THE IMPORTANCE OF BEING EARNEST: IMPLEMENTATION AND OUTCOMES OF A MULTIDISCIPLINARY ENDOCARDITIS TEAM

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07/26/22

Disclosures

- None

Objectives

- Review University of Michigan endocarditis outcomes prior to creation of a multidisciplinary endocarditis team
- Highlight improvement in mortality and other clinical outcomes associated with implementation of an endocarditis team
- Review research opportunities associated with multidisciplinary endocarditis teams

The Patient

40 year old man

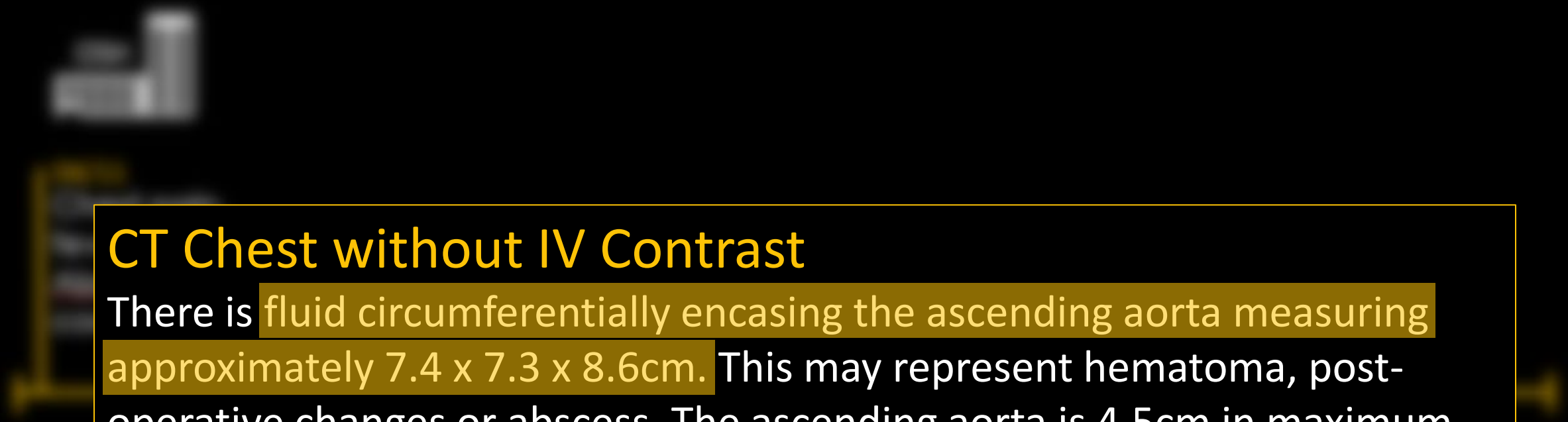
Chief Complaint: Fevers

PMH/PSH

- Bicuspid aortic valve s/p St. Jude's Mechanical Aortic Valve Replacement (2014) c/b peri-operative occipital stroke w/ vision loss
- HTN
- HLD
- Obesity (BMI 37)

04/11/17

Chest pain,
fevers, nausea,
Abd pain,
cool R 4th digit



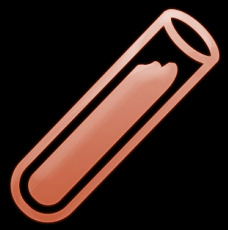
CT Chest without IV Contrast

There is fluid circumferentially encasing the ascending aorta measuring approximately 7.4 x 7.3 x 8.6cm. This may represent hematoma, post-operative changes or abscess. The ascending aorta is 4.5cm in maximum dimension. Aortic valve prosthesis noted. There is no pericardial effusion.

04/11
Chest pain,
fevers, nausea,
Abd pain,
cool R 4th digit

CT Chest
7.4x7.3x8.6cm
Peri-aortic
fluid collection.
Aortic root abscess?

04/12



×3

Vancomycin
Zosyn
Gentamycin

Cardiac Surgery

04/11
Chest pain,
fevers, nausea,
Abd pain,
cool R 4th digit

04/13
TTE LVEF 35%,
no vegetation.
BCx3 +MRSA

CT Chest
7.4x7.3x8.6cm
Peri-aortic
fluid collection.
Aortic root abscess?

21:57
04/12

M

ICU

Cardiac Surgery

Please obtain CT Aorta to further characterize fluid collection

Cardiac Surgery

"…It is unclear whether the patient has an infection around his graft, as we have seen this type of fluid collection occur with the use of glue material when doing aortic surgery. His old operative notes will be a most important acquisition."

Transesophageal Echocardiogram

LVEF 35%. Normal overall RV systolic function.

LV dilated. LA markedly dilated. RV mildly to moderately dilated. RA markedly dilated.

Aortic root/proximal ascending aorta (presumably composite) graft with surrounding soft-tissue density and liquid density material worrisome for pathology (anastamotic leak and/or paraprosthetic infection).

No flow between the ascending aorta and surrounding area.

No evidence of vegetation.

Infectious Disease

"…presenting with signs and sequelae of MRSA AV endocarditis (prosthetic). The key will be getting the fluid collection drained and getting adequate source control… . MRSA prosthetic valve endocarditis can be quite destructive and have high M and M…."

"…if surgical option will happen, it is best to do this earlier rather than later."

“…if surgical option will happen, it is best to do this earlier rather than later.”

“Fluid appears simple on CT but clinically concerning. Reoperation of a prior Bentall procedure is one with high risk of death and complications. Please obtain operative report. This fluid collection may be due to surgical glue.”

"…if surgical option will happen, it is best to do this earlier rather than later."

"Pt is persistently bacteremic and his risk of further events is higher with each day that he is bacteremic. Recommend surgical intervention in light of aortic root abscess and persistent MRSA bloodstream infection… Await CT surg recs and appreciate their help in care of this patient."

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"Please obtain NM PET scan."

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"Will need surgical source control for any chance of good outcome for this infection of high severity."

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"Please obtain peri-aortic fluid drainage."

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"Will need surgical source control for any chance of good outcome for this infection of high severity."

"Continued fevers and leukocytosis likely due to periaortic abscess and high endovascular burden of infection. I don't think this is a survivable infection without aortic valve surgery / local source control."

"Fluid appears simple on CT but clinically concerning. Reoperation of a prior Bentall procedure is one with high risk of death and complications. Please obtain operative report. This fluid collection may be due to surgical glue."

"Please obtain NM PET scan."

"Please obtain peri-aortic fluid drainage."

04/11-04/16
Persistent chest pain.
Persistent sepsis.
MRSA bacteremia.
LVEF 35%.
Large aortic
fluid collection.
Splenic, renal, & brain
emboli.

04/19
Cardiac Surgery
requests peri-aortic
fluid drainage

Afebrile.
WBC uptrending.
NM Sarcoid PET.
04/17

IR peri-aortic fluid
aspiration.
04/20

04/11-04/16
Persistent chest pain.
Persistent sepsis.
MRSA bacteremia.
LVEF 35%.
Large aortic fluid collection.
Splenic, renal, & brain emboli.

04/17
Afebrile.
WBC uptrending.
NM Sarcoid PET.

04/19
Cardiac Surgery requests peri-aortic fluid drainage

04/20
IR peri-aortic fluid aspiration.

04/22
3am
Acute hypoxia progressing to NRB.
Hemoptysis → intubated.

4/25

3:59 am

PEA Arrest

Continuous pulmonary hemorrhage with clots evident on suctioning.

Autopsy Summary:

- Prosthetic valve endocarditis with infection extending through aortic annulus, into peri-aortic graft hematoma/abscess, and then into right lung middle lobe with much associated hemorrhage.
- Numerous acute infarcts to multiple organs.
- Congestive heart failure (right and left) with cardiomegaly probably due to original valvular disease plus prosthetic valve malfunction.

Why did we fail?

System Failure

This must be an anomaly… right?

Background - Infective Endocarditis

- ~43,000 cases per year in the U.S
- In hospital mortality 15-20%
- Lack of randomized controlled trials complicates patient management

Epidemiology - Infective Endocarditis

Contemporary Trends in Native Valve Infective Endocarditis in United States (from the National Inpatient Sample Database)

Muhammad Zia Khan, MD,[a,*] Muhammad Bilal Munir, MD,[b,c] Muhammad U. Khan, MD,[a] Safi U. Khan, MD,[a] Mina M Benjamin, MD,[a] and Sudarshan Balla, MD[b]

- 2012 – 2016: ~40,000 cases per year in the U.S
- In hospital mortality 10.8%

Infective Endocarditis Mortality

Infective Endocarditis at Michigan Medicine

- No existing registry or database of patients
- How do our outcomes compare to national numbers?
- How frequently do we operate on patients?
- Mortality for surgical vs. medical management?
- Is there consistent documentation regarding decision making process?

Infective Endocarditis at Michigan Medicine

- 1 year retrospective review of patients admitted with IE
- Charts identified by search using an internal research tool (Data Direct) with ICD-9 and 10 codes previously used in other epidemiologic studies

Infective Endocarditis at Michigan Medicine

- Between July 1, 2014 and June 30, 2015
  - 179 patients identified
  - 105 cases of definite and possible endocarditis by Duke Criteria
  - 78 cases of definite endocarditis
  - 68 cases of definite endocarditis AND at least 1 indication for surgery per the 2015 American Heart Association guidelines

Surgical Indications

- AHA Guidelines
  - Class I Indications
    - Valve dysfunction resulting in symptoms or signs of heart failure
    - IE caused by fungal or highly resistant organisms (eg, vancomycin-resistant Enterococcus, multidrug-resistant Gram-negative bacilli)
    - IE complicated by heart block, annular or aortic abscess, or destructive penetrating lesions
    - Evidence of persistent infection (manifested by persistent bacteremia or fever lasting >5-7 days and provided that other sites of infection and fever have been excluded) after the start of appropriate antimicrobial therapy

Surgical Indications

- AHA Guidelines
  - Class IIa indications
    - Recurrent emboli and persistent or enlarging vegetations despite appropriate antibiotic therapy
    - Severe valve regurgitation and mobile vegetations >10 mm
  - Class IIb indication
    - Mobile vegetations >10 mm, particularly when involving the anterior leaflet of the mitral valve and associated with other relative indications for surgery

Infective Endocarditis at Michigan Medicine

- 68 patients with definite endocarditis and surgical indications
  - Overall in-hospital mortality: 29.4%

Infective Endocarditis Mortality

Infective Endocarditis at Michigan Medicine

- 17 patients (25%) without a documented cardiac surgery consult
  - 15% of patients had no consult placed
  - 10% of patients had a consult placed but there was no documentation
  - In-hospital mortality for these patients: 47.1%

Infective Endocarditis at Michigan Medicine

- 17 patients (25%) without a documented cardiac surgery consult
  - In-hospital mortality for these patients: 47.1%
- 51 patients with documented cardiac surgery consultation
  - 26 patients managed medically
    - In-hospital mortality: 38.5%, 2-year mortality 65.4%

Infective Endocarditis at Michigan Medicine

- 17 patients (25%) without a documented cardiac surgery consult
  - In-hospital mortality for these patients: 47.1%
- 51 patients with documented cardiac surgery consultation
  - 26 patients managed medically
    - In-hospital mortality: 38.5%, 2-year mortality 65.4%
  - 25 patients underwent surgery
    - In-hospital mortality: 8% ; **p = 0.01**, 2-year mortality 20% ; **p = 0.001**
    - Mean time to consult from admission: 7.1 days
    - Mean time to surgery from consult: 7.3 days

Differences Between Surgically and Medically Managed Patients

Variable	Surgical Management (n=25)	Medical Management (n=26)	P-Value
Acute HD (%)	0	26.9	0.006
ICU Stay (%)	24	53.8	0.03
Mitral Valve (%)	16	42.3	0.04
Staph Aureus Bacteremia (%)	8	34.6	0.02
>2 Indications for Surgery (%)	12	38.5	0.03
STS Risk of Mortality >8% (%)	28.6	60	0.03

Documented Reasons for Deferring Surgical Intervention

Reason for Deferring Surgery	Number of Cases (n = 26)
High Peri-Operative Mortality	13 (50%)
Continued IV Drug Use	5 (19.2%)
Not Clearly Stated	2 (7.7%)
Patient Co-morbidities	2 (7.7%)
TPN Dependence	1 (3.8%)
Illness Acuity	1 (3.8%)
Patient/Family Declined	1 (3.8%)
Deconditioning	1 (3.8%)

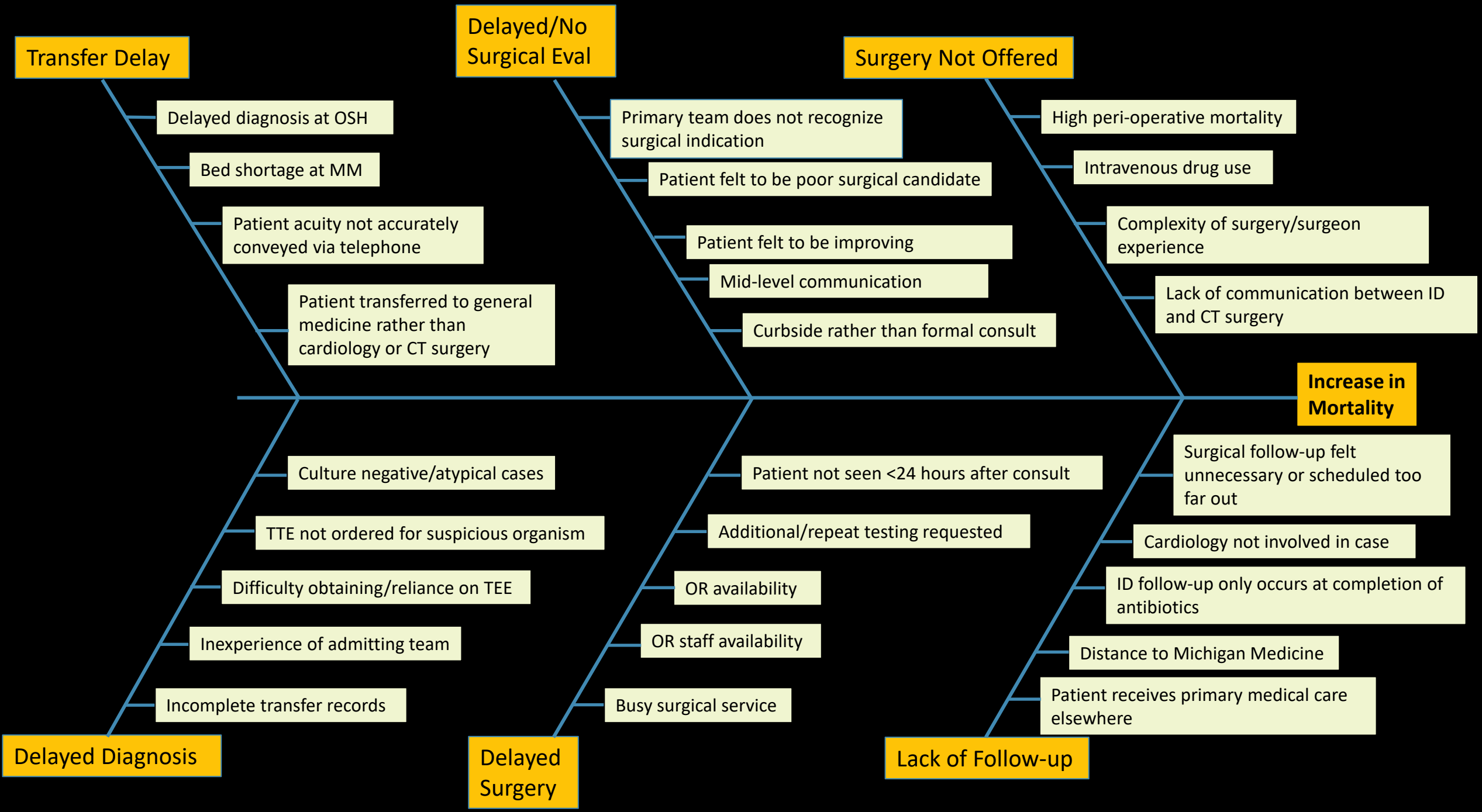
In-Hospital Outcomes for Critically Ill Patients

Variable	Mortality for Surgically Managed Patients (%)	Mortality for Medically Managed Patients (%)	P-Value
All Patients	8 (n =25)	38.5 (n =26)	0.01
STS Risk of Morality >8%	16.7 (n=6)	73.3 (n=15)	0.02
ICU Patients	0 (n = 6)	85.7 (n = 14)	0.02
Vasopressor Requirement	0 (n =5)	77.8 (n = 9)	0.003
Mechanical Ventilation	0 (n =4)	85.7 (n =7)	0.003
ICU/Vasopressors/Mechanical Ventilation	0 (n=4)	83.3 (n=6)	0.01

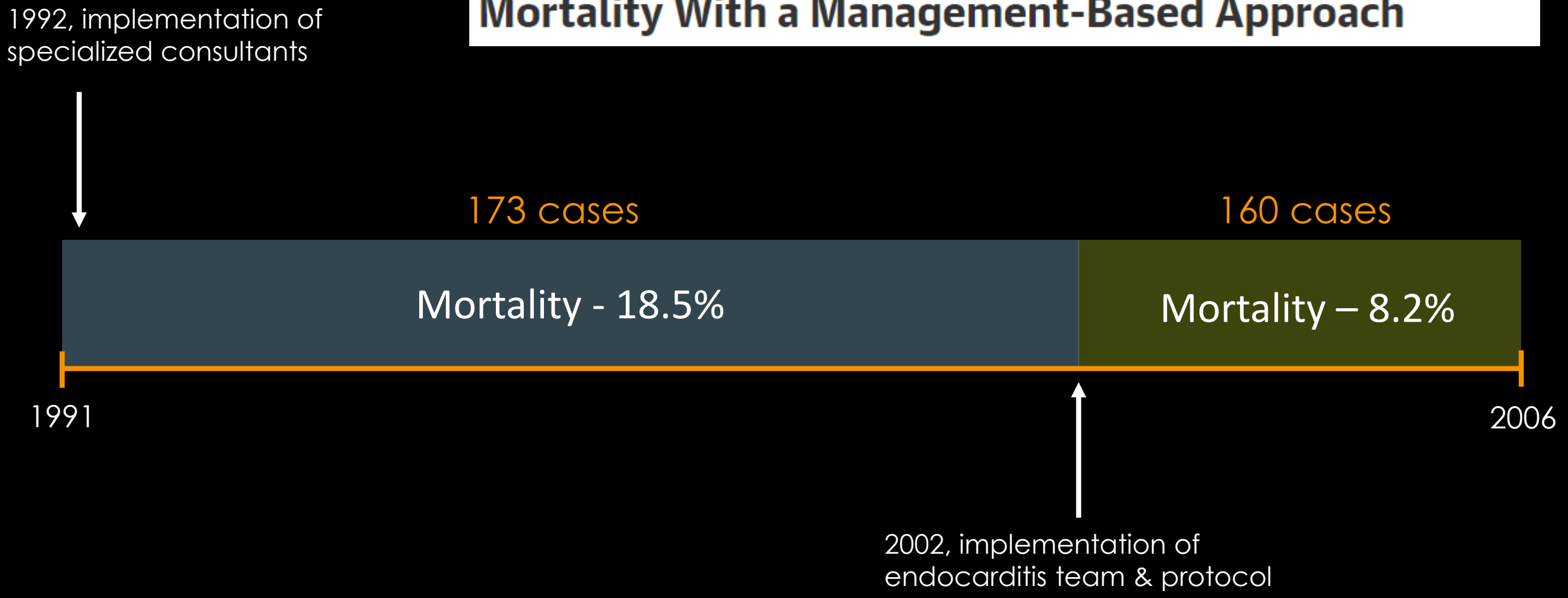
Summary

- In-hospital mortality and 2-year mortality was significantly improved for patients who underwent surgical valve replacement
- Critically ill patients are often not referred for or offered surgery but may still benefit from surgical intervention
- There is room for improving communication between providers
- There are likely other unidentified factors contributing to higher patient mortality

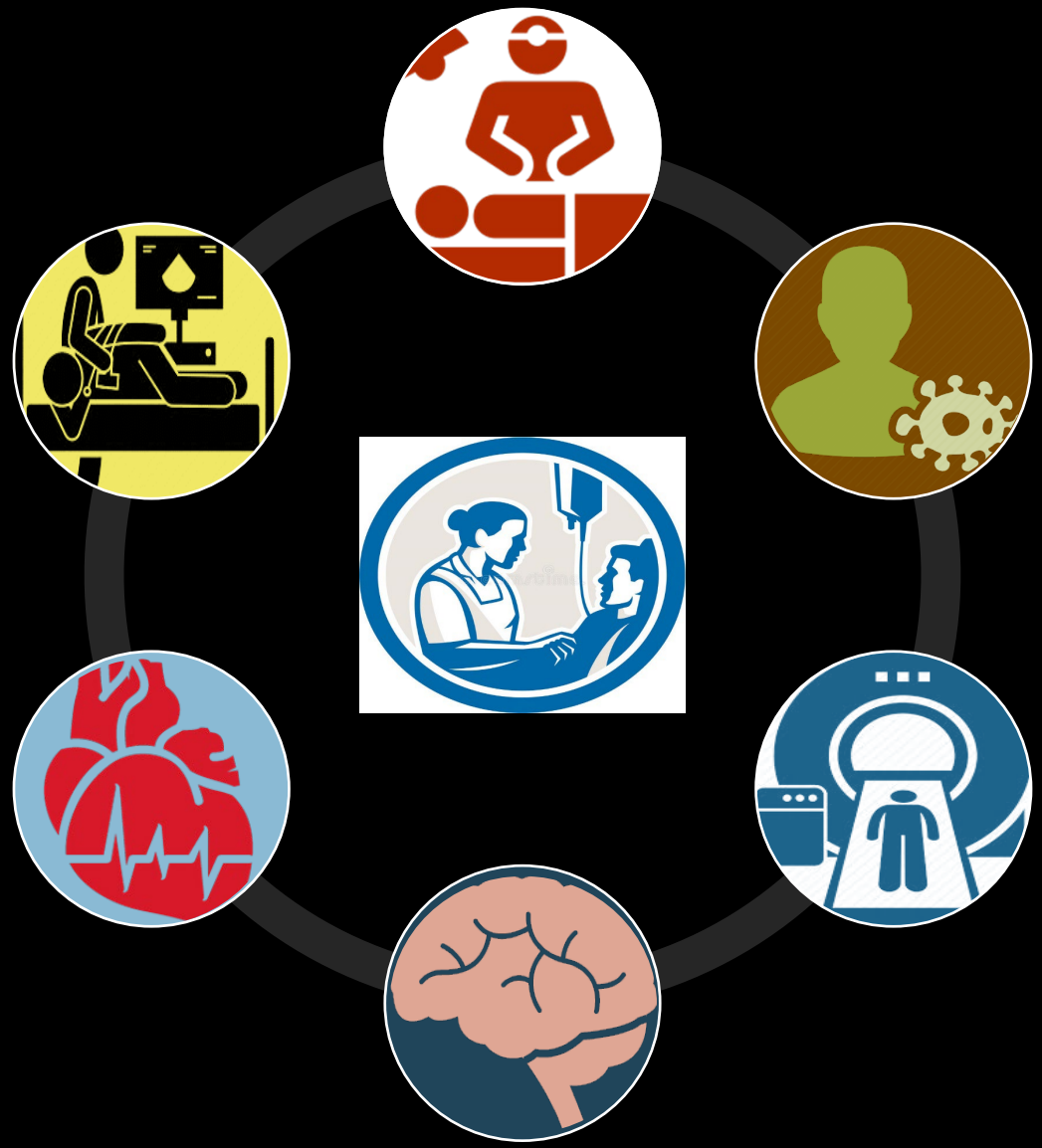
How can we do better?


Transfer Delay
Delayed diagnosis at OSH
Bed shortage at MM
Patient acuity not accurately conveyed via telephone
Patient transferred to general medicine rather than cardiology or CT surgery
Delayed/No Surgical Eval
Primary team does not recognize surgical indication
Patient felt to be poor surgical candidate
Patient felt to be improving
Mid-level communication
Curbside rather than formal consult
Surgery Not Offered
High peri-operative mortality
Intravenous drug use
Complexity of surgery/surgeon experience
Lack of communication between ID and CT surgery
Increase in Mortality
Culture negative/atypical cases
TTE not ordered for suspicious organism
Difficulty obtaining/reliance on TEE
Inexperience of admitting team
Incomplete transfer records
Delayed Diagnosis
Patient not seen <24 hours after consult
Additional/repeat testing requested
OR availability
OR staff availability
Busy surgical service
Delayed Surgery
Surgical follow-up felt unnecessary or scheduled too far out
Cardiology not involved in case
ID follow-up only occurs at completion of antibiotics
Distance to Michigan Medicine
Patient receives primary medical care elsewhere
Lack of Follow-up

Dramatic Reduction in Infective Endocarditis-Related Mortality With a Management-Based Approach



Botellho-Nevers et al. Arch Intern Med. 2009.



2015 ESC Endocarditis Guideline

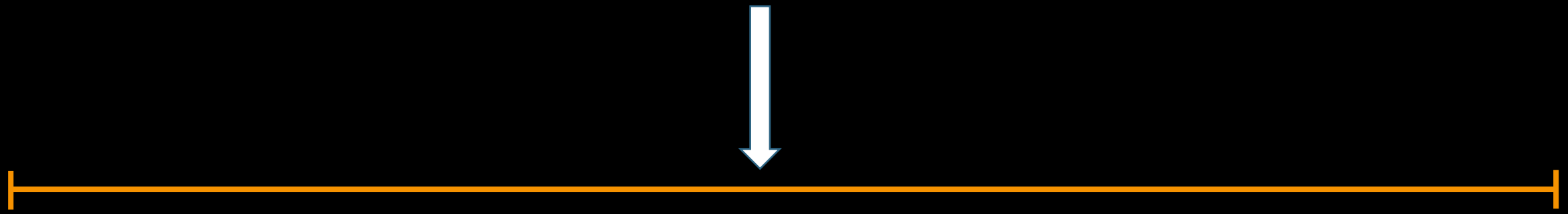
Role of the 'Endocarditis Team'

1. The 'Endocarditis Team' should have meetings on a regular basis in order to discuss cases, take surgical decisions, and define the type of follow-up.
2. The 'Endocarditis Team' chooses the type, duration, and mode of follow up of antibiotic therapy, according to a standardized protocol, following the current guidelines.
3. The 'Endocarditis Team' should participate in national or international registries, publicly report the mortality and morbidity of their centre, and be involved in a quality improvement programme, as well as in a patient education programme.
4. The follow-up should be organized on an outpatient visit basis at a frequency depending on the patient's clinical status (ideally at 1, 3, 6, and 12 months after hospital discharge, since the majority of events occur during this period[57]).

Multidisciplinary Endocarditis Team

December 2016 – Chart Review

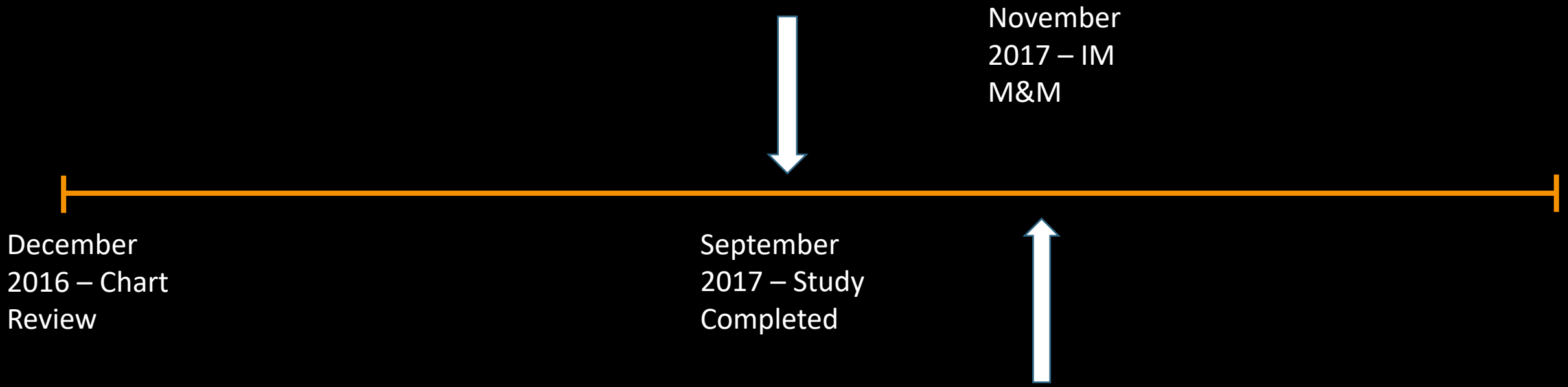
Multidisciplinary Endocarditis Team



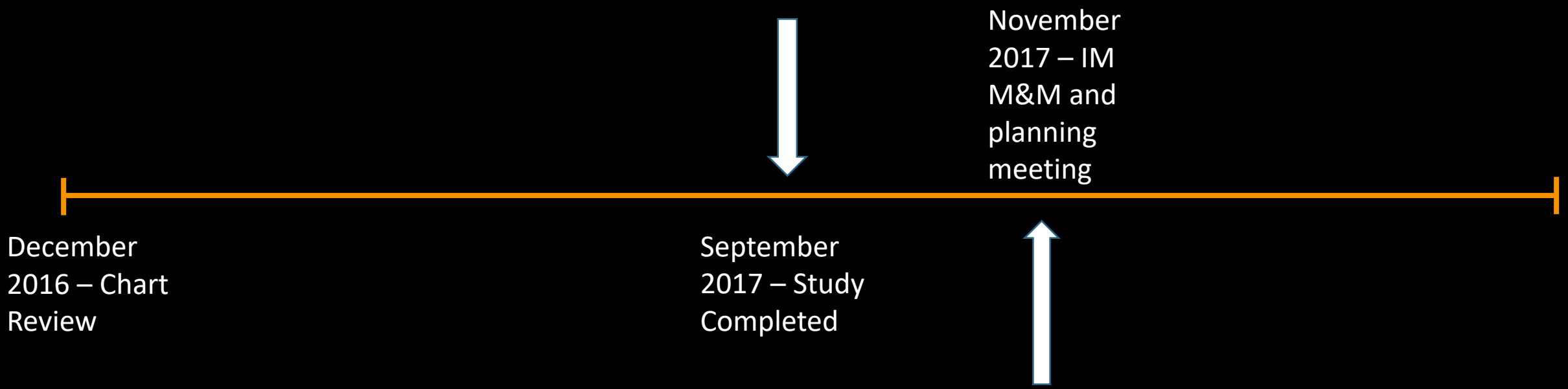
December 2016 – Chart Review

September 2017 – Study Completed

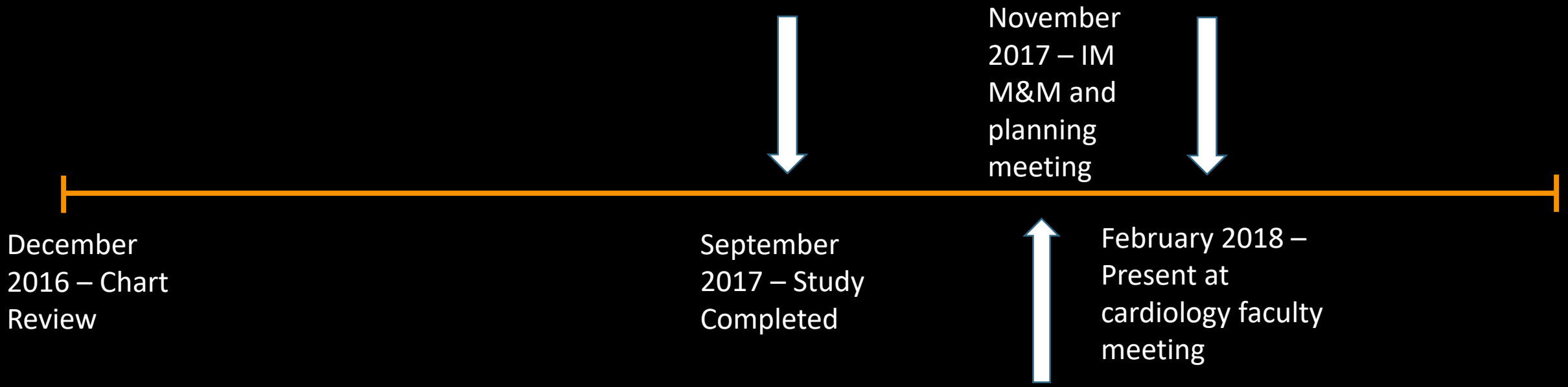
Multidisciplinary Endocarditis Team



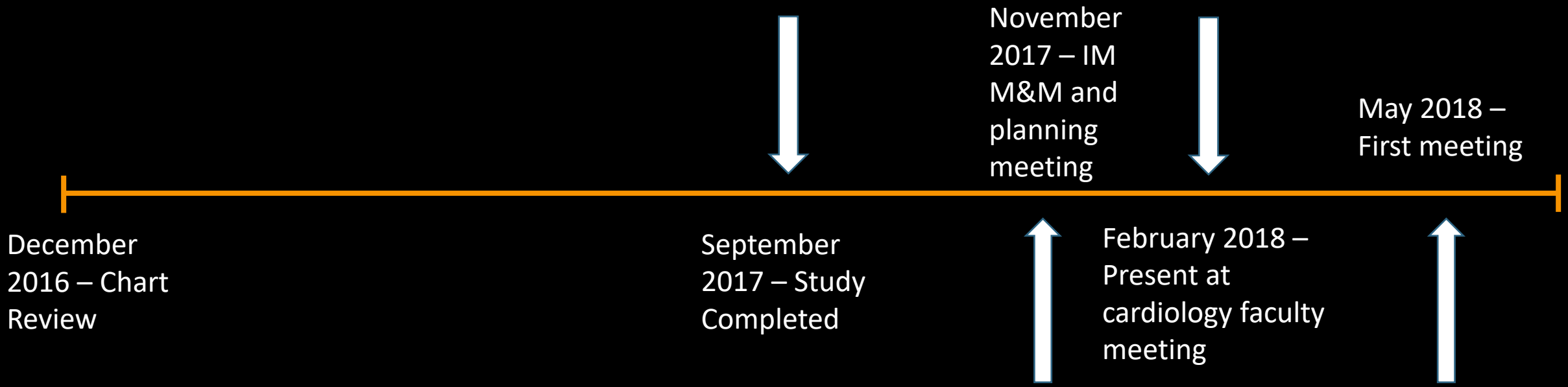
Multidisciplinary Endocarditis Team



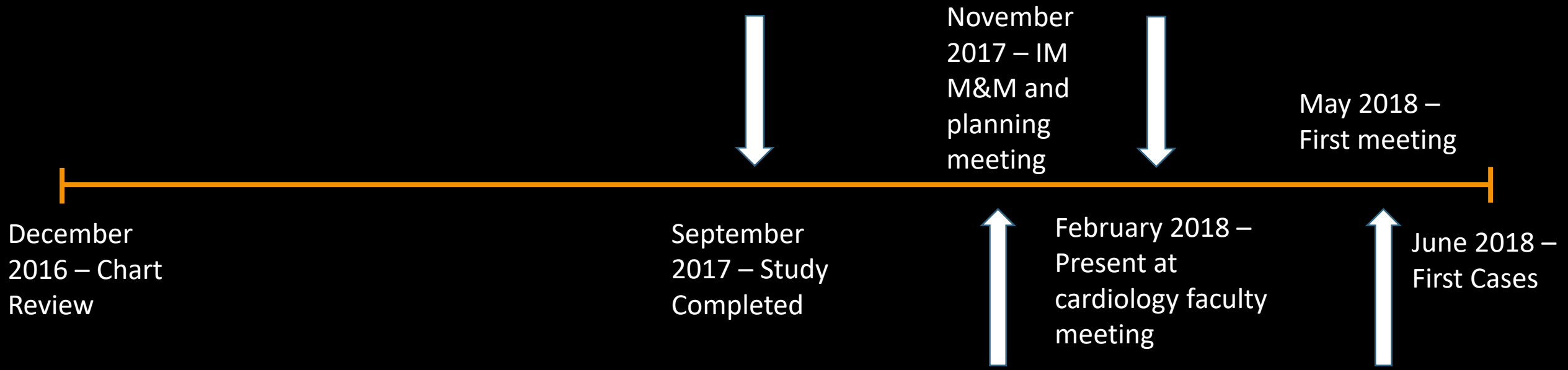
Multidisciplinary Endocarditis Team



Multidisciplinary Endocarditis Team



Multidisciplinary Endocarditis Team



Multidisciplinary Endocarditis Team

- Implemented June 14, 2018
  - 3 Infectious Diseases Specialists
  - 2 Cardiac Surgeons
  - 2 Cardiologists
  - 1 Stroke Neurologist
  - 1 Cardiac Surgery PA
  - 1 ID Pharmacist
    - Institutional Protocol Developed
    - Best Practice Advisory created in Epic encouraging cardiac surgery consultation for endocarditis patients

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ENDOCARDITIS DIAGNOSTIC AND MANAGEMENT ALGORITHM

Clinical Features Increasing Suspicion for Infectious Endocarditis (IE)

- Fever (90% pf patients)
- Heart Murmur (85% of patients)
- Systemic symptoms (anorexia, weight loss, night sweats)
- New stroke/neurologic deficits
- New bundle branch block
- New AV block of any degree
- New glomerulonephritis
- Cutaneous features of emboli/immunologic phenomenon
  1. Splinter hemorrhages
  2. Janeway lesions
  3. Osler's nodes)

Consider Early Surgery in Patients with IE

Class I Indications

- Valve dysfunction resulting in symptoms or signs of heart failure.
- IE caused by fungal or highly resistant organisms (eg, vancomycin-resistant Enterococcus, multidrug-resistant Gram-negative bacilli)
- IE complicated by heart block, annular or aortic abscess, or destructive penetrating lesions
- Evidence of persistent infection (manifested by persistent bacteremia or fever lasting >5-7 days and provided that other sites of infection and fever have been excluded) after the start of appropriate antimicrobial therapy

Class IIa indications

- Recurrent emboli and persistent or enlarging vegetations despite appropriate antibiotic therapy
- Severe valve regurgitation and mobile vegetations >10 mm

Class IIb indications

- Mobile vegetations >10 mm, particularly when involving the anterior leaflet of the mitral valve and associated with other relative indications for surgery

Risk factors for Infectious Endocarditis

- Prior IE
- Intravenous drug use (IVDU)
- Prosthetic valve
- Implantable cardiac device
- Indwelling central venous access
- Hemodialysis patients
- Poor dentition
- Bicuspid aortic valve
- Transplanted heart with valvulopathy
- Unrepaired cyanotic congenital heart disease or recently repaired with prosthetic material in the last 6 months or repaired cyanotic heart disease with prosthetic material and residual shunt

Typical Organisms in Native Valve IE

- Staph Aureus (both MSSA and MRSA)
- Enterococci
- Viridans Streptococci
- Streptococcus Gallolyticus
- HACEK Species

When to Evaluate a Patient for Infectious Endocarditis

Any patient for whom the provider has clinical suspicion for IE
Any patient that has ≥2 clinical features
Any patient with a typical organism (see above)

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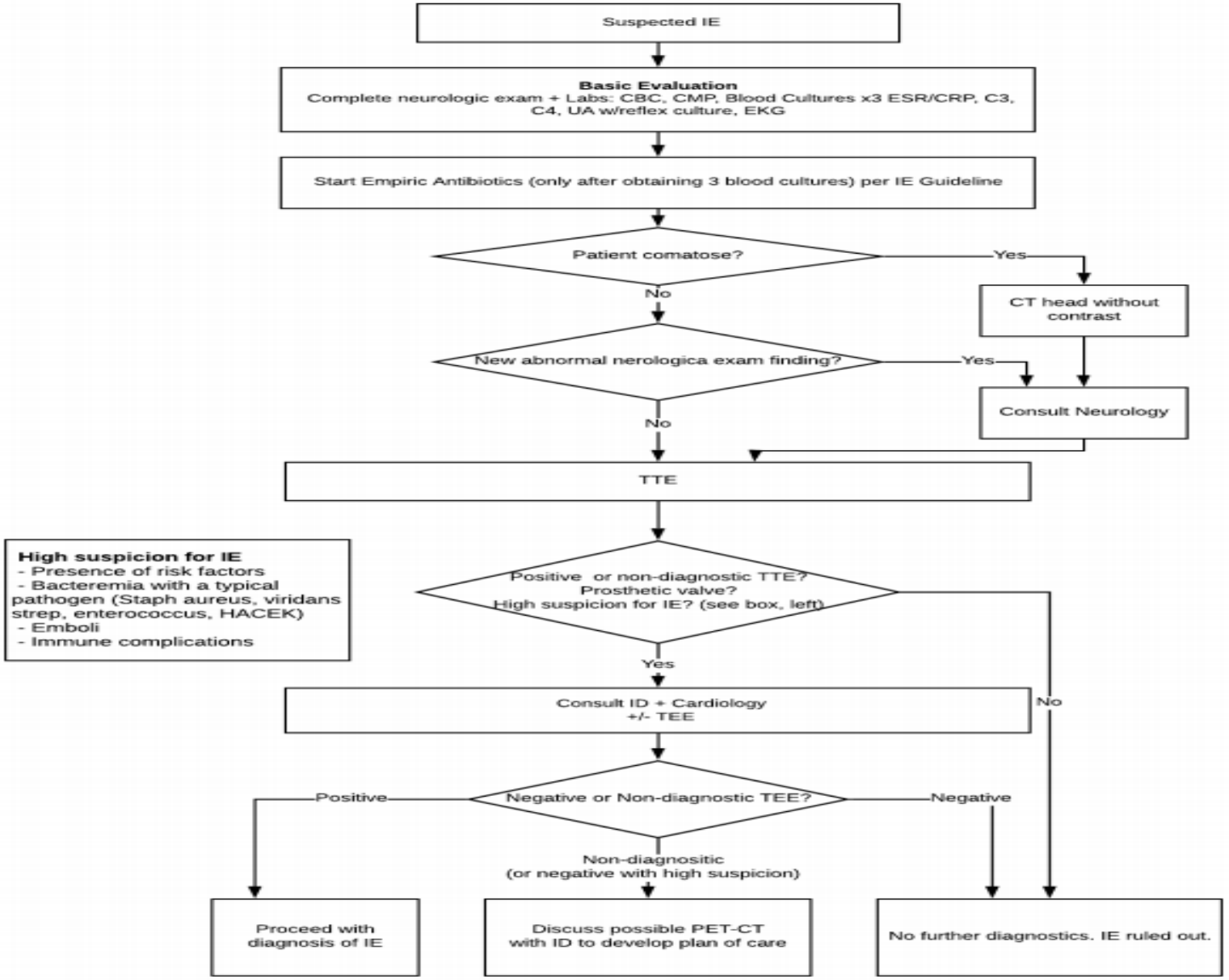

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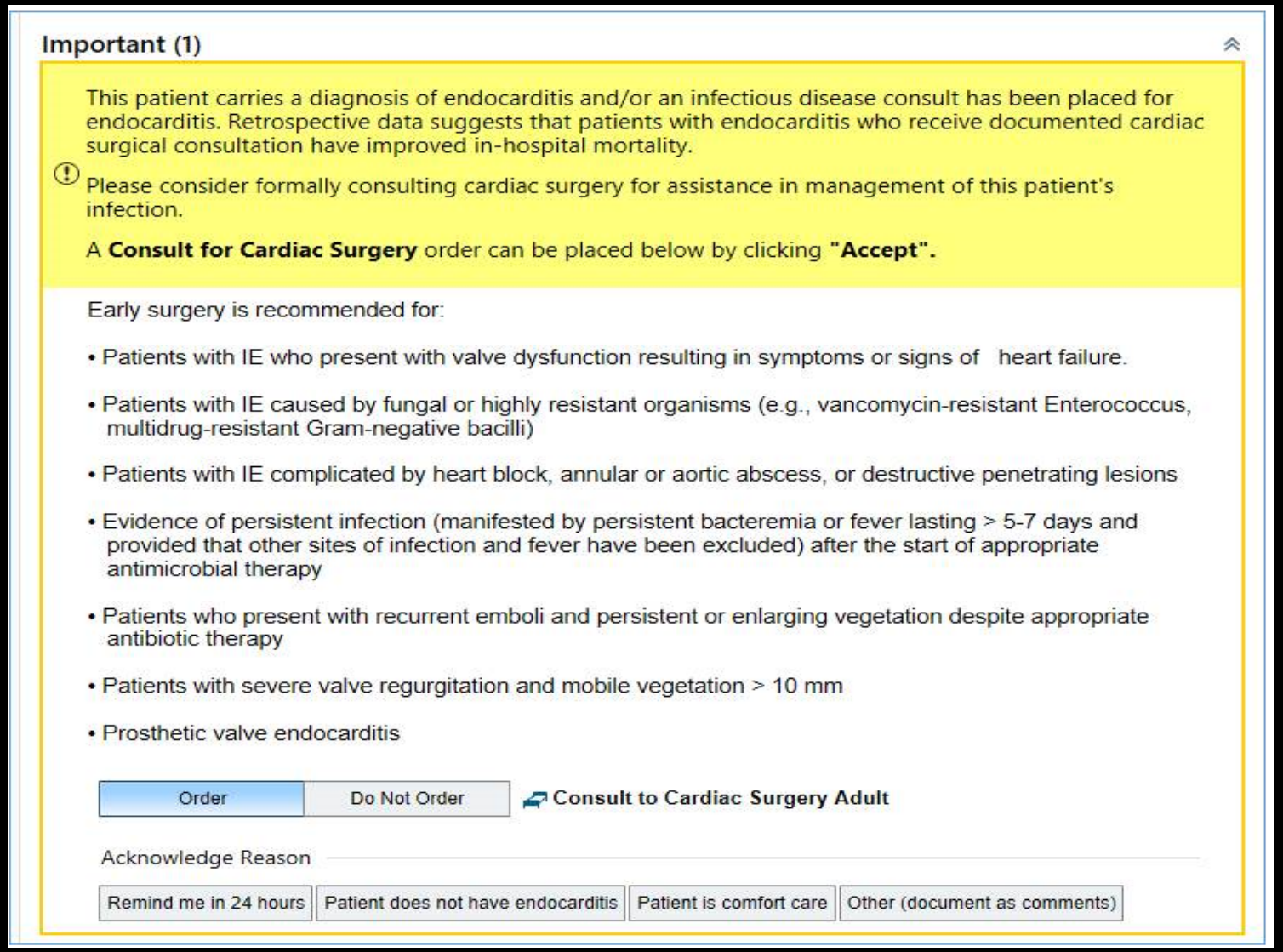
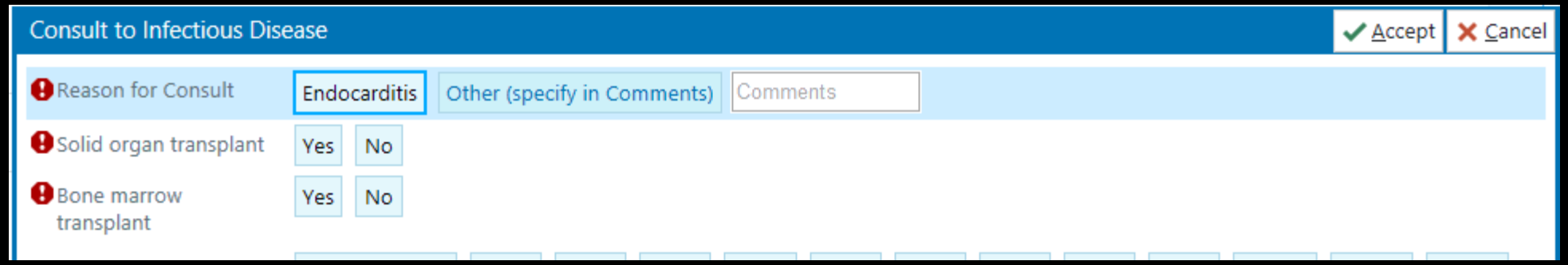
Best Practice Advisory



ID Consult Order



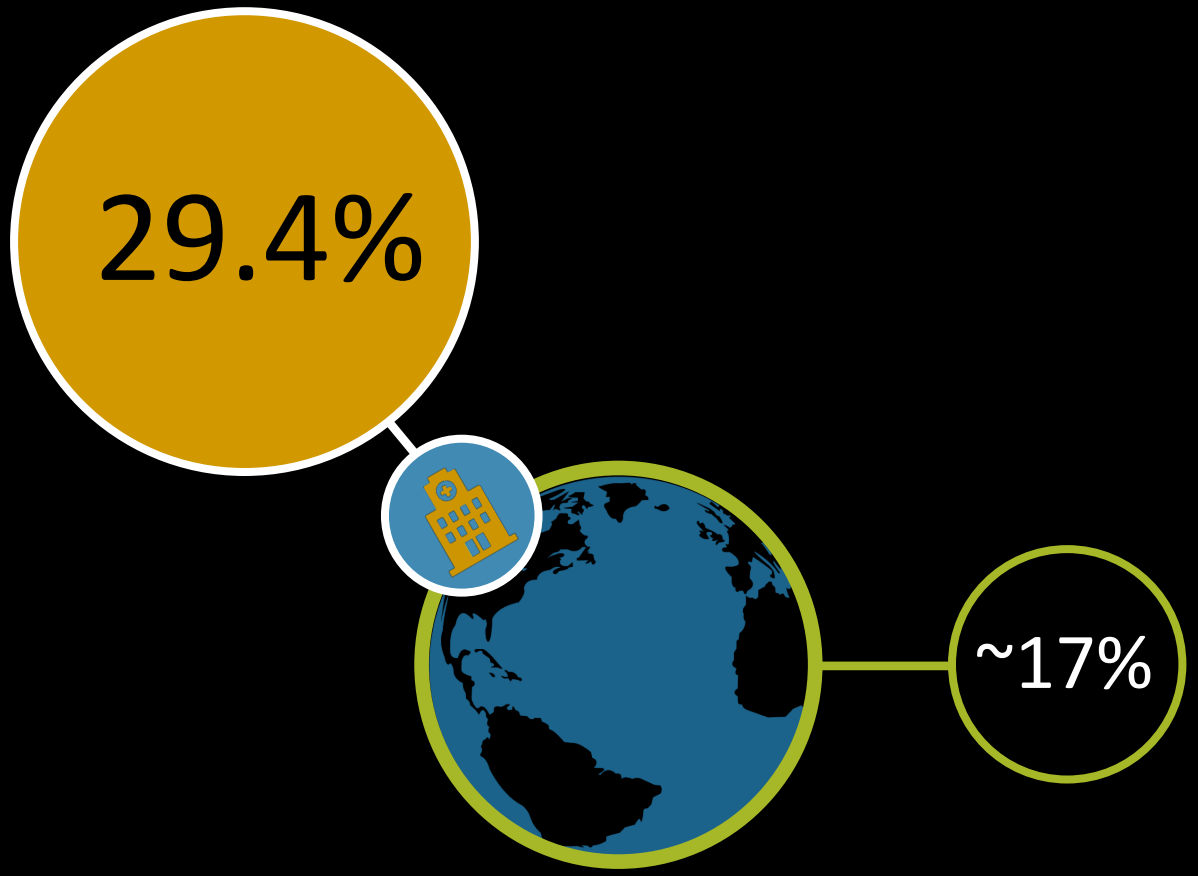
Medication Assisted Therapy in ID Clinic

- June 2019
  - Two ID providers obtained their DEA Waivers to prescribe MAT
  - Partnered with inpatient psychiatry consult service and Michigan Opioid Collaborative to develop a plan for ID providers to serve as a bridge for PWID and infectious complications interested in MAT

Multidisciplinary Endocarditis Team

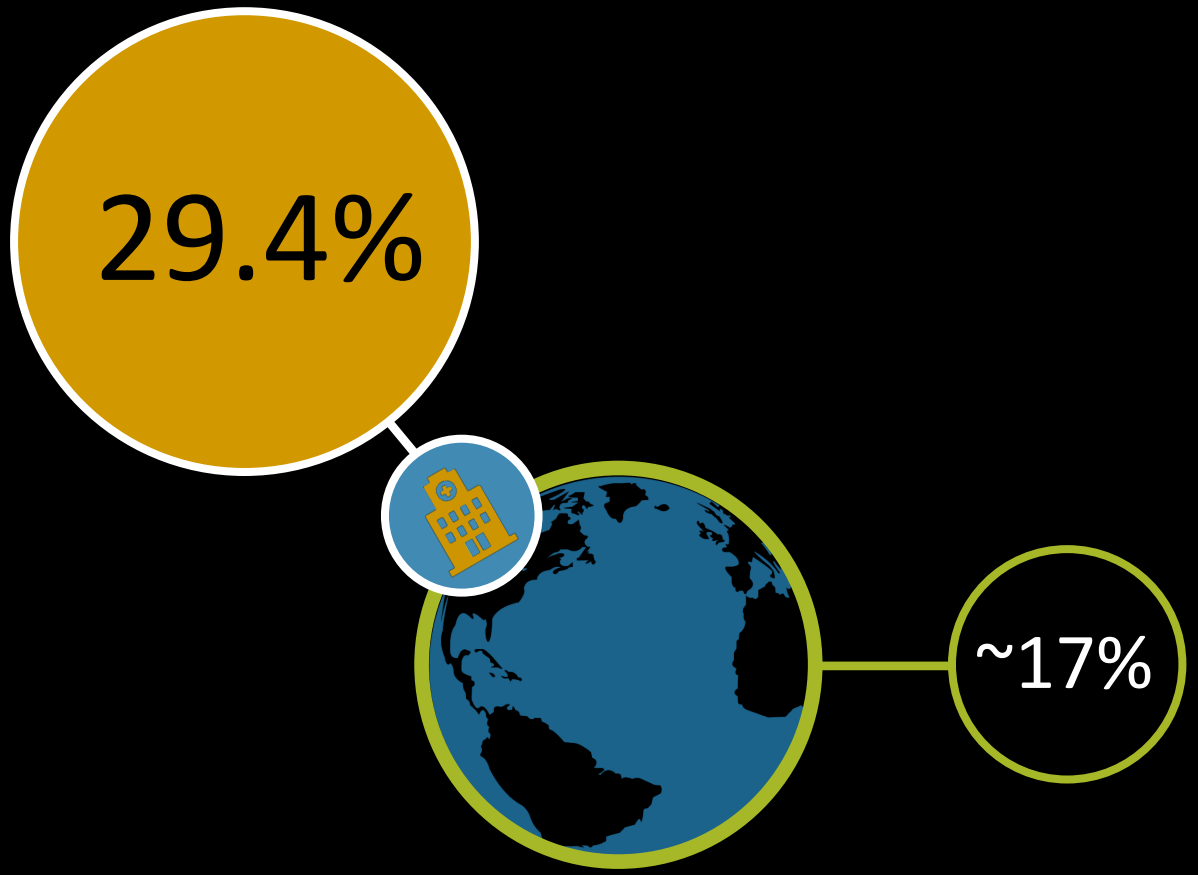
- Implemented June 14, 2018
  - As of June 13, 2019
    - 119 discussed cases

Infective Endocarditis Mortality



2015

Infective Endocarditis Mortality



2015

2019

Overall Outcomes

Patient Outcome	2018-2019 (n=119)
Total Inpatient mortality, % (n)	7.6 (9)

Overall Outcomes

Patient Outcome	2018-2019 (n=119)
Definite IE, % (n)	64.7 (77)
Definite IE mortality, % (n)	5.2 (4)
Total Inpatient mortality, % (n)	7.6 (9)

Overall Outcomes

Patient Outcome	2018-2019 (n=119)
Definite IE, % (n)	64.7 (77)
Definite IE mortality, % (n)	5.2 (4)
Possible IE, % (n)	32.8 (39)
Possible IE mortality, % (n)	10.3 (4)
Total Inpatient mortality, % (n)	7.6 (9)

Definite Endocarditis with Surgical Indication Outcomes

Variable	2014 - 2015	2018-2019	P-Value
Definite IE and Surgical Indications (n)	68	56	
Inpatient Mortality (%, n)	29.4	7.1 (4)	<0.0001

Definite Endocarditis with Surgical Indication Outcomes

Variable	2014 - 2015	2018-2019	P-Value
Definite IE and Surgical Indications (n)	68	56	
Inpatient Mortality (%, n)	29.4	7.1 (4)	<0.0001
Surgery Performed (%)	41	55.4	0.12
Average time from admission to surgery (days)	14	11.4	0.29

Definite Endocarditis with Surgical Indication Outcomes

Variable	2014 - 2015	2018-2019	P-Value
Definite IE and Surgical Indications (n)	68	56	
Inpatient Mortality (%, n)	29.4	7.1 (4)	<0.0001
Surgery Performed (%)	41	55.4	0.12
Average time from admission to surgery (days)	14	11.4	0.29
Average length of hospital stay prior to Cardiac Surgery consult (days)	7.1	2	<0.0001

Definite Endocarditis with Surgical Indication Outcomes

Mortality	2014-2015 (n=68)	2018-2019 (n=56)	P-Value
Overall, % (n)	29.4 (20)	7.1 (4)	<0.0001
Medical Management, % (n)	45 (18)	16 (4)	0.02
Surgical Management, % (n)	7.1 (2)	0 (0)	0.13

Surgery for Active Endocarditis

Academic Year	Active Endocarditis Surgical Cases
Annual Average (2014-2018)	35.75
2018-2019	52

Microbiologic Diagnoses

Microorganism	2014-2015 (n = 68)	2018-2019 (n = 56)	P-Value
MSSA, % (n)	14.7 (10)	26.8 (15)	0.10
MRSA, % (n)	10.3 (7)	10.7 ((6)	0.94
Coagulase Negative Staphylococcus, % (n)	10.3 (7)	5.4 (3)	0.32
Viridans Streptococcus, % (n)	17.6 (12)	23.2 (13)	0.44
Group B Streptococcus, % (n)	4.4 (3)	5.4 (3)	0.80
Enterococcus, % (n)	10.3 (7)	10.7 (6)	0.94
Fungal, % (n)	10.3 (7)	1.8 (1)	0.06
Polymicrobial, % (n)	8.8 (6)	3.6 (2)	0.24
Culture Negative, % (n)	4.4 (3)	5.4 (3)	0.80
Other, % (n)	8.8 (6)	7.1 (4)	0.73

Patient Variables

Variable	2014-2015 (n = 68)	2018-2019 (n = 56)	P-value
Average Age (years)	57.5	50.7	0.02
Male Gender, % (n)	60.3 (41)	62.5 (35)	0.80
OSH Transfers, % (n)	65.7 (44)	60.7 (34)	0.57
Average Days to Transfer	8.5	8.7	0.90
IV Drug Use, % (n)	14.7 (10)	14.3 (8)	0.95
Diabetes	26.5 (18)	16.1 (9)	0.16
ESRD	16.2 (11)	14.3 (8)	0.77
Acute Renal Failure	16.2 (11)	0 (0)	0.002
Prosthetic Valve, % (n)	51.5 (35)	28.6 (16)	0.01
Presence of CIED, % (n)	13.2 (9)	12.5 (7)	0.91
Aortic Valve Involvement	52.9 (39)	57.1 (32)	0.64
Mitral Valve Involvement	42.6 (29)	44.6 (25)	0.82
Cerebral Emboli, % (n)	27.9 (19)	50 (28)	0.01

Patient Variables

Variable	2014-2015 (n = 68)	2018-2019 (n = 56)	P-value
ICU Admission, % (n)	48.5 (33)	64.3 (36)	0.08
Vasopressor Requirement, % (n)	34.3 (23)	39.3 (22)	0.57
Mechanical ventilation, % (n)	29.9 (20)	55.4 (31)	0.004
Heart Failure from IE, % (n)	48.5 (33)	50.0 (28)	0.87
IE Complicated by Heart Block/Abscess, % (n)	26.5 (18)	23.2 (13)	0.67
Persistent Bacteremia, % (n)	7.4 (5)	16.1 (9)	0.13
Recurrent Emboli, % (n)	42.6 (29)	26.8 (15)	0.07
Vegetation >10 mm, % (n)	29.4 (20)	32.1 (18)	0.75
Mean STS Risk Score, %	11.8	9.8	0.40

Combined Cohort Regression Analysis for Predictors of In-Hospital Mortality

Variable	Estimate	Standard Error	Z-Value	P-Value
Age	-0.0237	0.018	-1.62	0.11
Gender	-1.055	0.582	-1.81	0.07
Diabetes	-1.210	0.572	-2.12	0.03
Prosthetic Valve	-0.754	0.526	-1.43	0.15
Heart Failure	-0.956	0.521	-1.83	0.07
Vasopressor	0.37	0.735	0.50	0.51
Mechanical Ventilation	-0.587	0.721	0.82	0.42
ICU Admission	-1.345	0.803	-1.68	0.09
Year	1.70	0.547	3.28	0.001

Propensity Matched Analysis

Outcome	2014-2015	2018-2019	t-statistic
Overall In-hospital Mortality, %	34	5.7	-2.91
Medical Management In-Hospital Mortality, %	52.2	13	2.39
Surgical Management In-Hospital Mortality, %	0	0	N/A
Patients Managed Surgically, %	37.8	56.7	1.63
Time to Surgery (days)	11.57	11.64	0.02

Multidisciplinary Endocarditis Team

- Changes in plan of care based upon involvement of Multidisciplinary Endocarditis Team

Change in Plan of Care	Proportion of case (n=56)
Any change	83.9 (47)
Change in antibiotic plan	62.5 (35)
Change in surgical planning	21.4 (12)
Recommended TEE	16.1 (9)
Recommended additional neurologic imaging	7.1 (4)
Recommended additional infectious work-up	7.1 (4)
Recommended other additional diagnostic imaging	23.2 (13)

Multidisciplinary Endocarditis Team

The Clinical Impact of Implementation of a Multidisciplinary Endocarditis Team

Sami El-Dalati, MD • Daniel Cronin, MD • James Riddell IV, MD • ... Matthew Romano, MD • Bo Yang, MD, PhD • George Michael Deeb, MD • Show all authors

The Patient

71 year old man

Chief Complaint: Fevers

PMH/PSH

- 3v Coronary artery disease
- NASH cirrhosis
- PVT
- HCC s/p RFA (2014)
- Type II Diabetes
- Pancytopenia
- TIA (2016)
- Back surgery
- Cataract surgery

PMH/PSH

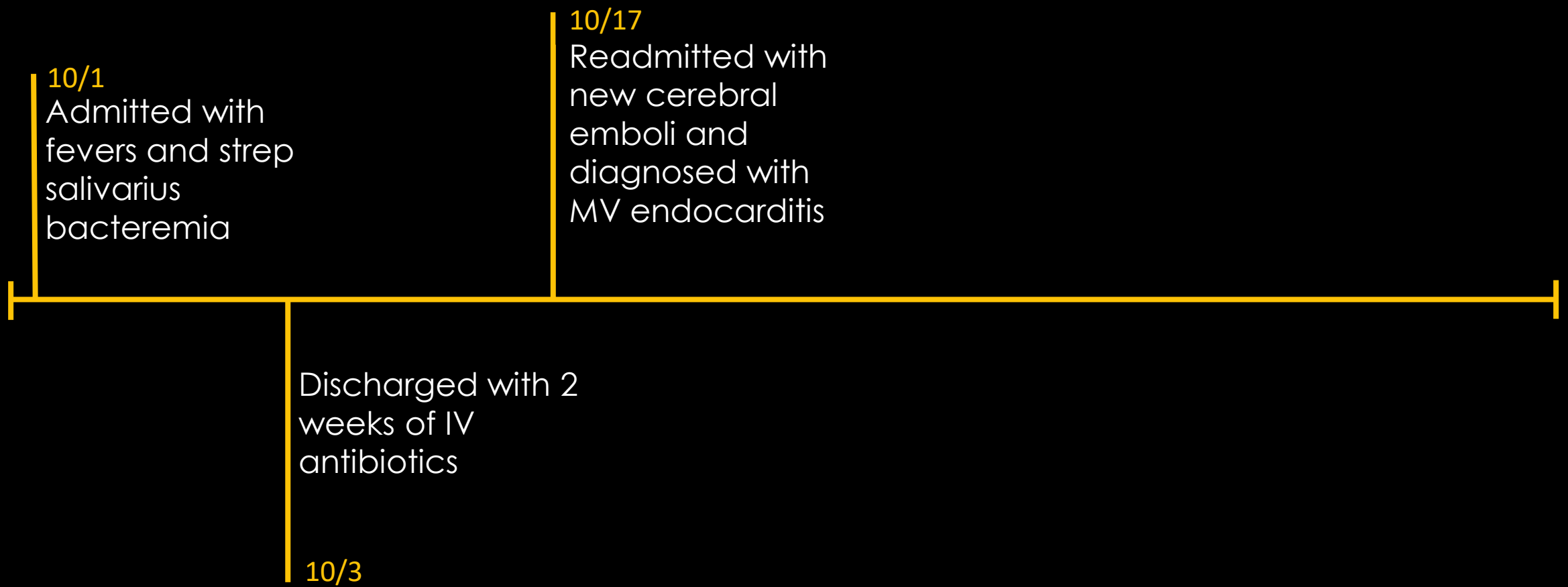
- 3v Coronary artery disease
- NASH cirrhosis
- PVT
- HCC s/p RFA (2014)
- Type II Diabetes
- Pancytopenia
- TIA (2016)
- Back surgery
- Cataract surgery

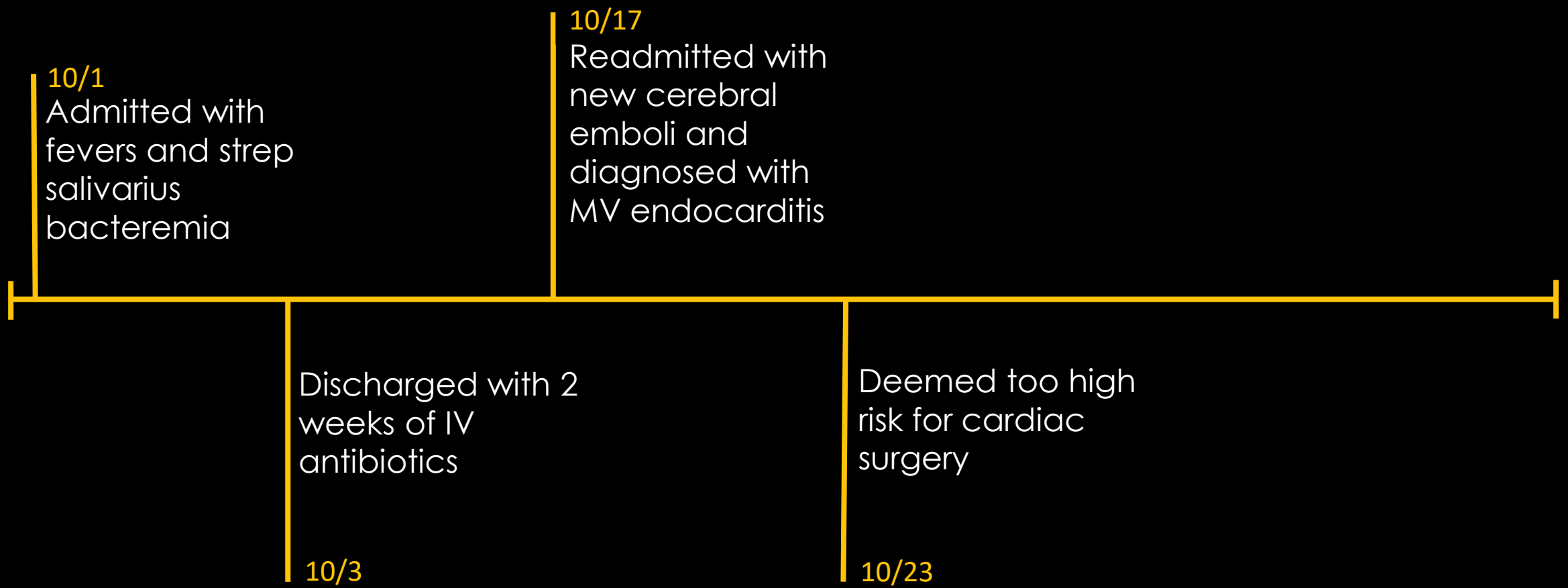
Medications

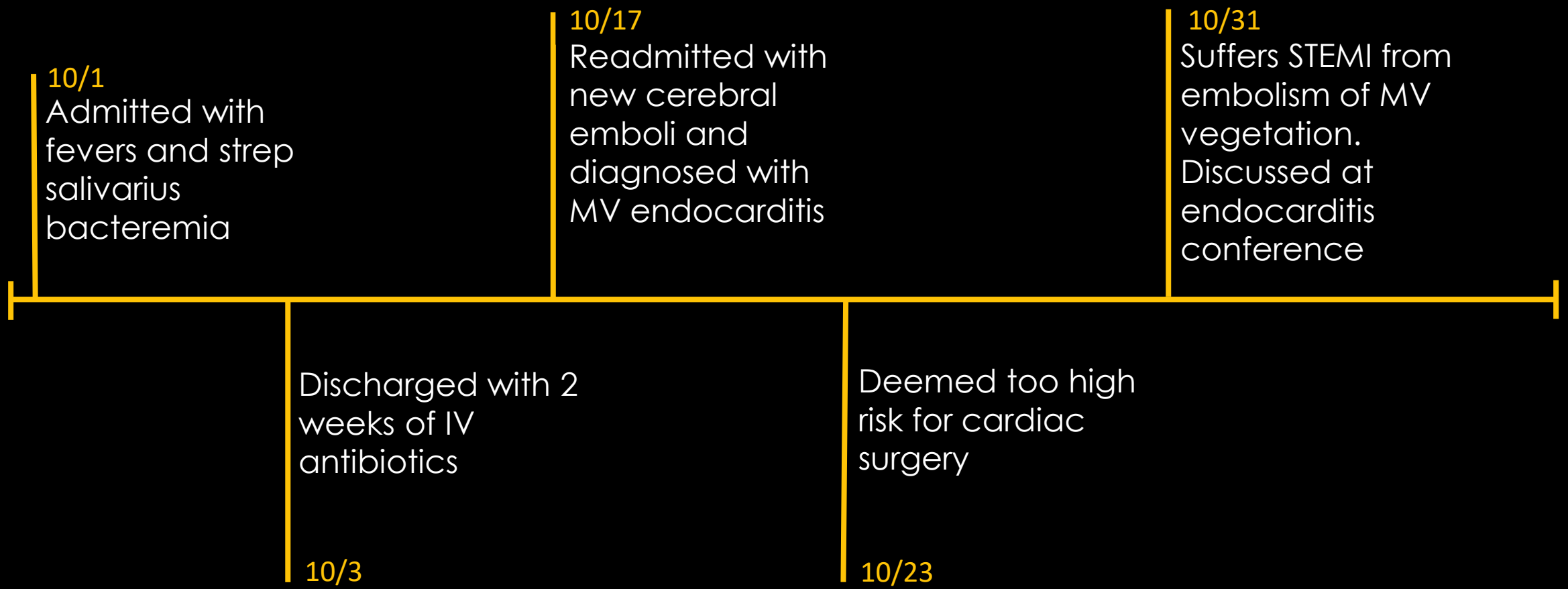
- Captopril 50 mg daily
- Ferrous Sulfate 325 mg QOD
- Finasteride 5 mg daily
- Glipizide 5 mg daily
- Metformin 1000 mg BID
- Omeprazole 20 mg daily
- Tamsulosin 0.4 mg daily

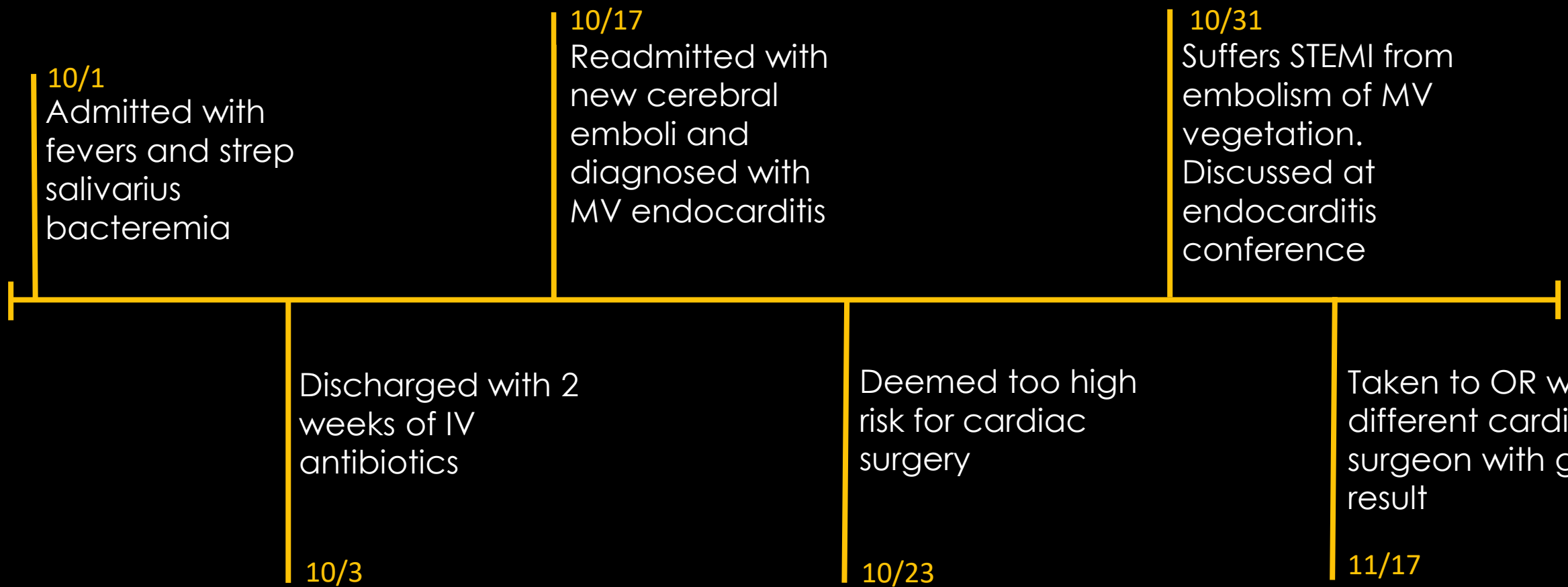
10/1
Admitted with fevers and strep salivarius bacteremia


10/1
Admitted with fevers and strep salivarius bacteremia
Discharged with 2 weeks of IV antibiotics
10/3


10/1
Admitted with fevers and strep salivarius bacteremia
10/17
Readmitted with new cerebral emboli and diagnosed with MV endocarditis
Discharged with 2 weeks of IV antibiotics
10/3


10/1
Admitted with fevers and strep salivarius bacteremia
10/3
Discharged with 2 weeks of IV antibiotics
10/17
Readmitted with new cerebral emboli and diagnosed with MV endocarditis
10/23
Deemed too high risk for cardiac surgery


10/1
Admitted with fevers and strep salivarius bacteremia
10/3
Discharged with 2 weeks of IV antibiotics
10/17
Readmitted with new cerebral emboli and diagnosed with MV endocarditis
10/23
Deemed too high risk for cardiac surgery
10/31
Suffers STEMI from embolism of MV vegetation. Discussed at endocarditis conference


10/1
Admitted with fevers and strep salivarius bacteremia
10/3
Discharged with 2 weeks of IV antibiotics
10/17
Readmitted with new cerebral emboli and diagnosed with MV endocarditis
10/23
Deemed too high risk for cardiac surgery
10/31
Suffers STEMI from embolism of MV vegetation. Discussed at endocarditis conference
11/17
Taken to OR with different cardiac surgeon with good result

Research Opportunities

Additional Research

Original Article | Published: 14 December 2019

Physician perceptions of a multidisciplinary endocarditis team

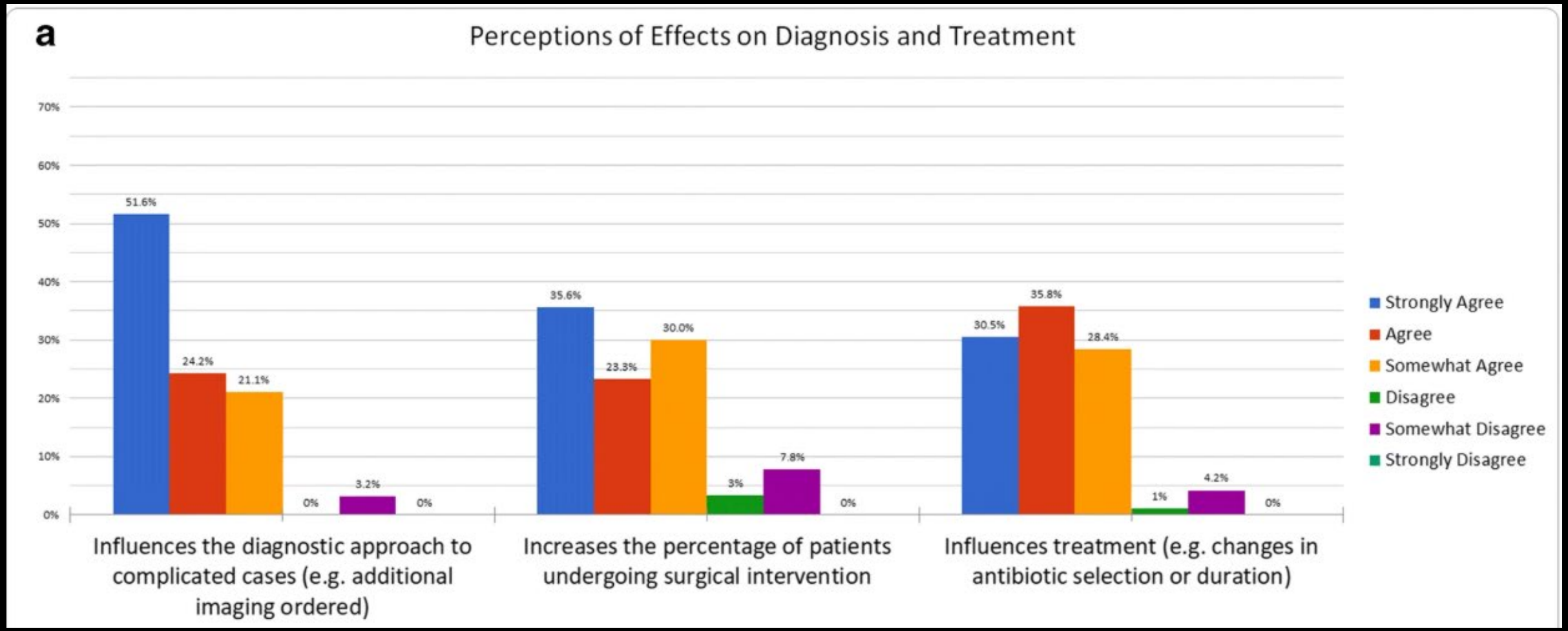
Sami El-Dalati ✉, Irina Khurana, Nathaniel Soper, Daniel Cronin, Michael Shea, Richard L. Weinberg, James Riddell IV, Laraine Washer, Emily Shuman, James Burke, Sadhana Murali, D. Alexander Perry, Christopher Fagan, Twisha Patel, Kirra Ressler & George Michael Deeb

European Journal of Clinical Microbiology & Infectious Diseases **39**, 735–739(2020) | Cite this article

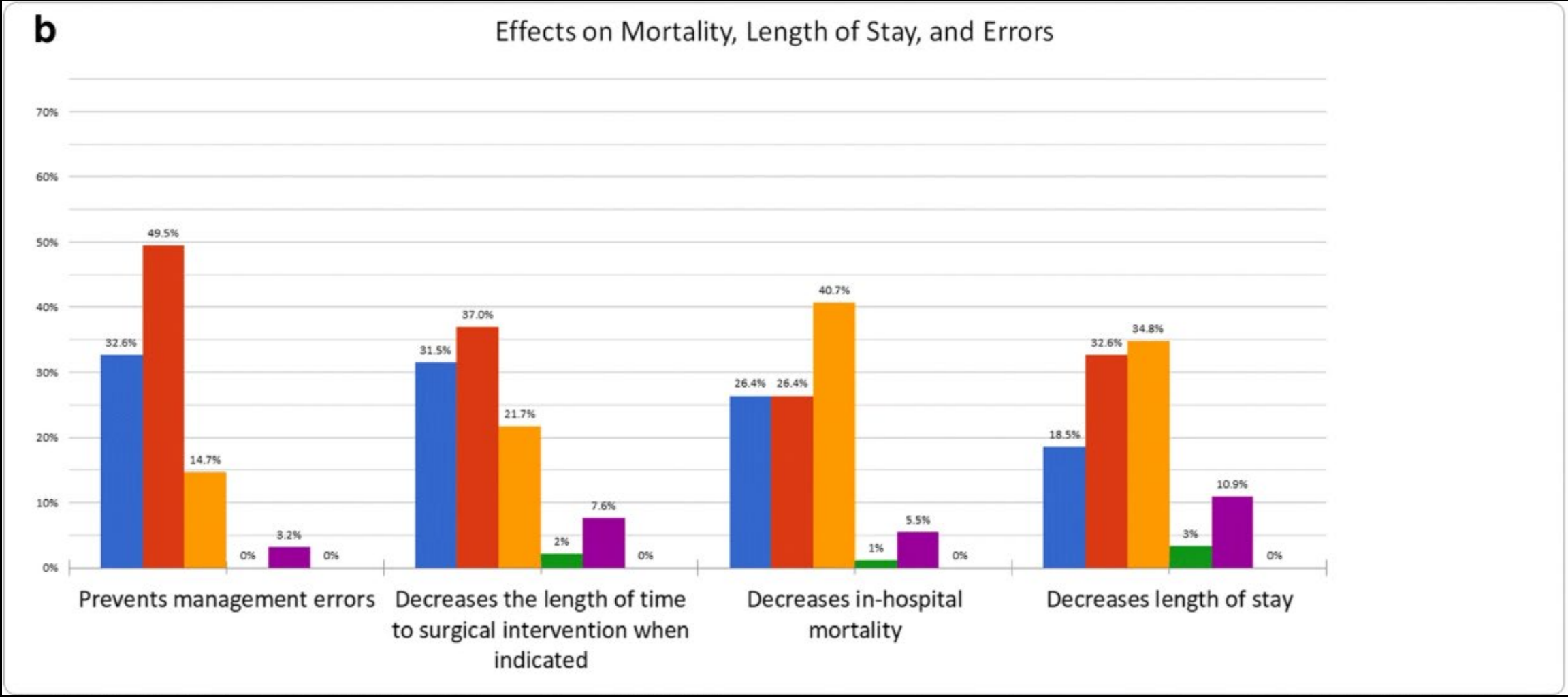
Additional Research

Specialty	**Number of responses**	**% of total responses**	**Response rate (%)**
Cardiac surgery	6	5%	6/24 (25%)
Cardiology	28	22%	28/104 (27%)
General internal medicine	73	58%	73/263 (28%)
Infectious diseases	19	15%	19/30 (63%)
Total	126	100%	126/421 (30%)
Level of training	**Number**		**% of respondents**
Faculty	71		56%
Fellow	4		3%
Intern	19		15%
Resident	32		26%

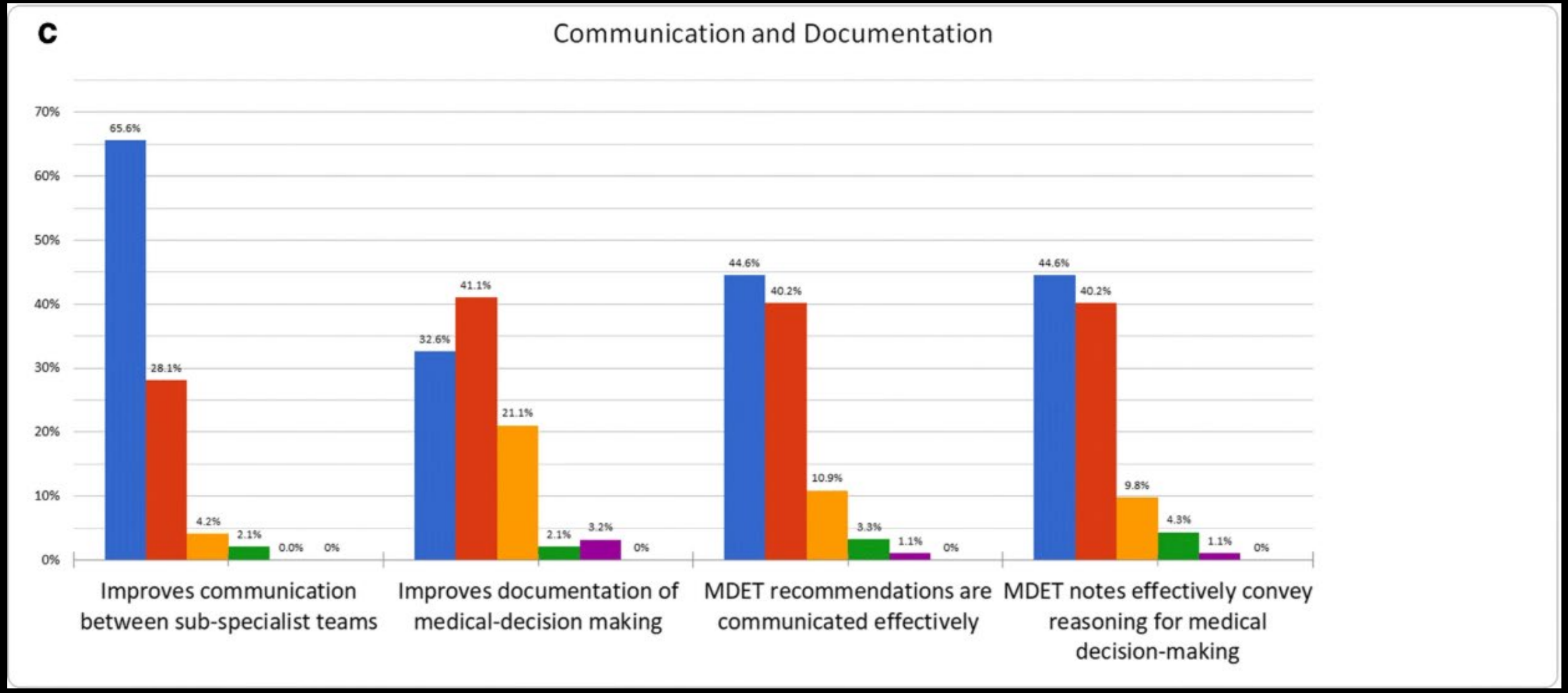
Additional Research



Additional Research



Additional Research



Additional Research

Brief Report | Published: 04 September 2019

Correlating cardiac F-18 FDG PET/CT results with intra-operative findings in infectious endocarditis

Sami El-Dalati MD, Venkatesh L. Murthy MD, PhD, Anna B. Owczarczyk MD, PhD, Christopher Fagan MD, James Riddell IV MD, Sandro Cinti MD & Richard L. Weinberg MD, PhD

Journal of Nuclear Cardiology (2019) | Cite this article

Additional Research

ORIGINAL ARTICLES

The Clinical Impact of 16S Ribosomal RNA Polymerase Chain Reaction Bacterial Sequencing in Infectious Endocarditis

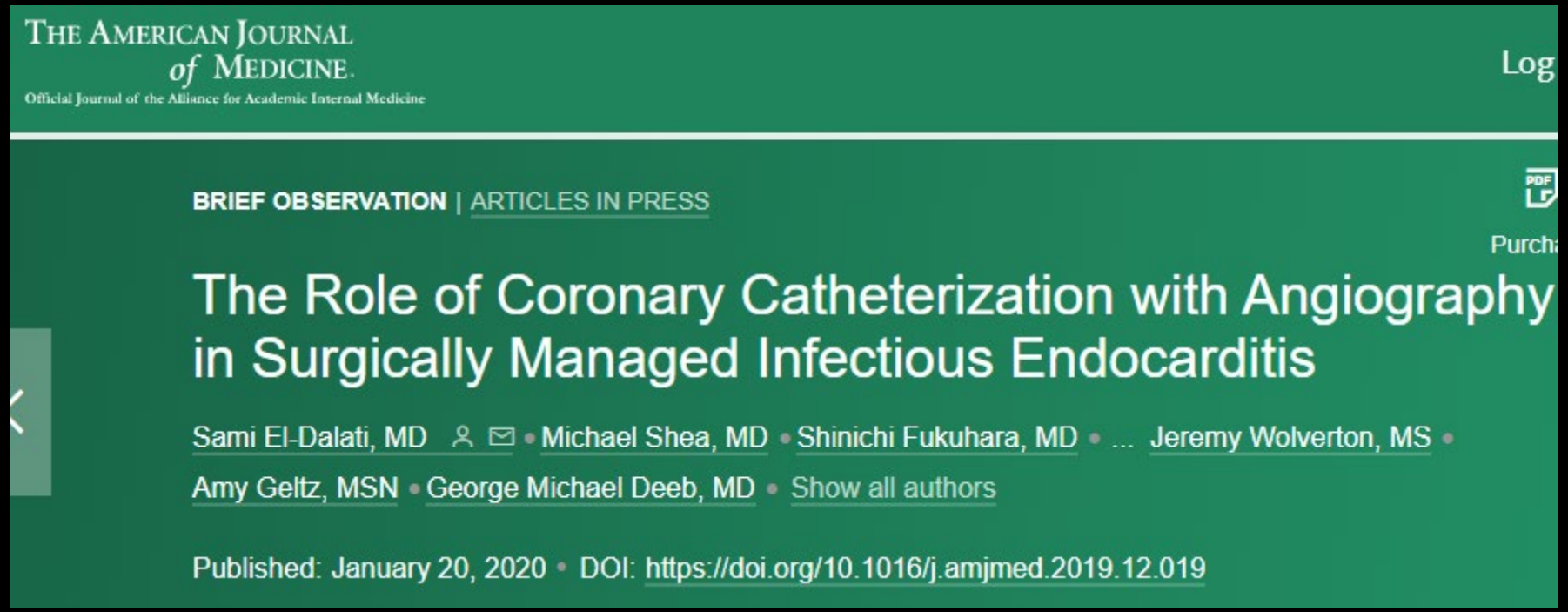
A Single Center Experience

El-Dalati, Sami MD*; Riddell, James IV MD*; Fagan, Christopher MD†; Owczarczyk, Anna B. MD, PhD‡; Fukuhara, Shinichi MD§; Wasylyshyn, Anastasia MD*; Patel, Twisha PharmD||; Cinti, Sandro MD*

Author Information

Infectious Diseases in Clinical Practice: May 2020 - Volume 28 - Issue 3 - p 138-141

Additional Research



THE AMERICAN JOURNAL of MEDICINE
Official Journal of the Alliance for Academic Internal Medicine

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BRIEF OBSERVATION | ARTICLES IN PRESS

Purcha

The Role of Coronary Catheterization with Angiography in Surgically Managed Infectious Endocarditis

Sami El-Dalati, MD • Michael Shea, MD • Shinichi Fukuhara, MD • ... Jeremy Wolverton, MS • Amy Geltz, MSN • George Michael Deeb, MD • Show all authors

Published: January 20, 2020 • DOI: https://doi.org/10.1016/j.amjmed.2019.12.019

Additional Research

Results

There were 430 patients who received coronary catheterization with angiography prior to surgical valve replacement for infectious endocarditis, and 168 patients proceeded to surgery without coronary angiography. Nine percent of patients underwent coronary artery bypass grafting at the time of valve replacement as a result of coronary angiography findings. There was no significant difference in 30-day mortality for patients with endocarditis who underwent coronary angiography when compared with those who did not receive coronary angiography (2.6 vs 2.4%; $P = 0.89$).

Additional Research

Conclusions

Left heart catheterization with coronary angiography prior to surgical valve replacement leads to coronary artery bypass grafting in the minority of infective endocarditis patients.

Additional Research

JAC-Antimicrobial Resistance
Education and research in antimicrobial stewardship and resistance

Oxacillin plus ertapenem combination therapy leads to rapid blood culture clearance and positive outcomes among patients with persistent MSSA bacteraemia: a case series

Sami El-Dalati ✉, Sanjay Sridaran, Marissa Uricchio, Ellen G Kline, Ryan Shields

JAC-Antimicrobial Resistance, Volume 3, Issue 3, September 2021, dlab148,

Additional Research

JAC - Antimicrobial Resistance
Education and research in antimicrobial stewardship and resistance

Partial oral antibiotic treatment of endocarditis in patients who inject drugs: a case series

Kaylie Miller, Emily Evans, Kathleen R. Sheridan, Varidhi Nauriyal, J. Alexander Viehman, Ryan Rivosecchi, Bobbi Jo Stoner, Sami El-Dalati

Additional Team Research

Heart Valve Infection Prevention Patient Card

MICHIGAN MEDICINE
UNIVERSITY OF MICHIGAN

- You are at increased risk for heart valve infection
- You should take antibiotics before certain procedures (see reverse)
- Show this card to your medical provider
- Please seek medical attention for:
  - Fevers (temperature>100.4 F or 38.0 C)
  - Unexplained chills or shakes
  - Night sweats
- Please ask your doctor to collect blood cultures for the above symptoms and before starting antibiotics

Additional Team Research

Heart Valve Infection Prevention Provider Card

- Antibiotic Prophylaxis against bacterial endocarditis is recommended for the following procedures
  - Dental cleanings, cavity fillings, tooth extractions, draining dental abscesses
  - Tonsillectomy and/or adenoidectomy
  - Bronchoscopy with biopsy
- Please consider obtaining 2 sets of blood cultures in this patient for
  - Unexplained febrile illness

    AND/OR
  - Before starting oral or IV antibiotics
- For questions please call the Michigan Medicine Infectious Diseases Clinic at 734-647-5899 or the Cardiac Surgery Clinic at 888-287-1082

Additional Work

ACADEMIC MEDICINE
Journal of the Association of American Medical Colleges
AAMC

INVITED COMMENTARY: PDF ONLY

The Importance of Being Earnest

El-Dalati, Sami MD; Cronin, Daniel MD **Author Information**

Academic Medicine: March 31, 2020 - Volume Publish Ahead of Print - Issue -

Additional Work

Therapeutic Advances in Infectious Disease

A step-by-step guide to implementing a multidisciplinary endocarditis team

Sami El-Dalati, Daniel Cronin, James Riddell IV, Michael Shea, Richard L. Weinberg, Emily Stoneman, Twisha Patel, Kirra Ressler and George Michael Deeb

UK Endocarditis Team

- Multidisciplinary team comprised of:
  - Cardiac Surgery
  - Cardiology
  - ACES
  - Infectious Diseases
  - Neurology
  - Neurosurgery
  - Pharmacy
  - Social work

- Meet weekly on Wednesday from 4-5 PM via Zoom
- Discuss all UK inpatients admitted with endocarditis

UK Endocarditis ID Consult Service

- Stand-alone Infectious Diseases Consult Service focusing on patients with endocarditis and cardiac device infections
  - Staffed with 1 attending and APP
  - Supported by:
    - Nurse navigator
    - Social worker
    - Pharmacist
  - Daily interdisciplinary rounds
  - Weekly meeting with oncoming attending to discuss antibiotic plans
- Opportunities for students, residents and fellows to rotate

UK Endocarditis Team

- Patient admitted to:
  - Hospital Medicine
  - Cardiology
  - Cardiac Surgery
  - Neurology
  - Neurosurgery

UK Endocarditis Team

- Consults to:
  - Infectious Diseases
  - Cardiac Surgery
  - +/- Addiction Medicine
  - +/- Neurology/Neurosurgery

- ID Endocarditis Service
  - Emails out list of patients 24 hours prior to all team members
  - Attending on service leads the multidisciplinary meeting

UK Endocarditis Team

- Advanced Practice Provider
  - Rounds and sees patients on the inpatient service
  - Provides continuity as attendings switch

UK Endocarditis Team

- Pharmacist
  - Assists with selection and dosing of antibiotic regimens
  - Reviews laboratory studies and adjusts antibiotics for OPAT patients
  - Development of oral antibiotic protocol
  - Assists with prior authorizations for oral antibiotics/long-acting glycopeptides
  - Works with nurse navigator to coordinate hepatitis C treatment

UK Endocarditis Team

- Nurse Navigator
  - Arranges follow-up appointments
  - Calls patients within 48 hours of discharge
  - Point of contact for patients after discharge
  - Calls patients for appointment reminders
  - Coordinates outpatient testing
  - Interfaces with nursing and support staff from other specialties
  - Works with pharmacist and specialty pharmacy to coordinate hepatitis C treatment

UK Endocarditis Team

- Social Worker
  - Sees inpatients and helps with transition of care to outpatient
  - Connects patients to ambulatory case management services
    - WRAP Program
      - Grant funded initiative that provides transportation assistance and substance use counseling for patients with infections related to substance use disorders
  - Assists with transportation resources for non-SUD patients

UK Endocarditis Team

- Multidisciplinary Outpatient Clinic
  - ID/Cardiac Surgery
  - Held one-half day per month (3rd Friday of the month)
  - Allows patients to see both providers at once
    - ID resources can be used to ensure transportation
  - Primary clinic for complex endocarditis patients requiring outpatient surgical evaluation

UK Endocarditis Team

- Outreach Clinic
  - Targeting high-need areas in Eastern Kentucky
  - Tentative start date of July 2023

Lessons Learned

- Sometimes it takes fresh faces to solve old problems. Our model of care had been stagnant for years but people had become so accustomed to its inefficiencies that they were indifferent to change until residents looked at the problem differently.

- Data is important, it gets your foot in the door, but it will only take you so far. Speak to people's humanity because it is the constant driver of why we all enter medicine.

- Identify a common goal for all stakeholders and create solutions around it.

Lessons Learned

- Have the courage to act without a guarantee of success.
- Ground your mission in your purpose so that you can stand resilient against obstacles and setbacks.
- The hope that things could change for the better became the foundation of that very change.

The hope that things could change for the better became the foundation of that very change.

Acknowledgments

- Elizabeth O'Donnell PhD
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- Cardiac Surgery: Michael Deeb MD, Kirra Ressler PA-C, Shinichi Fukuhara MD, Matthew Romano MD
- ID: Jamie Riddell MD, Dan Kaul MD, Laraine Washer MD, Emily Stoneman MD, Suzanne Bradley MD, Alex Perry MD
- Pharmacy: Twisha Patel PharmD
- Neurology: James Burke MD, Sadhana Murali MD
- Social Work: Karissa Canfield MSW

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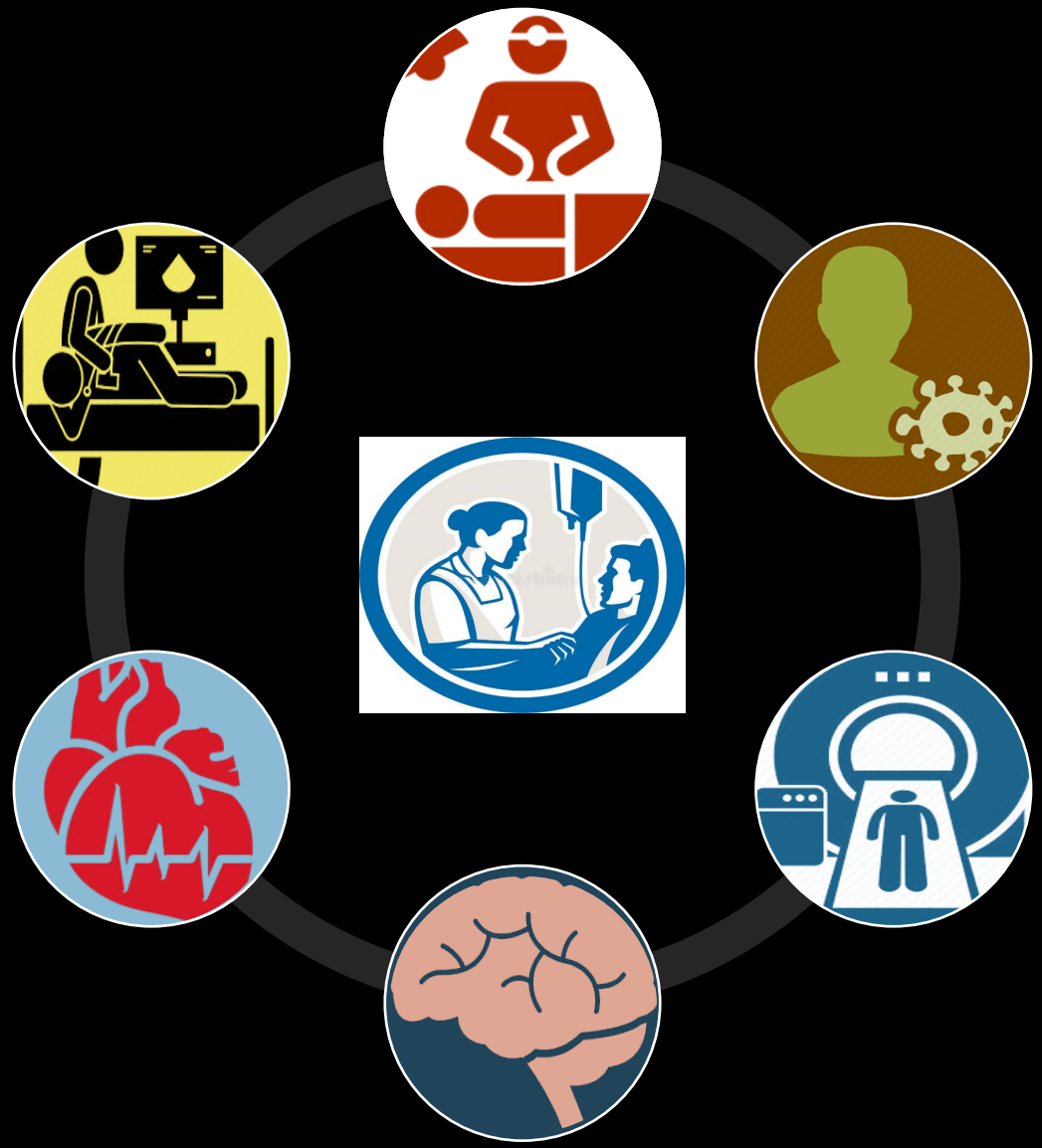

Questions?

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