

# T2 Magnetic Resonance Improves the Timely Management of Candidemia

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## Background

- Prompt initiation of antifungal therapy is the most important modifiable factor for patient outcomes of candidemia.
- Early detection of candidemia may be limited by current diagnostic methods. As part of an antimicrobial stewardship program quality improvement, our institution previously implemented guidelines advocating 2 serial 1,3-B-D glucan assays combined with blood culture for candidemia diagnosis.
- The T2 magnetic resonance (T2MR) assay detects the presence of candidemia from a whole blood sample within 3 to 5 hours. Five *Candida* species are detected and reported in 3 groups: *C. albicans/tropicalis*, *C. glabrata/krusei*, and *C. parapsilosis*.
- Our institution implemented T2MR in November 2015, replacing 2 serial 1,3-B-D glucan assays with a single T2MR in our institutional guideline for presumed candidiasis. The electronic medical record prompts prescribers to order T2MR when anidulafungin is prescribed.

## Methods

### Study Design

This was a single pre-test/post-test quasi experiment performed at Henry Ford Health-System, comprised of 4 hospitals throughout the Detroit metropolitan area. This study was approved by the Henry Ford Health System Institutional Review Board.

### Subjects

Patients diagnosed with candidemia by either T2MR, 1,3-B-D glucan or blood cultures between April 1, 2015 and May 6, 2016.

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> <li>Adult patients &gt; 18 years of age</li> </ul>	<ul style="list-style-type: none"> <li>Recurrent candidemia</li> </ul>
<ul style="list-style-type: none"> <li>First episode of candidemia</li> </ul>	<ul style="list-style-type: none"> <li>Infection with fungus or yeast other than <i>Candida</i> species</li> </ul>
<ul style="list-style-type: none"> <li>Diagnosed by one of the following three methods:               <ul style="list-style-type: none"> <li>T2MR</li> <li>Blood culture</li> <li>1,3-B-D glucan result <math>\geq</math> 200 pg/mL</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Another indication for antifungal therapy</li> <li>Patients receiving amphotericin B</li> <li>Death before time of first actionable result</li> <li>Comfort care or hospice designation at the time of first actionable diagnostic result</li> </ul>

### Data Collection and Endpoints

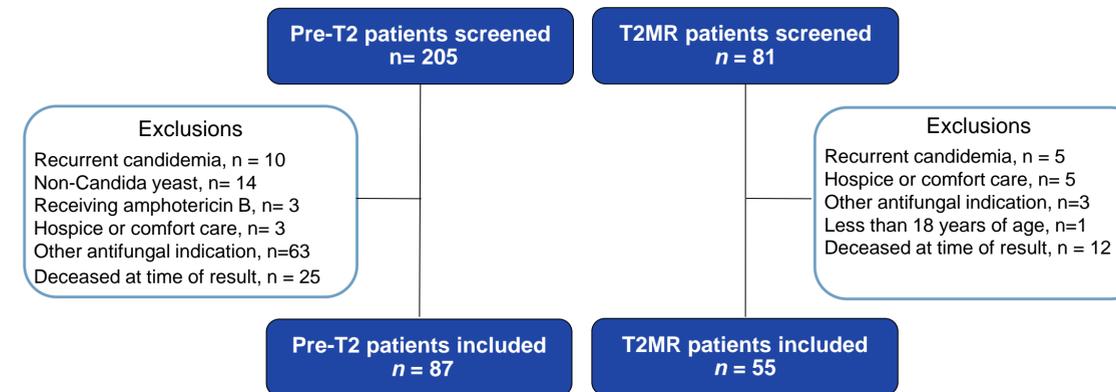
Data was collected from electronic medical records using a standardized case report form. Data points included patient characteristics such as age and sex, risk factors for candidemia, comorbid conditions, diagnostic information, management, and outcomes. The primary endpoint was time to appropriate antifungal therapy, defined as the time of laboratory order for diagnostic test to the time of initiation of active or presumed active antifungal therapy. Time to detection of candidemia was defined as the from time of order of diagnostic testing to the time of the first actionable result. Secondary endpoints included intensive care unit and total hospital length of stay after the onset of candidemia, endophthalmitis and crude in hospital mortality.

### Statistical analysis

Descriptive measures were used to characterize the patient population. Bivariate analyses were performed using the Chi-square or Fisher's exact test for categorical variables and the Student's *t*-test or Mann-Whitney U-test for continuous variables. A subgroup analysis was of patients diagnosed by T2MR was also performed. Analyses were completed using IBM-SPSS Statistics, version 22.0.

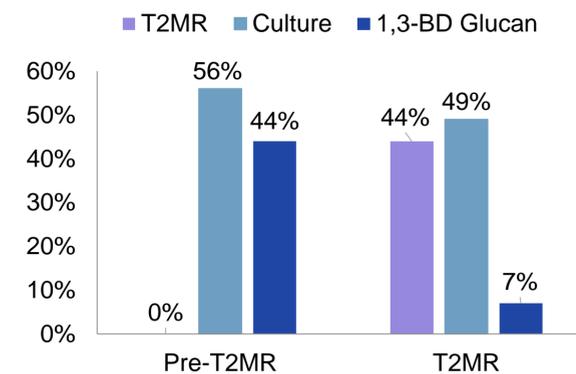
## Results

### Patient Screening and Baseline Characteristics



Characteristic	Pre – T2MR	Post-T2MR	P value
Age, years	63 (54.73)	19 (38%)	0.573
Sex, male	52 (59.8%)	29 (52.7%)	0.409
ICU at time of candidemia onset	63 (72.4%)	47 (85.5%)	0.07
Gastrointestinal surgery within 30 days	32 (36.8%)	15 (27.3%)	0.241
Broad spectrum antimicrobials	79 (90.8%)	49 (89.1%)	0.739
Diabetes	24 (27.6%)	22 (40%)	0.739
Hemodialysis	13 (14.9%)	5 (9.1%)	0.307
Active cancer	16 (18.4%)	14 (25.5%)	0.315
Solid organ or bone marrow transplant	4 (4.6%)	8 (14.5%)	0.06
Neutropenia	6 (6.9%)	1 (1.8%)	0.248
Immunosuppression	24 (27.6%)	15 (27.3%)	0.967
Total parenteral nutrition	16 (18.4%)	8 (14.5%)	0.55
Multifocal <i>Candida</i> colonization	9 (10.3%)	3 (5.5%)	0.31
Severe sepsis	46 (52.8%)	36 (65.5%)	0.14

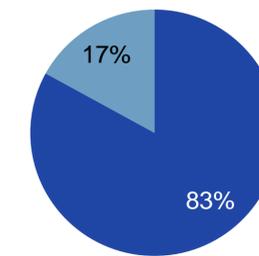
### Method of Diagnosis (First Positive Result) and Species Identified



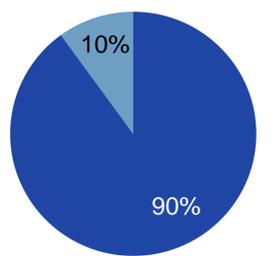
Candida species	Pre – T2MR	Post-T2MR
<i>C. albicans/tropicalis</i>	25 (28.7%)	23 (41.8%)
<i>C. glabrata/krusei</i>	11 (12.6%)	11 (20%)
<i>C. parapsilosis</i>	10 (11.5%)	10 (18.2%)
Other <i>Candida</i>	4 (4.6%)	9 (16.4%)
multiple	0	1 (1.8%)
1,3 B-D glucan only	37 (42.5%)	1 (1.8%)

### Candidemia Management

#### Initial Antifungal Agent, Pre-T2MR



#### Initial Antifungal Agent, T2MR



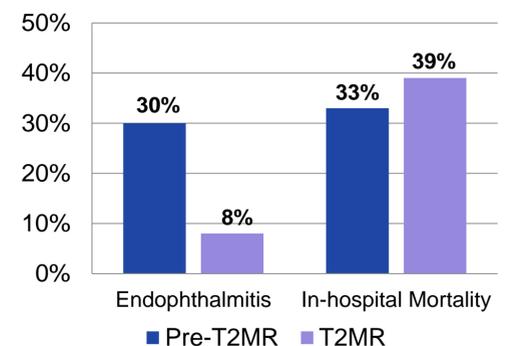
Quality of Care Measure	Pre – T2MR	Post-T2MR	P value
Infectious Disease Consultation	84 (97%)	53 (96%)	0.953
Eye Exam Performed	54 (62%)	39 (71%)	0.28

### Time Endpoints and Patient Outcomes

Time Endpoints	Pre-T2MR	Post-T2MR	P value
Time to appropriate therapy, hrs	39.6 (12.9, 54.75)	26.6 (2.5, 47.1)	0.01
Time to detection of <i>Candida</i> species, hrs	41.75 (30.1, 65.9)	25.25 (6.3, 43)	0.01
Length of stay, days	13 (7-23)	9 (6-21)	0.164
ICU length of stay, days	13 (6-21)	6 (4-13)	0.009

Data presented as median (IQR)

### Clinical outcomes



### T2MR Subgroup (n=27)

- Among the 27 patients diagnosed by T2MR, 21 (91%) received initial echinocandin therapy
- Median (IQR) time to identification = 7.1 (4.1,17) hours and median (IQR) time to active therapy = 13.4 (2.2, 32.3) hours
- One patient was diagnosed with endophthalmitis and 10 patients experienced crude, in hospital mortality

## Discussion

- T2MR was associated with improved time to detection of candidemia and time to antifungal therapy.
- A significant proportion of patients, 24 (44%) were diagnosed by blood culture after T2MR implementation. Nine patients grew *Candida* species outside of the scope of the T2MR panel.
- While our early experience is promising, further efforts are needed to determine the optimal way to utilize this test in clinical practice.