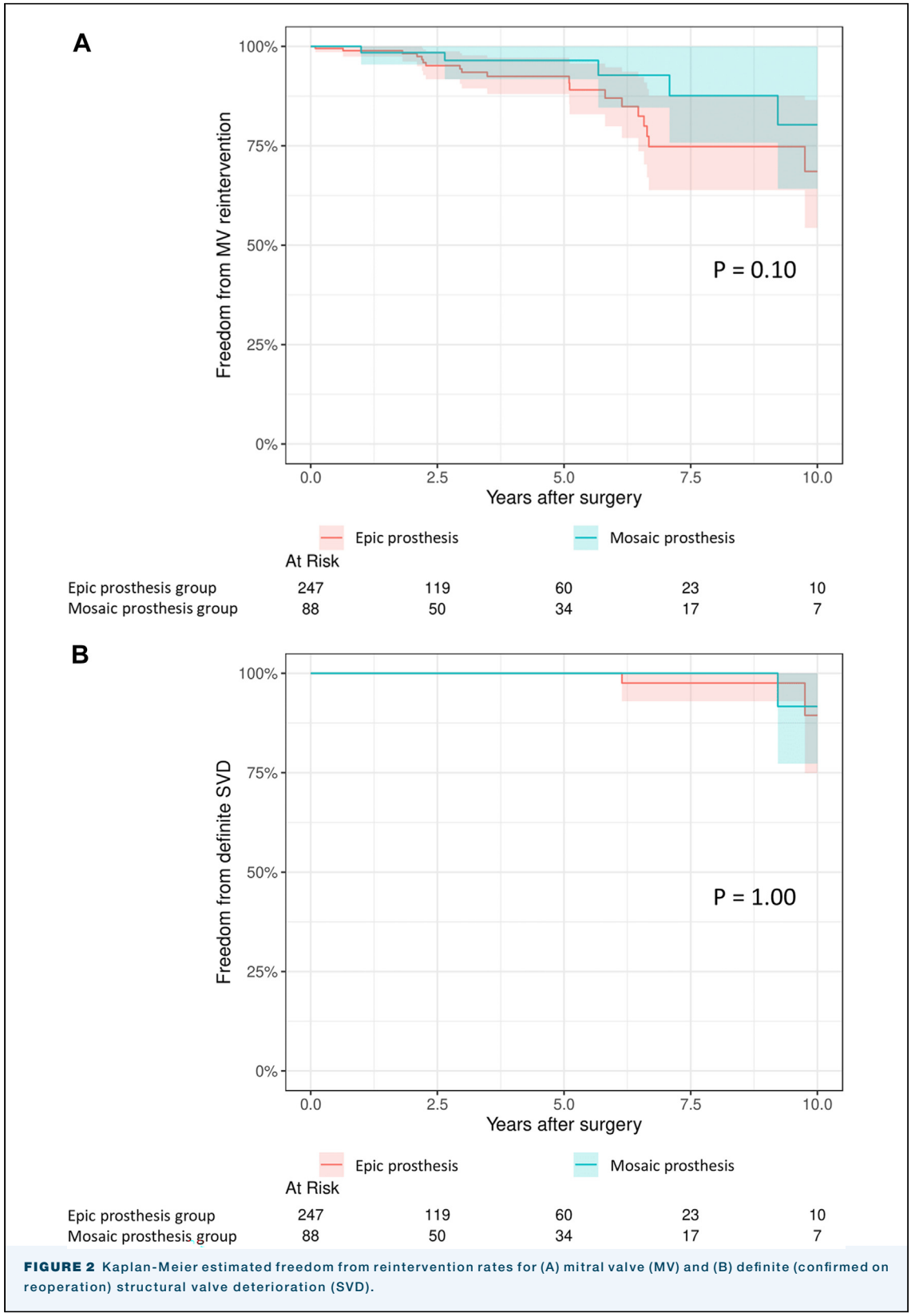

FIGURE 2 Kaplan-Meier estimated freedom from reintervention rates for (A) mitral valve (MV) and (B) definite (confirmed on reoperation) structural valve deterioration (SVD).

the clinical characteristics with which these patients present, but has decreased in the last years. We observed no significant difference in overall survival based on the type of prosthesis used. However, there was a statistical and clinical trend suggesting a higher risk of late reoperation associated with the Epic prosthesis, although freedom from SVD rates was similar between groups.

During the past few decades, biological prostheses have grown in popularity. From a patient's perspective, the disadvantages of mechanical valves, such as the requirement for lifelong anticoagulation treatment, are outweighed by the risks of reintervention for valve degeneration. Whereas guidelines recommend mechanical prostheses for patients younger than 65 years in case of MVR (class of evidence IIa, level of recommendation B), it is important to prioritize patients' wishes, life style, and occupation in the shared decision-making process between the informed patient and the responsible physician.[2]

A wide range of biological prostheses are currently available on the market, and variations in the design and type of material used to fabricate the prosthetic valves exist. The decision between a bovine pericardial prosthesis and a porcine prosthesis is primarily based on the surgeon's preference. A recent nationwide study from South Korea involving 3151 patients who underwent MVR did not demonstrate a significant difference in clinical outcomes between the 2 groups of prostheses.[3] However, the study considered various models within each group, and the results may not directly apply to all specific models.

In a comparative, propensity score-matched analysis of 940 patients undergoing MVR with Mosaic or Perimount (Edwards Lifesciences) pericardial prosthesis by Beute and coworkers,[4] superior freedom from SVD was observed with the Mosaic porcine prosthesis. Conversely, Uchino and colleagues[5] demonstrated superior freedom from reintervention when comparing the Perimount valve with the Epic bioprosthesis in a study involving 240 patients. The mode of SVD differs between pericardial and porcine prostheses, with failure of the pericardial valve usually due to leaflet calcification and of the porcine prosthesis due to leaflet tear and insufficiency.[5]

We have previously reported our experience with the Epic bioprosthesis for aortic, mitral, or double valve replacement.[1,6] Interestingly, midterm results showed no difference in the freedom from valve reintervention between the aortic and mitral valve groups, whereas a higher risk of reoperation for infective endocarditis was observed in the mitral valve group. Freedom from reintervention for SVD of 98.7% ± 0.6% at 5 years after MVR.

In this study, we aimed to explore the differences in clinical outcomes between the Mosaic and Epic prostheses for MVR. Despite a higher risk of reintervention, survival at 10 years after MVR was better in the Epic group, albeit statistically not significant. This is likely to be related to the differences in baseline characteristics as no significant difference was found after an inverse probability of treatment weighted analysis. The cumulative incidence function of mitral valve reintervention with death as competing risk showed that mitral valve reintervention occurred almost twice as often at 10 years after MVR in the Epic group as in the Mosaic group. On multivariable analysis, the Epic group showed a trend of higher risk of reintervention, but the difference between groups just failed to reach statistical significance. However, 10-year freedom from reoperation for SVD rates were not different between groups.

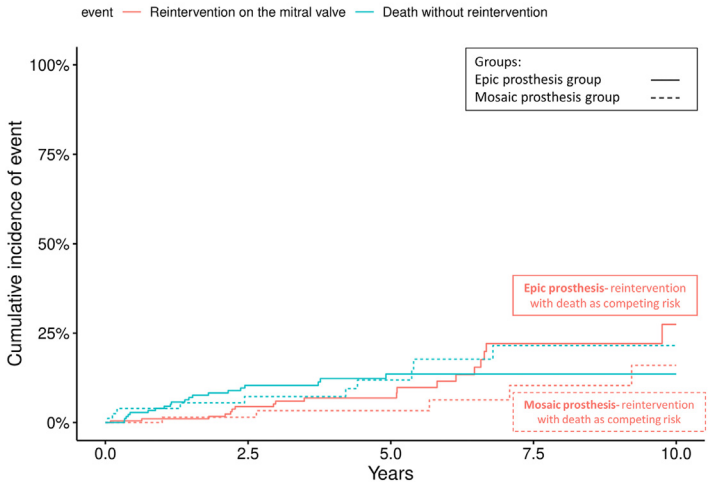

FIGURE 3 Cumulative incidence function of freedom from reintervention with death as competing risk. At 10 years after mitral valve replacement, the cumulative incidence of reintervention was twice as high in the Epic group.

The most common causes of reintervention were prosthetic valve endocarditis and valve thrombosis. Similar observations have recently been reported by Bernard and coworkers,[7] who analyzed 1397 patients after MVR with the Epic prosthesis. Seventy patients underwent reoperation during follow-up, and the authors reported SVD as a cause of reoperation in 38%. The prostheses studied in our analysis possibly vary in their resilience against complications other than SVD, which might, according to our results, have an important effect on clinical outcomes, especially within the first 10 years after MVR when SVD is less likely to develop.

LIMITATIONS. This is a retrospective study with limitations inherent to the study design. Clinical follow-up after surgical procedure ranged to more than 10 years.

As SVD is expected to occur more often with increasing time after valve implantation, no conclusion on the clinical results beyond the study follow-up time can be drawn. The lack of centralized clinical follow-up prevented us from studying the echocardiographic performance of both valve substitutes over time. Moreover, the cause of reintervention was lacking in a number of patients from the Epic group.

CONCLUSION. MVR is a safe and effective procedure with good early and long-term results. Early postoperative outcomes and long-term survival were comparable between the Epic and Mosaic groups. Our results suggest that SVD is an uncommon cause of reintervention within the first 10 years after MVR and did not differ between groups. However, the risk of reintervention seemed higher with the Epic prosthesis.

The Supplemental Material can be viewed in the online version of this article [https://doi.org/10.1016/j.atssr.2023.11.032] on http://www.annalsthoracicsurgery.org.

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DISCLOSURES

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