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Project Title: Analysis of Short- and Long-Term Outcomes of Medically Treated Isolated Left-Sided Endocarditis Patients: A 5-year Longitudinal Follow-up Study

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Summary (250 words max single spaced):

This is a retrospective study of medically treated isolated left-sided infective endocarditis (IE) in Manitoba over 12 years, with the aim of identifying predictors associated with favourable and non-favourable outcomes in patients with medical-only (i.e. non-operative) treatment of IE. Short- and long-term survival (up to 5 years) from 136 patients, and long-term hospitalization data from 66 patients from the Manitoba Centre for Health Policy (MCHP) were collected. The in-hospital mortality was 44%. Survival at 1 and 5 years was 43% and 23%. All-cause readmission at 1 and 5 years was 65% and 84%. Readmission due to major adverse events (heart failure, stroke, endocarditis) at 1 and 5 years was 26% and 47%, and due to recurrent endocarditis at 1 and 5 years was 19% and 28%. Severe valve regurgitation was a risk factor for in-hospital mortality ($p < 0.001$), poor long-term survival ($p < 0.001$), and recurrent endocarditis ($p = 0.002$). Isolated mitral valve involvement was a risk factor for in-hospital mortality ($p = 0.010$). Isolated aortic valve involvement was a risk factor for significant complications (acute renal failure requiring hemodialysis, stroke, heart failure) ($p = 0.048$). Prosthetic valve involvement ($p < 0.001$) and vegetations > 10mm ($p = 0.037$) were risk factors for poor long-term survival. Double valve involvement, ($p = 0.025$) and *Streptococcus viridans* group ($p < 0.001$) were associated with better long-term survival. *Staphylococcus aureus* was not a predictor of short- or long-term outcomes. Overall, this analysis suggests medical treatment of endocarditis carries a poor short- and long-term prognosis but does have a role in the management of endocarditis.

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Glossary of Abbreviations

IE	Infective endocarditis
IVDU	Intravenous drug use
LSIE	Left-sided infective endocarditis
HIPC	Health Information and Privacy Committee
MAE	Major adverse events
MCHP	Manitoba Centre for Health Policy
NVE	Native valve endocarditis
PVD	Peripheral vascular disease
PVE	Prosthetic valve endocarditis
REDCap	Research Electronic Data Capture
S. aureus	Staphylococcus aureus
SMD	Standardized mean difference

Introduction

Infective endocarditis (IE) is the bacterial or fungal infection of heart valves with an incidence of 1.5 to 11.6 per 100,000 people per year in Western countries.[1] Left-sided IE (LSIE) can be managed medically with antimicrobial therapy alone, or surgically through valve repair or replacement with additional antimicrobial therapy guided by North American and European guidelines.[2,3] Several multicenter studies have identified predictors of mortality in patients with IE.[4–10] However, these consisted of mixed populations of medically and surgically treated patients with heterogenous healthcare delivery. At present, therefore, a knowledge gap exists on the predictors of short- and long-term outcomes in medically treated patients with IE. This information is important for identifying patients that are more likely to benefit from medical treatment versus surgical valve repair/replacement, as current Society guidelines have provided minimal guidance on this issue.[2,3] The aim of this study was to provide a comprehensive analysis of medically treated isolated LSIE in a single tertiary care center over a 12-year period. Specifically, we sought to identify patient characteristics that were associated with acceptable outcomes from medical (i.e. never surgical) treatment. We hypothesized that certain patient and/or IE valvular characteristics would predict poor outcomes with medical only therapy.

Methods

Study Design

This is a retrospective study of prospectively collected patients aged 18 years or older that were medically treated for isolated LSIE in a tertiary center in Winnipeg between January 2004 and December 2016. The study was approved by the University of Manitoba Health Research Ethics Board, and the Manitoba Health Information and Privacy Committee (HIPC). Patients with IE were identified via ICD-9 and 10 diagnosis codes. Patients with tricuspid valve involvement, missing data on valve location, or intracardiac device-related IE were excluded from the analysis. Data was collected from medical records to complete multidisciplinary case review forms then

entered into a Research Electronic Data Capture (REDCap) database to obtain short-term outcomes. The data collected includes: findings at presentation, medical history, laboratory results, echocardiography data, microbiology data, antibiotics received, complications, and hospital disposition. The REDCap database was exported to the Manitoba Centre for Health Policy (MCHP) to obtain long-term survival and repeat hospitalization data. The MCHP contains the Manitoba Population Research Data Repository, which includes healthcare utilization data for Manitoba residents. Hospitalization data from MCHP was collected for patients that survived their initial admission and subsequent transfers, and admissions until March 2016, as use of hospitalization data from MCHP was approved for data until March 2016. Overall, short-term data from medical records, and long-term survival data from MCHP were collected from 136 patients that were medically treated for isolated LSIE from January 2004 to December 2016; whereas, long-term re-hospitalization data from MCHP was obtained for 66 patients who survived their initial hospital stay from January 2004 to March 2016.

The primary outcome was all-cause mortality. Secondary outcomes include: all-cause hospital readmission, hospital readmission because of major adverse events (MAE) (heart failure, stroke, and IE), and because of recurrent IE and its predictors.

Patient Cohort

Patient demographics, symptoms, medical history, echocardiographic parameters, laboratory results, causative organism, antibiotic regimen, complications, hospital length of stay, and hospital disposition were compared between native and prosthetic valve groups. In addition, Society guidelines identified IE factors that were also studied here, such as: valve location groups, vegetation size > 10mm and < 10mm groups, *Staphylococcus aureus* (*S. aureus*) and non-*S. aureus* groups, and antibiotic monotherapy and combination therapy groups.[2,3] The antibiotic regimen given was defined as the last known antibiotic regimen in effect during hospital admission. Monotherapy was defined as an antibiotic regimen consisting of only one antibiotic and is grouped into penicillins (excluding broad-spectrum penicillins), cephalosporins, vancomycin, and other antibiotics. Combination therapy was defined as an antibiotic regimen consisting of more than one antibiotics known to have synergy together and is divided into the following groups: double beta-lactam, beta-lactam with gentamicin, beta-lactam with vancomycin, vancomycin with gentamicin, and other regimens.[2,3,11] Beta-lactams include any narrow spectrum penicillin or cephalosporin.

Statistical Analysis

Categorical variables are expressed as absolute numbers and percentages and were compared using a Chi-Square or Fischer's Exact Test; whereas, continuous variables are expressed as median and interquartile range and were compared using a Mann-Whitney or Kruskal-Wallis test where appropriate. The standardized mean difference (SMD) was calculated as a measure of effect size, and a p-value of < 0.05 was considered statistically significant. Multivariable logistic regression analysis was used to identify independent predictors of in-hospital mortality, and significant complications (acute renal failure requiring hemodialysis, stroke, or heart

failure). All final models were developed using a stepwise selection process. Demographics, symptoms, medical history, echo parameters, lab results, causative organism, and antibiotic regimen were considered for the stepwise selection process. Variables with a p-value of less than 0.05 were entered into the model. Variables with a Wald test p-value greater than 0.05 were removed from the model. Long-term survival is expressed using Kaplan-Meier curves and was compared using a log-rank test. Long-term hospital readmission outcomes (all-cause readmission, readmission due to MAE, and recurrent IE) are expressed using cumulative incidence curves and were compared using Gray test. Long-term survival follow-up time was calculated as the time between the initial hospital admission and experiencing the outcome or being lost to follow-up; whereas, long-term hospital readmission outcomes were calculated as the time between hospital discharge and their next hospital admission or being lost to follow-up. Death was treated as a competing risk for the analysis of this outcome. Multivariable Cox proportional hazard analysis was used to identify independent predictors of long-term survival, and recurrent IE. All final models were developed using a stepwise selection process. Variables considered for the stepwise selection process include those described above, except for antibiotics received. A competing risks method was applied to Kaplan-Meier estimates and Cox proportional hazards models for the hospital readmission outcomes. All analysis was performed using SAS version 9.3.

Role of the Student

The student reviewed the medical records of 87 IE patients (36 medical and 51 surgical) that were treated from April 2015 to December 2016 to fill multidisciplinary case review forms. This analysis was focused on 136 medically treated patients from January 2004 and December 2016, of which 36 patients medically treated from April 2015 to December 2016 were reviewed by the student. The student subsequently entered the data to update our prospectively collected REDCap database of medically and surgically treated IE in Manitoba for export into MCHP. The student conducted a review of the literature, with input from infectious disease, cardiology, and cardiac surgery consultants, to design this study, including inclusion/exclusion criteria, data to be analyzed, and study outcomes.

The student is also currently involved with the initiation of a provincial-wide Delphi method that will be used to develop a clinical decision pathway for best practice for the management of IE in Manitoba. The Delphi method is a consensus building process that uses surveys for anonymized reiterative ranking of consensus statements by a group of experts.[12] The surveys are repeated until consensus is achieved, and statements that achieve pre-defined criteria of consensus will be used to develop local provincial guidelines for the management of IE. The student helped design the protocol for the Delphi process, and is currently developing the initial survey with input from Society Guidelines,[2,3] systematic reviews regarding IVDU,[13,14] as this topic is inadequately addressed in guidelines, our group's previous analyses of surgical IE and right-sided IE,[15,16] and input from expert consultants.

Results

Patient Demographics and Presentation

Baseline patient demographics are detailed in Table 1. A total of 136 (104 (76.5%) native and 32 (23.5%) prosthetic valve) medically managed patients for isolated LSIE were included in this analysis. The median age was 67 years, and 52 patients (38.2%) were female. Isolated aortic or mitral involvement were less likely to have mild to moderate regurgitation compared to double valve (aortic + mitral) involvement (6.0% vs. 17.0% vs. 33.0%; p = 0.008). Isolated mitral valve involvement was more likely to have moderate to severe regurgitation compared to isolated aortic or double valve involvement (15.3% vs. 2.0% vs. 7.4%; p = 0.040).

Organisms and Antibiotic Therapy

Microbiology is described in Table 2. The most common causative organism of left-sided NVE was *S. aureus* (50.0%), followed by *Streptococcus viridans* group (14.4%) and Enterococcus spp. (14.4%); whereas, the most common causative organism of left-sided PVE was *Streptococcus viridans* group (37.5%), followed by Enterococcus spp. (28.1%) and *S. aureus* (18.8%). *S. aureus* IE was not more likely to have vegetations > 10mm (25.9% vs. 26.9%; SMD = 0.02; p = 0.890), or intracardiac abscess or fistula on echocardiography (1.7% vs. 10.3%; SMD = 0.37; p = 0.078) than IE due to other organisms. Table 3 describes the antibiotics, and consistency of the regimen according to guidelines, given for the most common causes of isolated LSIE.

Short-Term Clinical Outcomes and Predictors

Peri-procedural complications and hospital disposition are outlined in Table 4. Patients with vegetations > 10mm were more likely to have embolic events (44.4% vs. 24.0%; SMD = 0.44; p = 0.021) and develop an in-hospital stroke (13.9% vs. 3.0%; SMD = 0.40; p = 0.030), but less likely to stay longer in hospital (10 vs. 16 days; SMD = 0.09; p = 0.027) than vegetations < 10mm. *S. aureus* IE was not more likely to have embolic events than IE due to other organisms (27.6% vs. 30.8%; SMD = 0.07; p = 0.687). Sixty (44.1%) patients died in-hospital. Patients that received combination therapy were more likely to die in-hospital (60.5% vs. 37.0%; SMD = 0.48; p = 0.010); whereas, those who received monotherapy were more likely to be discharged home (40.2% vs. 20.9%; SMD = 0.43; p = 0.028).

Eight risk factors for in-hospital mortality with medical only treatment were identified (Table 5). These included severe valve regurgitation (p < 0.001), isolated mitral valve involvement (p = 0.010), double beta-lactam combination therapy (p = 0.016), other combination therapies (p = 0.002), and comorbidities. Conversely, two independent factors were associated with a lower risk of in-hospital mortality, which included fever (> 37.5) at presentation (p = 0.001) and cephalosporin monotherapy (p = 0.028). Isolated aortic valve involvement was a risk factor for significant complications (acute renal failure requiring hemodialysis, stroke, heart failure) (p = 0.048).

Long-term Survival and Hospitalization Outcomes, and Predictors

Survival outcomes were available for all 136 patients in the studied cohort (Figure 1). The 30-day survival rate for medically treated patients was 64.0%, 42.6% at 1 year, and 23.2% at 5 years. MCHP privacy legislation for small sample size prevented disclosure of the number of at-risk patients for long-term outcomes if there were less than 6 patients. Hospitalization outcomes were available for 66 patients (survived their initial hospital stay and any subsequent transfers and admitted prior to March 2016). The all-cause re-hospitalization rate was 22.7% at 30 days, 64.6% at 1 year, and 84.4% at 5 years. At 1 and 5 years, readmission due to MAE (heart failure, stroke, IE) was 26.1% and 47.3% (Figure 2), and due to recurrent IE was 18.5% and 27.5% (Figure 3).

Six risk factors for worse long-term survival with medical only treatment were identified (Table 6). These included older age ($p = 0.013$), PVD ($p = 0.021$), vegetation > 10mm ($p = 0.037$), severe regurgitation ($p < 0.001$), and prosthetic valve involvement ($p < 0.001$). Conversely, there were four independent predictors associated with better survival, which included having a recent invasive procedure ($p < 0.001$), fever at presentation ($p < 0.001$), double valve involvement ($p = 0.025$), and *Streptococcus viridans* group ($p < 0.001$). Two risk factors for recurrent IE were identified, which included IVDU ($p < 0.013$) and severe regurgitation ($p = 0.002$). *S. aureus* was not an independent predictor of outcomes in medically treated LSIE.

Discussion

In this analysis of medically treated isolated LSIE in Manitoba over a 12-year period, we observed that severe regurgitation was a risk factor for poor short- and long-term survival, and recurrent IE. Isolated mitral involvement was a risk factor for in-hospital mortality. PVE and vegetation > 10mm were risk factors for poor long-term survival in medically treated patients. Lastly, double valve involvement and *Streptococcus viridans* group were associated with acceptable long-term survival with medical only treatment. We believe this is one of the first comprehensive analyses of medically only managed IE patients in which predictors of short- and long-term outcomes were identified. Previous studies consisted of mixed populations of medically and surgically treated patients.[4–9] This data is useful for informing the decision-making process for medical vs. surgical treatment of IE, as current guidelines have largely provide bedside clinicians only the indications for surgery.[2,3]

Surgery has typically been considered as a front-line therapy for severe regurgitation when associated with heart failure or vegetation > 10mm.[2,3] Similarly, our findings suggest severe regurgitation should be treated with surgery, as medical treatment is associated with poor short- and long-term outcomes. European guidelines also list severe regurgitation as a predictor of poor outcomes.[3] Mitral IE of moderate regurgitation may also not benefit from medical treatment. Isolated mitral involvement was both a risk factor for in-hospital mortality and was more likely to have moderate to severe regurgitation in this studied cohort. Contrary to isolated valve involvement, double valve involvement was associated with better long-term survival with medical only treatment independent from causative organism. Double valve involvement was also more

likely to have mild to moderate regurgitation in this cohort. This contrasts with the analysis of surgically treated IE in Manitoba which showed higher rates of severe regurgitation and in-hospital mortality in double valve IE,[15] suggesting double valve IE of milder severity may be responsive to medical treatment. Overall, our findings suggest management of IE based on severity of regurgitation. Surgery should be considered for severe regurgitation, and mitral IE with moderate regurgitation; whereas, medical treatment of double valve IE of milder severity can be considered.

Similar to the finding in this analysis, previous observational studies have identified that PVE was associated with higher rates of mortality.[4,6,10] Studied patients with PVE were more likely to have abscess or fistula on echocardiography, which is consistent with the literature.[17,18] The presence of these complications are indications for early surgery due to uncontrolled infection.[2,3] The poor long-term survival among medically treated PVE patients was likely driven by patients that were medically treated because they were too high-risk for surgery. Consistent with current guidelines for surgical therapy, valvular vegetation > 10mm was associated with poor long-term survival in patients treated medically only.[2,3] Furthermore, patients with vegetation > 10mm were also more likely to have embolic events, and in-hospital stroke. These findings were consistent with the results of a meta-analysis by Mohananey et al., which showed an association between vegetation > 10mm with both embolic events and mortality.[19] The presence of large vegetations is important in the decision to treat surgically, primarily for prevention of embolic events.[2,3] Our findings suggest that LSIE patients with vegetations > 10mm should be considered for surgery, as medical treatment is associated with a complicated course in-hospital, and poor long-term survival.

The relationship between *S. aureus* with poor outcomes in IE has been described in numerous observational studies.[4,5,7,9,20–23] In this study, however, it was not a predictor of short- and long-term outcomes with medical only treatment. Contrary to our study, other studies found that complications, including abscess and stroke, were more common in *S. aureus* IE.[20–23] It is likely that *S. aureus* IE in this cohort was of milder severity and thus did not predict outcomes with medical only treatment. Consistent with the current epidemiology of IE,[24] *S. aureus* was the most common cause of medically treated left-sided NVE in this study. Overall, our findings suggest *S. aureus* NVE of milder severity can be managed medically. Staphylococcal PVE carries a poor prognosis and was likely considered for urgent surgery.[3,7,23] *Streptococcus viridans* group was associated with better long-term survival. Other studies also support that *Streptococcus viridans* group is associated with a lower risk of mortality.[7,25] These findings suggest medical treatment should be the first line of management for *Streptococcus viridans* group IE.

The demographics of this cohort was similar to recent studies with clinical data on medically treated IE patients.[6,26,27] However, the in-hospital mortality of this cohort (44.1%) was higher than reported rates in similar cohorts, ranging from 21% to 31%.[6,7,26–28] Furthermore, the 1- and 5-year survival of this cohort was lower than reported 1- and 5-year survival rates in medically treated patients of 70% and 50%, respectively.[4,8] The high mortality of our cohort was likely driven by patient comorbidities. Some of the risk factors for poor outcomes in this study reflect a sicker population, including age, comorbidities, and double-beta lactam therapy. Similarly, other observational studies have identified age and comorbidities as predictors of poor

outcomes.[4–8] Double beta-lactam therapy is an alternative for beta-lactam-aminoglycoside combination therapy favored for patients with greater comorbidities due to the risk of aminoglycoside-related toxicity.[11] Combination antibiotic regimens classified as other were also a risk factor for in-hospital mortality. They included antibiotics recommended for resistant organisms or broad-spectrum antibiotics, which may reflect a more complex disease process. Long-term all-cause hospital readmission, and readmission due to recurrent IE were higher than reported rates in surgically treated IE in Manitoba.[15] Readmission due to recurrent IE may be partly driven by patients with IVDU, as it was a risk factor for readmission due to recurrent IE. It is established in the literature that recurrent IE is a significant concern for IE secondary to IVDU.[13] Even after surviving the initial hospitalization, medical treatment of IE carries a poor long-term prognosis likely because of older age and comorbidities.

Limitations

There were several limitations that require discussion. First, this study was limited by its retrospective design and that only patients with LSIE treated in Winnipeg were included in this analysis. While our institution provides the only dedicated cardiac care service for the Province of Manitoba, it is possible that patients with LSIE may have been treated elsewhere and not formally referred to an infectious disease or cardiac specialist to be entered into our dataset. Secondly, patients with isolated LSIE that may have been treated medically treated as they were deemed too high-risk for surgery were also included. Thirdly, we do not know the number of patients that died due to withdrawal of care. Fourth, there was missing long-term hospitalization data from patients admitted past March 2016 due to an inability to obtain more current data from the MCHP at the time of writing. Lastly, MCHP privacy legislation for small sample size prevented disclosure of the number of at-risk patients for long-term outcomes if there were less than 6 patients.

Conclusion

In our retrospective analysis of medically treated isolated LSIE in Manitoba over a 12-year period, we found that severe valve regurgitation, isolated mitral valve involvement, PVE, and vegetation > 10mm were risk factors for poor outcomes. Double valve IE and *Streptococcus viridans* group were associated with better long-term survival. Medical treatment of IE carries a poor prognosis, but our findings do have implications on the role of medical treatment. Severe regurgitation, and mitral IE with moderate regurgitation should be considered for surgery. Medical treatment can be considered for double valve IE and *S. aureus* NVE of milder severity. Medical treatment of *Streptococcus viridans* group IE should be tried as the first line of management. The results of this data, along with our group's previous publications[15,16] will be leveraged to facilitate a provincial process with key stakeholders to develop a clinical decision pathway for best practice for the management of IE in Manitoba.

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Table 1. Baseline Characteristics of 136 Medically Treated Patients with Isolated Left-Sided Endocarditis*

Variable	Left Sided IE (N = 136)	Native Valve (N = 104)	Prosthetic Valve (N = 32)	SMD	p-value
Demographics/Patient History					
Age	67 (56 - 77)	67 (55 - 76)	75 (58 - 80)	0.13	0.350
Sex (Female)	52 (38.2%)	41 (39.4%)	11 (34.4%)	-0.11	0.607
Type II Diabetes	58 (42.7%)	47 (45.2%)	11 (34.4%)	-0.22	0.279
Renal Failure Requiring Dialysis	25 (18.4%)	23 (22.1%)	2 (6.3%)	-0.47	0.065
Hypertension	69 (50.7%)	55 (52.9%)	14 (43.8%)	-0.18	0.366
COPD	16 (11.8%)	10 (9.6%)	6 (18.8%)	0.26	0.208
Peripheral Vascular Disease	18 (13.2%)	13 (12.5%)	5 (15.6%)	0.09	0.766
Cerebrovascular Disease	14 (10.3%)	12 (11.5%)	2 (6.3%)	-0.19	0.519
Heart Failure	15 (11.0%)	8 (7.7%)	7 (21.9%)	0.41	0.047
Recent Invasive Procedure	18 (13.2%)	12 (11.5%)	6 (18.8%)	0.20	0.370
Intravenous Drug Use	8 (5.9%)	6 (5.8%)	2 (6.3%)	0.02	1.000
Symptoms at Presentation					
Fever (>37.5)	80 (58.8%)	60 (57.7%)	20 (62.5%)	0.10	0.629
Loss of Appetite	24 (17.7%)	17 (16.4%)	7 (21.9%)	0.14	0.473
Septic Shock	20 (14.7%)	17 (16.4%)	3 (9.4%)	-0.21	0.405
Neurological Injury Type I	9 (6.6%)	7 (6.7%)	2 (6.3%)	-0.02	1.000
Neurological Injury Type II	51 (37.5%)	35 (33.7%)	16 (50.0%)	0.34	0.095
Echo Parameters					
Any Vegetation Size >10mm	36 (26.5%)	31 (29.8%)	5 (15.6%)	-0.34	0.112
Abscess / Fistula	9 (6.6%)	3 (2.9%)	6 (18.8%)	0.53	0.006
Isolated Aortic Valve	50 (36.8%)	32 (30.8%)	18 (56.3%)	0.53	0.009
Isolated Mitral Valve	59 (43.4%)	52 (50.0%)	7 (21.9%)	-0.61	0.005
Aortic + Mitral Valve	27 (19.9%)	20 (19.2%)	7 (21.9%)	0.07	0.743
Severe Regurgitation	21 (15.4%)	18 (17.3%)	3 (9.4%)	-0.24	0.403

N – number of patients

SMD – standardized mean difference

*Variables expressed as N (%) and compared using Chi-square test, or median (interquartile range) and compared using Mann-Whitney test based on non-missing values.

Table 2. Microbiology of 136 Medically Treated Patients with Isolated Left-Sided Endocarditis*

Organism	Left Sided IE (N = 136)	Native Valve (N = 104)	Prosthetic Valve (N = 32)	SMD	p-value
Streptococcus viridans group	27 (19.9%)	15 (14.4%)	12 (37.5%)	0.55	0.004
Streptococcus spp.	10 (7.4%)	8 (7.7%)	2 (6.3%)	-0.06	1.000
Group G and Group C Streptococcus	2 (1.5%)	2 (1.9%)	0 (0.0%)	-0.20	1.000
Coagulase negative Staphylococci	9 (6.6%)	6 (5.8%)	3 (9.4%)	0.14	0.439
Staphylococcus aureus	58 (42.7%)	52 (50.0%)	6 (18.8%)	-0.70	0.002
MRSA	7 (5.2%)	7 (6.7%)	0 (0.0%)	-0.38	0.199
MSSA	51 (37.5%)	45 (43.3%)	6 (18.8%)	-0.55	0.012
Propionibacterium acnes	1 (0.7%)	1 (1.0%)	0 (0.0%)	-0.14	1.000
Culture negative endocarditis	10 (7.4%)	9 (8.7%)	1 (3.1%)	-0.24	0.452
Enterococcus spp.	24 (17.7%)	15 (14.4%)	9 (28.1%)	0.34	0.075
Other	9 (6.6%)	8 (7.7%)	1 (3.1%)	-0.20	0.685

N – number of patients

SMD – standardized mean difference

*Variables expressed as N (%) and compared using Chi-square test, or median (interquartile range) and compared using Mann-Whitney test based on non-missing values.

Table 3. Antibiotics for the Most Common Organisms in Medically Treated Isolated Left-Sided Endocarditis*

	Native Valve			Prosthetic Valve		
	Staphylococcus aureus (N = 52)	Streptococcus viridans group (N = 15)	Enterococcus spp. (N = 15)	Staphylococcus aureus (N = 6)	Streptococcus viridans group (N = 12)	Enterococcus spp. (N = 9)
Combination Therapy						
Double B-lactam	1	0	1	0	0	3
B-lactam + Gent	3	3	1	2	1	3
B-lactam + Vanc	1	1	1	0	1	1
Vanc + Gent	1	0	3	0	0	0
Other	1	1	1	2	1	0
Monotherapy						
Penicillins	30	3	3	2	2	0
Cephalosporins	9	7	0	0	5	1
Vancomycin	4	0	0	0	1	0
Other	2	0	5	0	1	1
Consistency†	44 (84.6%)	13 (86.7%)	7 (46.7%)	2 (33.3%)	9 (75.0%)	6 (66.7%)

N – number of patients

*Variables expressed as N

†Consistency with guidelines. Variables expressed as N (% relative to organism)

Table 4. Short-Term Outcomes of 136 Medically Treated Patients with Isolated Left-Sided Endocarditis*

Variable	Left Sided IE (N = 136)	Native Valve (N = 104)	Prosthetic Valve (N = 32)	SMD	p-value
Complications					
Acute Kidney Injury	18 (13.2%)	14 (13.5%)	4 (12.5%)	-0.03	1.000
Acute Renal Failure Requiring Hemodialysis	15 (11.0%)	12 (11.5%)	3 (9.4%)	-0.07	1.000
Pneumonia	8 (5.9%)	8 (7.7%)	0 (0.0%)	-0.41	0.198
Atrio-Ventricular Block	4 (2.9%)	2 (1.9%)	2 (6.3%)	0.22	0.235
Heart Failure	7 (5.2%)	4 (3.9%)	3 (9.4%)	0.22	0.355
Stroke	8 (5.9%)	4 (3.9%)	4 (12.5%)	0.32	0.088
Embolic Events†	40 (29.4%)	28 (26.9%)	12 (37.5%)	0.23	0.251
Cerebral Emboli	33 (24.3%)	23 (22.1%)	10 (31.3%)	0.21	0.292
Ischemic	22 (16.2%)	17 (16.4%)	5 (15.6%)	-0.02	0.923
Hemorrhagic	11 (8.1%)	7 (6.7%)	4 (12.5%)	0.20	0.286
Mycotic Aneurysm	4 (2.9%)	3 (2.9%)	1 (3.1%)	0.01	1.000
Peripheral Emboli§	8 (5.9%)	5 (4.8%)	3 (9.4%)	0.18	0.391
Distant Infection	9 (6.6%)	7 (6.7%)	2 (6.3%)	-0.02	1.000
Adverse Reaction to Antibiotics	4 (2.9%)	2 (1.9%)	2 (6.3%)	0.22	0.235
Significant Complications‡	26 (19.1%)	18 (17.3%)	8 (25.0%)	0.19	0.333
Hospital Length of Stay (Days)	15 (8 - 33)	17 (9 - 35)	13 (7 - 20)	-0.41	0.068
Disposition					
Home	46 (33.8%)	37 (35.6%)	9 (28.1%)	-0.16	0.436
Transfer to Another Facility	30 (22.1%)	24 (23.1%)	6 (18.8%)	-0.11	0.606
Died In-Hospital	60 (44.1%)	43 (41.4%)	17 (53.1%)	0.24	0.241

N – number of patients

SMD – standardized mean difference

*Variables expressed as N (%) and compared using Chi-square test, or median (interquartile range) and compared using Mann-Whitney test based on non-missing values.

†Include embolic events at presentation and during admission.

§Include embolic events outside of cerebral circulation, except cutaneous manifestations.

‡Significant complications include acute renal failure requiring hemodialysis, stroke, and heart failure.

Table 5. Multivariable Logistic Regression Analysis for Independent Predictors of Short-Term Outcomes in 136 Medically Treated Patients with Isolated Left-Sided Endocarditis

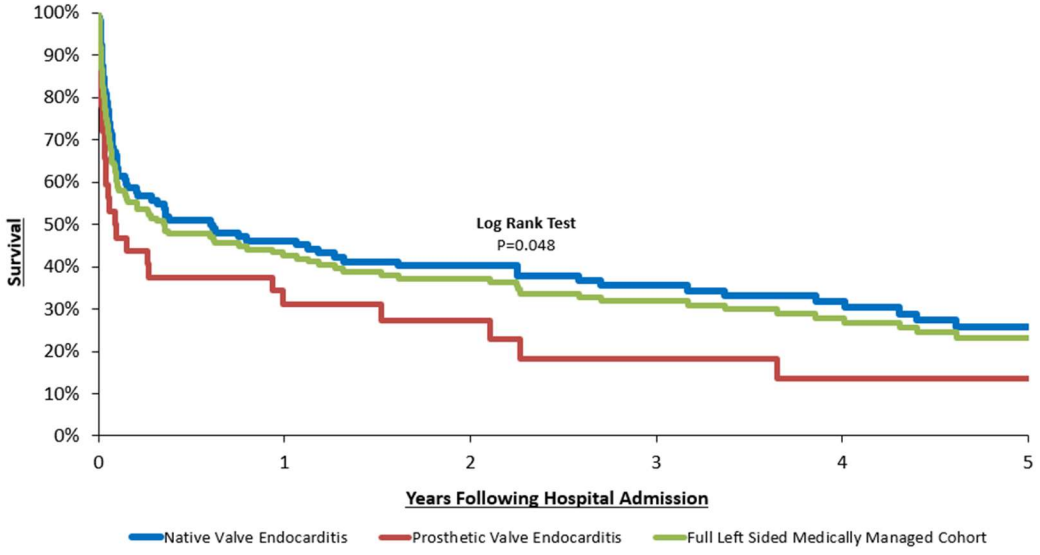
Outcome	Variable	Odds Ratio	95% Confidence Interval	p-value
In-hospital mortality*,†	Hypertension	2.67	1.03 - 6.92	0.043
	COPD	6.73	1.55 - 29.17	0.011
	Peripheral Vascular Disease	7.23	1.72 - 30.32	0.007
	Fever (>37.5)	0.19	0.07 - 0.51	0.001
	Loss of Appetite	4.60	1.32 - 16.01	0.017
	Severe Regurgitation	9.97	2.61 - 38.01	<0.001
	Isolated Mitral Valve IE	3.55	1.36 - 9.27	0.010
	Double Beta-lactam – Combination	19.48	1.73 - 218.95	0.016
	Other – Combination	65.18	4.94 - 859.32	0.002
	Cephalosporins – Monotherapy	0.24	0.07 - 0.86	0.028
Significant complications*,†,§	Isolated Aortic Valve IE	2.40	1.01 - 5.71	0.048

*Final models chosen using stepwise selection methods.
†Models are based on non-missing data from 136 medically treated patients with isolated left-sided endocarditis.
§Significant complications include acute renal failure requiring hemodialysis, stroke, and heart failure.

Table 6. Multivariable Logistic Regression Analysis for Independent Predictors of Long-Term Outcomes in 136 Medically Treated Patients with Isolated Left-Sided Endocarditis

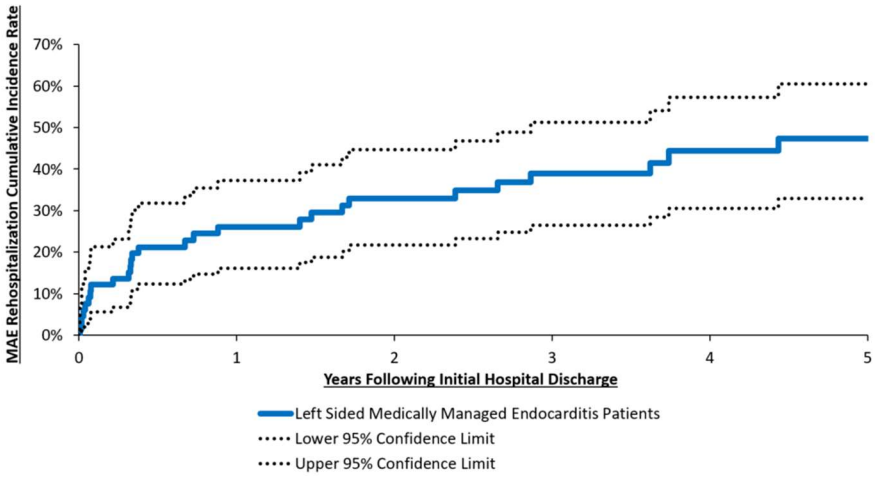
Outcome	Variable	Hazard Ratio	95% Confidence Interval	p-value
Survival*,†	Age (per year)	1.02	1.00 - 1.03	0.013
	Peripheral Vascular Disease	1.96	1.10 - 3.46	0.021
	Recent Invasive Procedure	0.25	0.12 - 0.54	<0.001
	Fever (>37.5)	0.46	0.30 - 0.71	<0.001
	Loss of Appetite	2.15	1.23 - 3.77	0.008
	Vegetation > 10mm	1.67	1.03 - 2.71	0.037
	Aortic + Mitral Valve IE	0.53	0.30 - 0.92	0.025
	Severe Regurgitation	3.03	1.75 - 5.26	<0.001
	Prosthetic Valve Endocarditis	3.65	2.12 - 6.28	<0.001
	Streptococcus viridans group	0.24	0.12 - 0.46	<0.001
Recurrent Endocarditis*,§	Intravenous Drug Use	5.29	1.42 - 19.65	0.013
	Severe Regurgitation	6.80	2.07 - 22.39	0.002

*Final models chosen using stepwise selection methods.
†Models are based on non-missing data from 136 medically treated patients with isolated left-sided endocarditis.
§Models are based on non-missing data from 66 medically treated patients that survived their initial admission and subsequent transfers and admitted prior to March 2016.



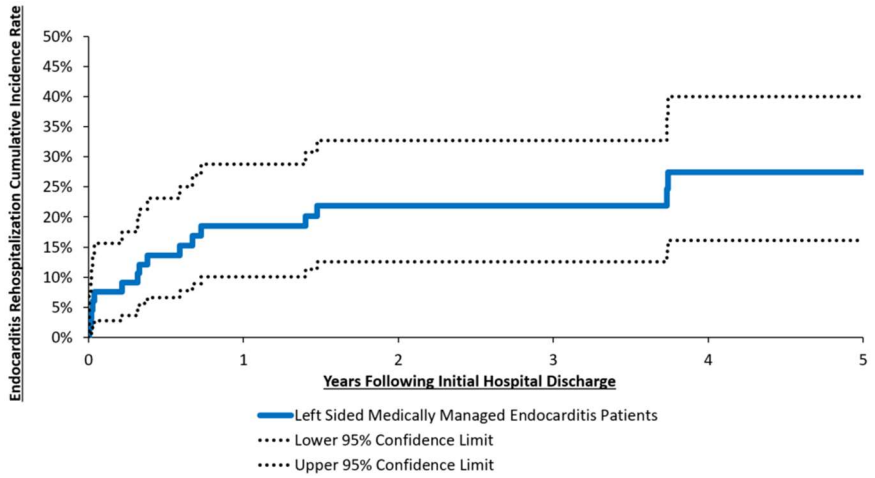
Cohort	30 Day		1 Year		5 Year	
	At Risk	Rate (%)	At Risk	Rate (%)	At Risk	Rate (%)
Left-Sided IE (N = 136)	88	64.0% (55.3% - 71.4%)	58	42.6% (34.3% - 50.8%)	18	23.2% (15.9% - 31.4%)
Native Valve (N = 104)	71	67.3% (57.4% - 75.4%)	48	46.2% (36.4% - 55.4%)	-	25.7% (17.0% - 35.3%)
Prosthetic Valve (N = 32)	17	53.1% (34.7% - 68.5%)	10	31.3% (16.4% - 47.3%)	-	13.7% (3.8% - 29.8%)

Figure 1. Survival of 136 medically treated patients with isolated left-sided endocarditis for up to 5 years.



Cohort	30 Day		1 Year		5 Year	
	At Risk	Rate (%)	At Risk	Rate (%)	At Risk	Rate (%)
Left-Sided IE (N = 66)	56	12.1% (5.6% - 21.3%)	34	26.1% (16.1% - 37.3%)	6	47.3% (32.9% - 60.5%)

Figure 2. Hospital readmission due to MAE (heart failure, stroke, recurrent IE) of 66 medically treated patients with isolated left-sided endocarditis for up to 5 years.



Cohort	30 Day		1 Year		5 Year	
	At Risk	Rate (%)	At Risk	Rate (%)	At Risk	Rate (%)
Left-Sided IE (N = 66)	59	7.6% (2.8% - 15.6%)	38	18.5% (10.1% - 28.8%)	8	27.5% (16.1% - 40.0%)

Figure 3. Hospital readmission due to recurrent IE of 66 medically treated patients with isolated left-sided endocarditis for up to 5 years.

Endocarditis Data Collection Form

Record ID _____

Surgical or Medically Managed Endocarditis Cohort
◯ Surgical
◯ Medically Managed

DEMOGRAPHICS

Medical Record Number _____

City of Residence _____

Province of Residence
◯ MB
◯ ON
◯ NU
◯ Other

DOB (M-D-Y) _____

Age of Patient at Admission _____

Sex of Patient
◯ Male
◯ Female

Hospital Admission Date _____

Hospital Discharge Date _____

Referring Cardiologist _____

Referring Physician _____

Hospital of Diagnosis
◯ SBGH
◯ HSC
◯ Other

SYMPTOMS AT PRESENTATION

Fever (>37.5)
◯ Yes
◯ No

Duration of Fever (In Days) _____

Loss of Appetite
◯ Yes
◯ No

Embolic Episodes
◯ Peripheral
◯ Central

Embolic Episodes Site _____

Heart Failure
◯ Yes
◯ No
(Dx of Heart Failure in Chart)

Septic Shock
◯ Yes
◯ No
(Diagnosed via 2013 Sepsis Guidelines)

Neurological Injury Type I
◯ Yes
◯ No
(Type I Neurological Injury eg. Stroke/TIA)

Neurological Injury Type II
◯ Yes
◯ No
(Type II Neurological Injury eg. Confusion/Delrium)

Other Symptoms
_____

PATIENT HISTORY

Weight (kg)
_____

Height (cm)
_____

Ethnicity of Patient
◯ Caucasian
◯ Aboriginal
◯ Hispanic
◯ Black
◯ Filipino
◯ Other
◯ Unknown

Family history of CAD
◯ Yes
◯ No

Diabetes (Type I)
◯ Yes
◯ No

Diabetes (Type II)
◯ Yes
◯ No

Diabetic Control
☐ None or Diet
☐ Oral Meds
☐ Insulin

Hypercholesterolemia
◯ Yes
◯ No

Hypertension
◯ Yes
◯ No

Current Smoker
◯ Yes
◯ No

Former Smoker
◯ Yes
◯ No

Total Number of Pack Years in Lifetime
_____

How Long Since Former Smoker Quit (Years)
_____

IVDU Usage
◯ Active
◯ Prior

COPD
◯ Yes
◯ No

COPD Severity _____

COPD FeV1 _____

COPD Predicted (%) _____

COPD FVC _____

COPD Predicted (%) _____

Asthma
◯ Yes
◯ No

Peripheral Vascular Disease
◯ Yes
◯ No

Congestive Heart Failure
◯ Yes
◯ No

NYHA Class
◯ I
◯ II
◯ III
◯ IV

Alcohol Abuse
◯ Yes
◯ No

Drinks per Week _____

Liver Disease
◯ Yes
◯ No

Drug Abuse
◯ Yes
◯ No

GI Bleed or Peptic Ulcer
◯ Yes
◯ No

Crohn's Disease or Ulcerative Colitis
◯ Yes
◯ No

Renal Insufficiency (Cr 110-176)
◯ Yes
◯ No

Renal Failure (Cr > 176)
◯ Yes
◯ No

Baseline Serum Creatinine _____

Dialysis
◯ Yes
◯ No

Dialysis Type
◯ Hemodialysis
◯ Peritoneal

Dialysis Type of Access
◯ Line
◯ Fistula

Pulmonary Hypertension (Primary)
◯ Yes
◯ No

Pulmonary Hypertension (Secondary)
◯ Yes
◯ No

TIA
◯ Yes
◯ No

CVA
◯ Yes
◯ No

CVA When
◯ Recent (< 2 weeks)
◯ Remote (> 2 weeks)

CVA Type
◯ Ischemic
◯ Hemorrhagic

Infection
◯ Yes
◯ No

Prior Endocarditis < 1 Year
◯ Yes
◯ No

Prior Endocarditis Organism
_____

Immunosuppressive Therapy
◯ Yes
◯ No

Cancer
◯ Yes
◯ No

Indwelling Cath
◯ Yes
◯ No

Documented Confusion / Delirium
◯ Yes
◯ No

Recent Invasive Procedure?
◯ Yes
◯ No

Recent Dental Procedure
◯ Yes
◯ No

Prosthetic Material: Pacemaker
◯ Yes
◯ No

Recent Hospital Admission < 2 Weeks
◯ Yes
◯ No

CATHETERIZATION DATA

Date of Cath / Angio
_____

Cath / Angio Same Admission as Surgery
◯ Yes
◯ No

Coronary Artery Rupture
◯ Yes
◯ No

Left Angio Gram LVEDP
_____

Left Angio Gram CO
_____

Left Angio Gram CI
_____

Right Angio Gram RVSP _____

Right Angio Gram PAS _____

Right Angio Gram PAD _____

Right Angio Gram PAW _____

EF _____

EF Method
◯ LV Gram/Angiogram
◯ ECHO
◯ Radionuclide/MUGA

MEDICATIONS

MEDICATIONS
☐ ASA
☐ ACE Inhibitors
☐ ARB Antagonist
☐ Beta Blockers
☐ Ca Antagonists
☐ Lipid Lowering Agents - Statin
☐ Lipid Lowering Agents - Non-Statin
☐ Nitro po/spray/patch
☐ Nitro IV
☐ Heparin SC (LMW)
☐ Heparin IV
☐ Benzodiazepine
☐ Antianxiety
☐ Anticoagulants - Coumadin
☐ Anticoagulants - Pradaxa
☐ Plavix
☐ Antiarrhythmics
☐ Digoxin
☐ Diuretics
☐ Antibiotics
☐ Antihypertensives
☐ Bronchodilators
☐ Steroids
☐ Insulin
☐ Oral Hypoglycemics
☐ Proton Pump Inhibitors
☐ Antidepressants

ASA Stopped Prior to Surgery
◯ Yes
◯ No

Plavix Stopped Prior to Surgery
◯ Yes
◯ No

Antibiotics Prior to Admission
◯ Yes
◯ No

Antibiotic Dose _____

Antibiotic Duration _____

Other Medications

_____

FIRST + ECHO FINDING (TTE)

TTE Date of Echo _____

Valve Type
- ◯ Native - Abnormal
- ◯ Native - Normal
- ◯ Repair
- ◯ Tissue - Surgical
- ◯ Tissue - TAVI
- ◯ Mechanical

Vegetation Size (mm) _____

Vegetation Size (>1cm or < 1cm)
- ◯ >1cm
- ◯ < 1cm

Hemodynamic Lesion
- ◯ Regurgitation
- ◯ Stenosis
- ◯ Mixed

Severity
- ◯ Mild
- ◯ Mild to Moderate
- ◯ Moderate to Severe
- ◯ Severe

Valve Location
- ◯ Mitral
- ◯ Aortic - Bicuspid
- ◯ Aortic - Tricuspid
- ◯ Tricuspid
- ◯ Pulmonary
- ◯ PM
- ◯ ICD
- ◯ Multiple
- ◯ Other

Echo Quality
- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor

TTE Date of Echo _____

Valve Type
- ◯ Native - Abnormal
- ◯ Native - Normal
- ◯ Repair
- ◯ Tissue - Surgical
- ◯ Tissue - TAVI
- ◯ Mechanical

Vegetation Size (mm) _____

Vegetation Size (>1cm or < 1cm)
- ◯ >1cm
- ◯ < 1cm

Hemodynamic Lesion
- ◯ Regurgitation
- ◯ Stenosis
- ◯ Mixed

Severity
- ◯ Mild
- ◯ Mild to Moderate
- ◯ Moderate to Severe
- ◯ Severe

Valve Location

- ◯ Mitral
- ◯ Aortic - Bicuspid
- ◯ Aortic - Tricuspid
- ◯ Tricuspid
- ◯ Pulmonary
- ◯ PM
- ◯ ICD
- ◯ Multiple
- ◯ Other

Echo Quality

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor

END TREATMENT ECHO (TTE)

TTE Date of Echo _____

Valve Type

- ◯ Native - Abnormal
- ◯ Native - Normal
- ◯ Repair
- ◯ Tissue - Surgical
- ◯ Tissue - TAVI
- ◯ Mechanical

Vegetation Size (mm) _____

Vegetation Size (>1cm or < 1cm)

- ◯ >1cm
- ◯ < 1cm

Hemodynamic Lesion

- ◯ Regurgitation
- ◯ Stenosis
- ◯ Mixed

Severity

- ◯ Mild
- ◯ Mild to Moderate
- ◯ Moderate to Severe
- ◯ Severe

Valve Location

- ◯ Mitral
- ◯ Aortic - Bicuspid
- ◯ Aortic - Tricuspid
- ◯ Tricuspid
- ◯ Pulmonary
- ◯ PM
- ◯ ICD
- ◯ Multiple
- ◯ Other

Echo Quality

- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor

TTE Date of Echo _____

Valve Type
- ◯ Native - Abnormal
- ◯ Native - Normal
- ◯ Repair
- ◯ Tissue - Surgical
- ◯ Tissue - TAVI
- ◯ Mechanical

Vegetation Size (mm) _____

Vegetation Size (>1cm or < 1cm)
- ◯ >1cm
- ◯ < 1cm

Hemodynamic Lesion
- ◯ Regurgitation
- ◯ Stenosis
- ◯ Mixed

Severity
- ◯ Mild
- ◯ Mild to Moderate
- ◯ Moderate to Severe
- ◯ Severe

Valve Location
- ◯ Mitral
- ◯ Aortic - Bicuspid
- ◯ Aortic - Tricuspid
- ◯ Tricuspid
- ◯ Pulmonary
- ◯ PM
- ◯ ICD
- ◯ Multiple
- ◯ Other

Echo Quality
- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor

INTRAOPERATIVE ECHO FINDINGS

TTE Date of Echo _____

Valve Type
- ◯ Native - Abnormal
- ◯ Native - Normal
- ◯ Repair
- ◯ Tissue - Surgical
- ◯ Tissue - TAVI
- ◯ Mechanical

Vegetation Size (mm) _____

Vegetation Size (>1cm or < 1cm)
- ◯ >1cm
- ◯ < 1cm

Hemodynamic Lesion
- ◯ Regurgitation
- ◯ Stenosis
- ◯ Mixed

Severity
- ◯ Mild
- ◯ Mild to Moderate
- ◯ Moderate to Severe
- ◯ Severe

Valve Location

◯ Mitral
◯ Aortic - Bicuspid
◯ Aortic - Tricuspid
◯ Tricuspid
◯ Pulmonary
◯ PM
◯ ICD
◯ Multiple
◯ Other

Echo Quality

◯ Excellent
◯ Good
◯ Fair
◯ Poor

TTE Date of Echo

_____

Valve Type

◯ Native - Abnormal
◯ Native - Normal
◯ Repair
◯ Tissue - Surgical
◯ Tissue - TAVI
◯ Mechanical

Vegetation Size (mm)

_____

Vegetation Size (>1cm or < 1cm)

◯ >1cm
◯ < 1cm

Hemodynamic Lesion

◯ Regurgitation
◯ Stenosis
◯ Mixed

Severity

◯ Mild
◯ Mild to Moderate
◯ Moderate to Severe
◯ Severe

Valve Location

◯ Mitral
◯ Aortic - Bicuspid
◯ Aortic - Tricuspid
◯ Tricuspid
◯ Pulmonary
◯ PM
◯ ICD
◯ Multiple
◯ Other

Echo Quality

◯ Excellent
◯ Good
◯ Fair
◯ Poor

TEE ECHO FINDINGS

TEE Date _____

Valve Type
- ◯ Native - Abnormal
- ◯ Native - Normal
- ◯ Repair
- ◯ Tissue - Surgical
- ◯ Tissue - TAVI
- ◯ Mechanical

Vegetation Size (mm) _____

Vegetation Size (>1cm or < 1cm)
- ◯ >1cm
- ◯ < 1cm

Hemodynamic Lesion
- ◯ Regurgitation
- ◯ Stenosis
- ◯ Mixed

Severity
- ◯ Mild
- ◯ Mild to Moderate
- ◯ Moderate to Severe
- ◯ Severe

Valve Location
- ◯ Mitral
- ◯ Aortic - Bicuspid
- ◯ Aortic - Tricuspid
- ◯ Tricuspid
- ◯ Pulmonary
- ◯ PM
- ◯ ICD
- ◯ Multiple
- ◯ Other

Echo Quality
- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor

Annular Abscess
- ◯ Yes
- ◯ No

TEE Date _____

Valve Type
- ◯ Native - Abnormal
- ◯ Native - Normal
- ◯ Repair
- ◯ Tissue - Surgical
- ◯ Tissue - TAVI
- ◯ Mechanical

Vegetation Size (mm) _____

Vegetation Size (>1cm or < 1cm)
- ◯ >1cm
- ◯ < 1cm

Hemodynamic Lesion
- ◯ Regurgitation
- ◯ Stenosis
- ◯ Mixed

Severity
- ◯ Mild
- ◯ Mild to Moderate
- ◯ Moderate to Severe
- ◯ Severe

Valve Location
- ◯ Mitral
- ◯ Aortic - Bicuspid
- ◯ Aortic - Tricuspid
- ◯ Tricuspid
- ◯ Pulmonary
- ◯ PM
- ◯ ICD
- ◯ Multiple
- ◯ Other

Echo Quality
- ◯ Excellent
- ◯ Good
- ◯ Fair
- ◯ Poor

Annular Abscess
- ◯ Yes
- ◯ No

SCANS

CT Scan - Brain _____

CT Scan - Abdomen _____

CT Scan - Chest _____

WBC Scan _____

BASELINE LABS (FIRST SITE SUSPECTED HOSPITAL ADMISSION)

Serum Creatinine _____

estimated GFR _____

Albumin _____

Bilirubin _____

LDH _____

Alkaline Phosphate _____

Hgb A1C (< 3 months) _____

Heptaglobin _____

Urine Analysis _____

RBC (Normal/Abnormal)
- ◯ Normal
- ◯ Abnormal

Protein (Normal/Abnormal)
- ◯ Normal
- ◯ Abnormal

Leukocytes (Normal/Abnormal)
◯ Normal
◯ Abnormal

WBC Counts _____

Hgb _____

Platelets _____

ESR _____

INR _____

CRP _____

LABS (DATE OF SURGERY)

Serum Creatinine _____

estimated GFR _____

Albumin _____

Bilirubin _____

LDH _____

Alkaline Phosphate _____

Hgb A1C (< 3 months) _____

Heptaglobin _____

Urine Analysis _____

RBC (Normal/Abnormal)
◯ Normal
◯ Abnormal

Protein (Normal/Abnormal)
◯ Normal
◯ Abnormal

Leukocytes (Normal/Abnormal)
◯ Normal
◯ Abnormal

WBC Counts _____

Hgb _____

Platelets _____

ESR _____

INR _____

CRP _____

ORGANISM 1

Organism _____

Date Positive _____

Date of First Negative Culture _____

Days Positive _____

Comments _____

ORGANISM 2

Organism _____

Date Positive _____

Date Negative _____

Days Positive _____

Comments _____

ORGANISM 3

Organism _____

Date Positive _____

Date Negative _____

Days Positive _____

Comments _____

ORGANISM CULTURED FROM SURGICAL SPECIMENS

Organism Cultured from Surgical Specimens _____

OTHER FEATURES

Time Differential (Duration between peripheral and line cultures drawn at same time) _____

Cultures Negative (Pre-Treatment) _____

Cultures Negative (Post-Treatment) _____

Serology

- ☐ Mycoplasma
- ☐ Bartonella
- ☐ Brucella
- ☐ Chlamydia
- ☐ Coxiella
- ☐ Legionella

Valve 16SRNA

- ◯ Yes
- ◯ No

16SRNA Organism Identified _____

TREATMENT EMPIRIC ANTIBIOTIC 1

Antibiotic _____

Dose _____

Start Date _____

End Date _____

Comments _____

TREATMENT EMPIRIC ANTIBIOTIC 2

Antibiotic _____

Dose _____

Start Date _____

End Date _____

Comments _____

TREATMENT EMPIRIC ANTIBIOTIC 3

Antibiotic _____

Dose _____

Start Date _____

End Date _____

Comments _____

TREATMENT DEFINITIVE ANTIBIOTIC 1

Antibiotic _____

Dose _____

Start Date _____

End Date _____

Appropriate
◯ Appropriate
◯ Not Appropriate

Comments _____

TREATMENT DEFINITIVE ANTIBIOTIC 2

Antibiotic _____

Dose _____

Start Date _____

End Date _____

Appropriate
◯ Appropriate
◯ Not Appropriate

Comments _____

TREATMENT DEFINITIVE ANTIBIOTIC 3

Antibiotic _____

Dose _____

Start Date _____

End Date _____

Appropriate
◯ Appropriate
◯ Not Appropriate

Comments _____

COMPLICATIONS

Bleeding
◯ Yes
◯ No

Comments _____

Re-exploration of Chest for Bleeding or Tamponade
◯ Yes
◯ No

Comments _____

Acute Renal Failure Requiring Hemodialysis
◯ Yes
◯ No

Comments _____

Stroke
◯ Yes
◯ No

Comments _____

Low Cardiac Output Syndrome
◯ Yes
◯ No

Comments _____

Pneumonia
◯ Yes
◯ No

Comments _____

Atrio-Ventricular Block
◯ Yes
◯ No

Comments _____

Other Complications _____

FOLLOW-UP

Symptoms _____

Date of Follow Up _____

FOLLOW-UP ECHO

Date of Echo _____

Valve Type
◯ Native - Abnormal
◯ Native - Normal
◯ Repair
◯ Tissue - Surgical
◯ Tissue - TAVI
◯ Mechanical

Vegetation Size (mm) _____

Vegetation Size (>1cm or < 1cm)
◯ >1cm
◯ < 1cm

Hemodynamic Lesion
◯ Regurgitation
◯ Stenosis
◯ Mixed

Severity
◯ Mild
◯ Mild to Moderate
◯ Moderate to Severe
◯ Severe

Valve Location

◯ Mitral
◯ Aortic - Bicuspid
◯ Aortic - Tricuspid
◯ Tricuspid
◯ Pulmonary
◯ PM
◯ ICD
◯ Multiple
◯ Other

Echo Quality

◯ Excellent
◯ Good
◯ Fair
◯ Poor

Date of Echo

_____

Valve Type

◯ Native - Abnormal
◯ Native - Normal
◯ Repair
◯ Tissue - Surgical
◯ Tissue - TAVI
◯ Mechanical

Vegetation Size (mm)

_____

Vegetation Size (>1cm or < 1cm)

◯ >1cm
◯ < 1cm

Hemodynamic Lesion

◯ Regurgitation
◯ Stenosis
◯ Mixed

Severity

◯ Mild
◯ Mild to Moderate
◯ Moderate to Severe
◯ Severe

Valve Location

◯ Mitral
◯ Aortic - Bicuspid
◯ Aortic - Tricuspid
◯ Tricuspid
◯ Pulmonary
◯ PM
◯ ICD
◯ Multiple
◯ Other

Echo Quality

◯ Excellent
◯ Good
◯ Fair
◯ Poor

RELAPSE / RE-INFECTION

Repeat Infection _____

Date of Relapse _____

Follow-up Organism _____

Follow-up Valve Type
- ☐ Aortic
- ☐ Mitral
- ☐ Tricuspid
- ☐ Native
- ☐ Prosthetic

Modified Duke Criteria
- ◯ Major
- ◯ Minor

DISPOSITION

Discharged from Hospital
- ◯ Home
- ◯ Personal Care Home
- ◯ Transfer to Another Hospital
- ◯ Rehab/Restorative Care

In-hospital mortality
- ◯ Yes
- ◯ No

Date of death _____

Location of Death
- ◯ ICCS
- ◯ ICMS
- ◯ CSIU
- ◯ A5
- ◯ Other

Cause of Death
- ☐ Cardiac - Low Output
- ☐ Cardiac - Ischemic
- ☐ Cardiac - Valvular
- ☐ Cardiac - Other
- ☐ Pulmonary
- ☐ Renal
- ☐ Vascular
- ☐ GI
- ☐ Infection
- ☐ Neurologic
- ☐ Other

Other Causes of Death _____

READMISSION DATA

ER Visit, Not Readmitted
◯ Yes
◯ No

ER Visit Reason _____

ER Visit Date _____

Readmission to this hospital within 30 days
◯ Yes
◯ No

Readmission Date _____

Reason for Readmission
☐ Valve-related
☐ Repeat Infection
☐ Acute Vascular Comp
☐ Pericardial Effusion / Tamponade
☐ CHF
☐ Subacute Endocarditis
☐ Myocardial Infarction
☐ Recurrent Angina
☐ Arrhythmia
☐ Renal Failure
☐ Neurologic
☐ Anticoag Comp
☐ Pleural Effusion
☐ Pneumonia / Respiratory Complication
☐ Thoracentesis

Reason for Readmisson: Other _____