Comparison of Bruker BioTyper and bioMérieux Vitek-MS for Rapid MALDI-TOF Identification of *Candida* spp.

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ABSTRACT

Objectives: Reporting sterile site yeast ID at the time of isolation will improve patient safety and reduce costs by avoiding use of inappropriate anti-fungal therapy. This study assessed MALDI-TOF ID accuracy using retrospective, previously characterized, clinically significant strains from the Alberta Provincial Laboratory.

Methods: IDs of 169 *Candida* were confirmed by Vitek II YS01 and API20C on receipt in Toronto. To evaluate the Bruker BioTyper (BRBT) and bioMérieux Vitek-MS (VTMS), yeasts were grown on 5% sheep blood (BA) and Sabouraud (SAB) agars for blinded, parallel testing (SAB after 16hx37°C; BA: after 22h and 36hx37°C). As instructed, colonies were applied to reusable BRBT target via wooden toothpick, and to VTMS slide via plastic 1ul loop. Formic acid extractions were completed directly on the target/slide for both systems. If a "No reliable ID" was obtained, the test was repeated.

Results: All yeast were identified correctly by BRBT and VTMS from SAB and BA (67 *C. albicans*, 1 *C. dublinensis*, 49 C. *glabrata*, 11 *C. kefyr*, 16 *C. krusei*, 2 *C. lusitaniae*, 11 *C. parapsilosis*, and 12 *C. tropicalis*). 16h growth was generally good on SAB: only 2 (1.2%) and 5 (2.9%) required re-testing on BRBT and VTMS, respectively. On BA at 22h/36h, *C. glabrata* growth was often poor: 34 (20.1%)/27(16%) yeasts were re-tested by BRBT vs. 4 (2.3%)/3 (1.8%) by VTMS. This difference appeared due to the application method (toothpick vs. loop) rather than to an ID deficiency, since reliable ID was achieved if loops were used on yeasts with poor growth for BRBT.

Conclusions: Both the BRBT and VTMS were equally able to accurately ID all *Candida* using MALDI-TOF. For BRBT, ID was more easily achieved from SAB than BA given the propensity for *C. glabrata* to grow poorly on BA. However, use of a plastic loop improved the ability of BRBT to ID *C. glabrata* from poor growth.

INTRODUCTION

Yeasts often take 3 days or more to identify in the clinical laboratory using conventional testing, and as a consequence, patients are most often treated empirically. When the correct species identity is not predicted, inappropriate therapy may have been used for a prolonged period before the organism identity becomes available.

Rapid identification should improve patient care as it will prevent initiation of inappropriate therapy in cases of infection with intrinsically resistant species and will allow for earlier tailoring of therapy in cases with susceptible species.
Appropriate patient care is cost-effective as it reduces morbidity and mortality rates and decreases hospital stay.

Rapid identification will also significantly reduce laboratory expenditures since less supplies/labour are required.

OBJECTIVES

To assess MALDI-TOF MS for rapid identification of clinical *Candida* spp. by performing a head-to-head comparison of the Bruker MALDI BioTyper and the bioMérieux VITEK-MS systems

MATERIALS & METHODS

- 169 retrospective, diverse clinical isolates courtesy U. of Alberta "Prov.-lab"
- Original identification: API 20C, Corn Meal Agar (CMA).
- Identities confirmed on receipt: API 20C, CMA and/or Vitek2 YS-01
- Blinded, parallel sub: Sabouraud (SAB) + 5% Sheep Blood Agar (BA)
- Testing: SAB after 16h inc at 37°C; BA after 22h and 36h inc at 37°C
- Same colonies picked for both instruments
- As per bioMérieux and Bruker, respectively, plastic loops were used to inoculate colonies for VITEK-MS, while wooden toothpicks were used for BioTyper
- On-slide/on-target formic-acid extraction for both before testing
- ID accuracy for both instruments was accessed using pre-established criteria – for the BioTyper, an acceptable ID score on a scale of 0-3 was considered >1.7, while for the VITEK MS, % ID confidence similar to that used for VITEK2 where ID confidence of >90% is usually considered acceptable
- Data was down-loaded from each instrument and analysed in Excel

RESULTS

- Both the BioTyper and VITEK-MS systems correctly identified 100% of the 169 *Candida* isolates to the species level from both SAB and BA
- The isolates were identified as 67 *C. albicans*, 49 C. *glabrata*, 16 *C. krusei*, 12 *C. tropicalis*, 11 *C. kefyr*, 11 *C. parapsilosis*, 2 *C. lusitaniae*, and 1 *C. dublinensis*
- On SAB at 16h, growth was generally good, and only 2 (1.2%) of isolates were required to be re-tested by BioTyper and 5 (2.9%) by VITEK-MS, respectively
- On BA, as *C. glabrata* often grew poorly (small colonies), the no. of repeat tests required for each system to produce an ID differed significantly (P=<0.0001):
  - At 22h: BioTyper n=34 (20.1%) vs. VITEK MS n=4 (2.3%)
  - At 36h: BioTyper n=27 (16%) vs. VITEK MS n=3 (1.8%)
    - ➢ VITEK-MS capable of identifying yeasts from less culture biomass
    - ➢ Most low ID BioTyper scores resulted from poor *C. glabrata* growth on BA, with insufficient inoculum transferred by wooden toothpick to target, then accentuated by fewer laser reads per spot: 240 shots by BioTyper vs. 500 shots by VITEK MS

Table 1. Summary of BioTyper ID accuracies for 169 *Candida* spp. obtained from Sabouraud and 5% sheep blood agars

ID score rating for BioTyper	SAB-16h No. (%)	BA-24h No. (%)	BA-36h No. (%)	Overall No. (%)
1 : >2.0-2.999	81 (47.9)	67 (39.7)	56 (33.1)	204 (40.2)
2 : 1.7-1.999	85 (50.3)	71 (42)	86 (50.9)	242 (47.7)
Combined ≥1.7	166 (98.2)	138 (81.7)	142 (84)	446 (88)
3 : <1.699	3 (1.8)	31 (18.3)	27 (16)	61 (24.1)
Total ID tests	169	169	169	507

Only from SAB were 98% of *Candida* identified within 24h with good scores (>1.7) using the MALDI BioTyper

RESULTS

Table 2. Summary of VITEK MS ID accuracies for 169 *Candida* obtained from Sabouraud and 5% sheep blood agars

ID confidence for VITEK MS	SAB-16h No. (%)	BA-24h No. (%)	BA-36h No. (%)	Overall No. (%)
99-99.9%	155 (91.7)	162 (95.9)	166 (98.2)	483 (95.3)
95-98.9%	4 (2.4)	2 (1.2)	1 (0.6)	7 (1.4)
90-94.9%	2 (1.2)	1 (0.6)	0	3 (0.6)
Combined ≥90%	161 (95.3)	165 (97.6)	167 (98.8)	493 (97.2)
80-89.9	2 (1.2)	0	1 (0.6)	3 (0.6)
70-80/NSQ	6 (3.6)	4 (2.4)	1 (0.6)	11 (2.1)
Total ID tests	169	169	169	507

Overall, using the VITEK MS, >97% of *Candida* were identified with high confidence (>90%) within 24h, regardless of the growth medium used to cultivate the organisms

CONCLUSIONS

- Both the Bruker MALDI BioTyper and bioMérieux VITEK-MS MALDI-TOF systems were equally capable of rapidly and accurately identifying all clinical *Candida* tested in this study
- Earlier identification was possible from SAB agar due to superior growth of all species, but this was especially noted for *C. glabrata* isolates which failed to grow well on the BA used in this study period
- The VITEK-MS was significantly less affected by low biomass on BA than was the MALDI BioTyper. This may possibly be due to:
  - VITEK-MS acquires 500 reads/spot (lengthens the read time)
  - BioTyper acquires 240 reads/spot (quicker read time)
    AND/OR
  - VITEK-MS uses a plastic loop to inoculate colonies
  - BioTyper uses a wooden toothpick to inoculate colonies
  - We found use of a plastic loop for MALDI BioTyper improved the performance in cases of poor *C. glabrata* growth on BA regardless of reads per spot, and suggest the loop should be the preferred tool in such circumstances

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