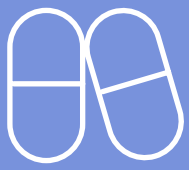
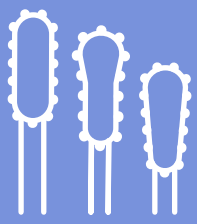
Scientific Booklet

Antibiotic Resistance





Copan

innovating together

Acknowledgments:

We would like to express our gratitude to the authors whose works have been arranged in this booklet: their insights and expertise greatly assisted this prime selection.

We are dedicated to developing and providing high-quality and cutting-edge biological sample collection products for human genomics, infectious diseases, environmental and forensic applications, along with automated workflow solutions. Copan's innovative approach enables an ever-expanding community of laboratories, scientists, and institutions to benefit from an accessible sample collection that guarantees reliable quality performance.

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In this booklet, you'll find a selection of the most interesting and recent independent studies where our collection products are used for Antimicrobial Resistant bacteria (AMR) screening and diagnosis. In the last years, AMR has become a global health concern - mainly due to antimicrobial use and abuse in healthcare and agriculture - and the development of tools to combat it is urgently needed.

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WASPLab® is the natural evolution of the WASP® project and Copan philosophy, and it takes care of the incubation/imaging of the plates and brings the customer into the world of Digital Bacteriology. Before and during the incubation, the unique WASPLab® vision system acquires images that will be available in high-quality digital format to the lab technician to perform the reading phase.

Antibiotic Resistance

Antibiotic Resistance

Am J Clin Pathol. 2017 Aug 1;148(2):119-127

Antibiotic Resistance

Performance of the cobas MRSA/SA Test for Simultaneous Detection of Methicillin-Susceptible and Methicillin-Resistant Staphylococcus aureus from Nasal Swabs

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Keywords

MSwab®	*Staphylococcus aureus*	Nasal Swab	Cobas MRSA/SA

Abstract

Objectives: Health care–associated methicillin-resistant Staphylococcus aureus (MRSA) and Staphylococcus aureus (SA) infections are continuing problems. Rapidly determining the MRSA colonization status of a patient facilitates practice to reduce spread of MRSA clinical disease. Sensitive detection of all SA prior to surgery, followed by decolonization, can significantly reduce postoperative infection from this pathogen. Our goal was to validate a new automated assay for this testing.

Methods: We compared performance of the cobas MRSA/SA Test on the cobas 4800 System to direct and enriched chromogenic culture using Copan MSwab® nasal swabs collected from patients at six United States sites.

Results: Compared to direct and enriched culture, the sensitivity for MRSA and SA was 93.1% and 93.9%, and the specificity was 97.5% and 94.2%, respectively. After discrepancy analysis, the sensitivity for MRSA and SA was 97.1% and 98.6%, and the specificity was 98.3% and 95.5%, respectively. Compared to direct culture, sensitivity for detecting any SA was 99.6%.

Conclusions: The cobas MRSA/SA Test is an effective tool to simultaneously perform surveillance testing for nasal colonization of both MRSA and MSSA.

Open Forum Infect Dis. 2018 May 22;5(6):ofy119

Antibiotic Resistance

Performance of TEM-PCR vs Culture for Bacterial Identification in Pediatric Musculoskeletal Infections

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Keywords

eSwab®	Bone Infection	Methicillin and Clindamycin/Erythromycin Resistance

Abstract

Improved diagnostics are needed for children with musculoskeletal infections (MSKIs). We collected synovial fluid (in cases of septic arthritis) or a swab of the infected area of bone (in cases of osteomyelitis) was placed into an eSwab® transport tube (Copan, Brescia, Italy) in children with MSKI. We assessed the performance of target-enriched multiplex polymerase chain reaction (TEMPCR) in order to identify Kingella kingae, Haemophilus influenzae, Streptococcus pyogenes, Streptococcus pneumoniae, S. aureus, methicillin (mecA) and clindamycin/erythromycin (ermA, ermC) resistance genes. TEM-PCR was concordant with culture in pathogen identification and antibiotic susceptibility testing, while increasing the overall yield of pathogen detection. This technology has the potential to inform judicious antimicrobial use early in the disease course.

J Glob Antimicrob Resist. 2018 Mar;12:149-152

Antibiotic Resistance

Macrolide Resistance in Mycoplasma Genitalium from Female Sex Workers in Belgium

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Keywords

FLOQSwabs®	Vaginal Swab	*Mycoplasma Genitalium*	Macrolide Resistance

Abstract

Objectives: Mycoplasma genitalium is emerging as an aetiological agent of sexually transmitted infections (STIs). Although M. genitalium is commonly treated with azithromycin, macrolide resistance associated with point mutations in the 23S rRNA gene is emerging.

Methods: In this study, the prevalence of M. genitalium and macrolide resistance in female sex workers (FSW) in Belgium was evaluated by a prospective study conducted between 2015 and 2016. Vaginal swabs were sampled with Copan FLOQSwabs® from 303 FSW who underwent testing for M. genitalium along with standard STI screening. All samples positive for M. genitalium were subsequently tested for mutations associated with macrolide resistance.

Results: M. genitalium was detected in 10.8% of participants and macrolide resistance-associated mutations (A2058G and A2059G) were found in 6.5% of isolates.

Conclusions: M. genitalium is clearly present in FSW in Belgium. In contrast to other reports, for now the occurrence of macrolide resistance appears limited in this specific target population.

Front Cell Infect Microbiol. 2019 Nov 6;9:379

Antibiotic Resistance

Automated Incubation and Digital Image Analysis of Chromogenic Media Using Copan WASPLab® Enables Rapid Detection of Vancomycin-Resistant Enterococcus

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Keywords

WASPLab®	eSwab®	Rectal Swab	VRE

Abstract

Objective: The aim of the present study was to assess whether the WASPLab® automation enables faster detection of vancomycin-resistant Enterococcus (VRE) on chromogenic VRE-specific plates by shortening the incubation time.
Methods: Ninety different VRE culture negative rectal eSwab® specimens were spiked with various concentrations (ranging from 3 × 102 to 3 × 107 CFU/ml) of 10 Enterococcus faecium strains (vancomycin MICs ranging from 32 to >256 mg/l), 3 E. faecium VanB strains (vancomycin MICs: 4, 8, and 16 mg/l), and 2 E. faecium VanB strains displaying vancomycin heteroresistance (vancomycin MICs: 64 and 96 mg/l).
Results: Besides the two strains exhibiting vancomycin heteroresistance, all the other 13 VRE strains included in this study were detected as early as 24 h on the WASPLab® even if the inoculum was low (3 × 103 CFU/ml). When the vancomycin MICs were high, all strains were detected as early as at 18 h. However, 30 h was a conservative time point for finalizing the analysis of chromogenic cultures.
Conclusion: These results suggested that the WASPLab® automated incubation could allow decreasing the initial incubation time to 18 h, followed by an intermediate time at 24 h and a final incubation period of 30 h for VRE culture screening, to deliver rapid results without affecting the analytical sensitivity.

Clin Microbiol Infect. 2019 Nov;25(11):1430.e5-1430.e12

Antibiotic Resistance

Copan WASPLab® Automation Significantly Reduces Incubation Times and Allows Earlier Culture Readings

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Keywords

FLOQSwabs®	Vaginal Swab	CPE - MRSA	MSSA - ESBL

Abstract

Objective: The aim was to evaluate whether laboratory automation (inoculation and automated incubation combined with timely defined high-resolution digital imaging) may help reduce the time required to obtain reliable culture analysis results.
Methods: We compared the results obtained by WASPLab® automation against WASP®-based automated inoculation coupled to conventional incubation and manual diagnostic on 1294 clinical samples (483 for the derivation set and 811 for the independent validation set) that included urine, genital tract and non-sterile site specimens, as well as eSwabs for screening of methicillin-resistant Staphylococcus aureus (MRSA), methicillin-sensitive Staphylococcus aureus (MSSA), extended-spectrum beta-lactamases (ESBLs) and carbapenemase-producing Enterobacteriaceae (CPE). We used sequential routine specimens referred to the bacteriology laboratory at Geneva University Hospitals between October 2018 and March 2019.
Results: The detection sensitivity of MRSA and MSSA at 18 hr on WASPLab® was 100% (95% confidence interval [CI], 94.48-100.00%). The detection sensitivity of ESBL and CPE at 16 hr on WASPLab® was 100% (95% confidence interval [CI], 94.87% to 100.00%). For urine specimens, the similarity was 79% (295/375) between 18 hr and 24 hr of incubation on WASPLab®. For genital tract and non-sterile site specimens, the similarity between 16 hr and 28 hr of incubation on WASPLab® were 26% (72/281) and 77% (123/159) respectively. Thus, 28 hr was defined as the final incubation time on WASPLab® for genital tract and non-sterile site specimens.
Conclusions: The results of this study show that WASPLab® automation enables a reduction of the culture reading time for all specimens tested without affecting performances. Implementing the established and duly validated incubation times will allow appropriate laboratory workflows for improved efficiency to be built.

Eur J Microbiol Immunol (Bp). 2019 Dec 25;9(4):131-137

Antibiotic Resistance

Liquid and Dry Swabs for Culture- and PCR-Based Detection of Colonization with Methicillin-Resistant Staphylococcus aureus during Admission Screening

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Keywords

MSwab®	eSwab®	*Staphylococcus Aureus*	MRSA

Abstract

Rapid detection of methicillin-resistant Staphylococcus aureus (MRSA) colonization status facilitates isolation and decolonization and reduces MRSA infections. Liquid but not dry swabs allow fully automated detection methods. However, the accuracy of culture and polymerase chain reaction (PCR) using liquid and dry swabs has not been analyzed. We compared different swab collection systems for routine nasal–throat MRSA screening in patients admitted to a tertiary care trauma center in Germany. Over 3 consecutive months, dry swabs (month 1), eSwabs® (month 2), or MSwabs® (month 3) were processed using Cepheid GeneXpert, Roche cobas and BD-MAX™ MRSA tests compared to chromogenic culture. Among 1680 subjects, the MRSA detection rate using PCR methods did not differ significantly between dry swabs, ESwab, and MSwab (6.0%, 6.2%, and 5.3%, respectively). Detection rates using chromogenic culture were 2.9%, 3.9%, and 1.9%, using dry, ESwab, and MSwab, respectively. Using chromogenic culture as the "gold standard", negative predictive values for the PCR tests ranged from 99.2–100%, and positive predictive values from 33.3–54.8%. Thus, efficient and accurate MRSA screening can be achieved using dry, as well as liquid E- or MSwab, collection systems. Specimen collection using eSwab® or MSwab® facilitates efficient processing for chromogenic culture in full laboratory automation while also allowing molecular testing in automated PCR systems.

PLoS One. 2019 Sep 12;14(9):e0222200

Antibiotic Resistance

High Prevalence of Multidrug Resistant Enterobacteriaceae Among Residents of Long Term Care Facilities in Amsterdam, The Netherlands

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Keywords

FLOQSwabs®	FecalSwab™	MDRO	ESBL-E

Abstract

Introduction: The aim of this study was to determine the rate of asymptomatic carriage and spread of multidrug-resistant micro-organisms (MDRO) and to identify risk factors for extended spectrum beta-lactamase-producing Enterobacteriaceae (ESBL-E) carriage in 12 long term care facilities (LTCFs) in Amsterdam, the Netherlands.

Methods: From November 2014 to august 2015, we collected from residents from LTCFs in Amsterdam, feces and nasal swabs with Copan FLOQSwabs® and FecalSwab™, respectively. We analyzed for presence of multidrug-resistant Gram-negative bacteria (MDRGN), including ESBL-E, carbapenemase-producing Enterobacteriaceae (CPE), colistin-resistant Enterobacteriaceae and methicillin-resistant Staphylococcus aureus (MRSA) and vancomycin-resistant enterococci (VRE).

Results: In total, 385 residents from 12 LTCFs (range 15-48 residents per LTCF) were enrolled. The prevalence of carriage of MDRGN was 18.2% (range among LTCFs 0-47%) and the prevalence of ESBL-E alone was 14.5% (range among LTCFs: 0–34%). Of 63 MDRGN positive residents, 50 (79%) were ESBL-E positive of which 43 (86%) produced CTX-M. Among 44 residents with ESBL-E positive fecal samples of whom data on contact precautions were available at the time of sampling, only 9 (20%) were already known as ESBL-E carriers. The prevalence for carriage of MRSA was 0.8% (range per LTCF: 0–7%) and VRE 0%. One CPE colonized resident was found. Typing of isolates by Amplified Fragment Length Polymorphism (AFLP) showed five MDRGN clusters, of which one was found in multiple LTCFs and four were found in single LTCFs, suggesting transmission within and between LTCFs. In multivariate analysis only the presence of MDRO in the preceding year remained a risk factor for ESBL-E carriage.

Conclusions: The ESBL-carriage rate of residents in LTCFs is nearly two times higher than in the general population but varies considerably among LTCFs in Amsterdam, whereas carriage of MRSA and VRE is low. The majority (80%) of ESBL-E positive residents had not been detected by routine culture of clinical specimens at time of sampling. Both improvement of basic hygiene, and funding for laboratory screening, should allow LTCFs in Amsterdam to develop standards of care to prevent transmission of ESBL-E.

Sci Rep. 2019 Aug 1;9(1):9637

Antibiotic Resistance

Whole Genome Sequencing Revealed New Molecular Characteristics in Multidrug Resistant Staphylococci Recovered from High Frequency Touched Surfaces in London

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Keywords

Dry Swab	Whole Genome Sequencing	MDR	Environment

Abstract

The rise of antibiotic resistance (AMR) is one of the most important public health threats worldwide. Today, increasing attention is being paid to multidrug resistant staphylococci isolated from healthcare and non-healthcare environments as the treatment of these bacteria has become increasingly difficult. In this study, we compared staphylococci isolates recovered from high frequency touched surfaces swabbed with Copan dry swab (Copan Italia, Brescia) from public areas in the community and hospitals in East and West London. 281 out of 600 (46.83%) staphylococci isolates recovered were multidrug resistant, of which 49 (8.17%) were mecA positive. There was significantly higher proportion of multidrug resistant staphylococci (P=0.0002) in East London (56.7%) compared to West London (49.96%). The most common species identified as multidrug resistant were S. epidermidis, S. haemolyticus and S. hominis, whereas penicillin, fusidic acid and erythromycin were the most frequent antibiotics the isolates were resistant to. Whole genome sequenced of mecA positive isolates revealed that S. sciuri isolates carried the mecA1 gene, which has only 84.43% homology with mecA. In addition, other frequently identified resistance genes included blaZ, qacA/B and dfrC. We have also identified a diverse range of SCCmec types, many of which were untypable due to carrying a novel combination of ccr genes or multiple ccr complexes.

Clin Microbiol Infect. 2020 May;26(5):619-625

Antibiotic Resistance

Comparison of the Copan WASPLab® Incorporating the Biorad Expert System Against the Sirscan 2000 Automatic for Routine Antimicrobial Disc Diffusion Susceptibility Testing

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Keywords

WASPLab®	BioRad Expert System	MRSA

Abstract

Objectives: This study investigated the agreement at the categorical level between the Copan WASPLab® incorporating the BioRad expert system against the SIRscan 2000 automatic for antimicrobial disc diffusion susceptibility testing.
Methods: The 338 clinical strains (67 Pseudomonas aeruginosa, 19 methicillin-resistant Staphylococcus aureus, 75 methicillin-sensitive S. aureus and 177 Enterobacterales isolates) analysed in this study were non-duplicate isolates obtained from consecutive clinical samples referred to the clinical bacteriology laboratory at Geneva University Hospitals between June and August 2019. For the WASPLab® the inoculum suspension was prepared in strict accordance with the manufacturer's instruction (Copan WASP srl, Brescia, Italy) by adding 2 mL of the 0.5 McFarland primary suspension used for the SIRscan analysis into a sterile tube filled with 4 mL of sterile saline (1:3 dilution). The inoculum (2 x 30 mL loop/spreader) was spread over the entire surface of MuellereHinton agar plates according to the AST streaking pattern defined by Copan. The antibiotic discs were dispensed by the WASP® and inoculated media were loaded on conveyors for transfer to the automatic incubators. The plates were incubated for 16 h, and several digital images were acquired. Inhibition zone diameters were automatically read by the WASPLab® and were adjusted manually whenever necessary. For the SIRscan 2000 automatic, the antimicrobial disc diffusion susceptibility testing was performed according to the EUCAST guidelines. The gradient strip method was used to resolve discrepancies.
Results: The overall categorical agreement between the compared methods reached 99.1% (797/804; 95% CI 98.2%e99.6%), 99.5% (1029/1034; 95% CI 98.9%e99.8%), and 98.8% (2798/2832; 95% CI 98.3%e99.1%) for P. aeruginosa, S. aureus and the Enterobacterales, respectively.
Conclusions: WASPLab® incorporating the BioRad expert system provides a fully automated solution for antimicrobial disc diffusion susceptibility testing with equal or better accuracy than other available phenotypic methods.

Antimicrob Resist Infect Control. 2021 Feb 17;10(1):37

Antibiotic Resistance

Vaginal Colonization with Antimicrobial-Resistant Bacteria Among Women in Labor in Central Uganda: Prevalence and Associated Factors

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Keywords

CLASSICSwab™	Multidrug Resistance	Vaginal Colonization

Abstract

Background: According to WHO, the antimicrobial resistant bacteria considered to be clinically most important for human health and earmarked for surveillance include extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae, carbapenem-resistant bacteria, methicillin-resistant (MRSA) and, macrolide-lincosamide-streptogramin B -resistant vancomycin-resistant (VRSA) Staphylococcus aureus and vancomycin-resistant Enterococcus (VRE). If these bacteria are carried in the female genital tract, they may be transmitted to the neonate causing local or systemic neonatal infections that can be difficult to treat with conventionally available antimicrobials. In order to develop effective treatment strategies, there is need for updated information about the prevalence of colonization with important antimicrobial-resistant pathogens.
Objective: We sought to estimate the prevalence of vaginal colonization with potentially pathogenic and clinically important AMR bacteria among women in labour in Uganda and to identify factors associated with colonization. Methods: We conducted a cross-sectional study among HIV-1 and HIV-2 negative women in labour at three primary health care facilities in Uganda. Drug susceptibility testing was done using the disk diffusion method on bacterial isolates cultured from vaginal swabs collected with CLASSIQSwabs™ (Copan Italia, Brescia). We calculated the prevalence of colonization with potentially pathogenic and clinically important AMR bacteria, in addition to multidrug-resistant (MDR) bacteria, defined as bacteria resistant to antibiotics from ≥3 antibiotic classes.
Results: We found that 57 of the 1472 enrolled women (3.9% prevalence; 95% Confidence interval [CI] 3.0%, 5.1%) were colonized with ESBL-producing Enterobacteriaceace, 27 (1.8%; 95% CI 1.2%, 2.6%) were colonized with carbapenem-resistant Enterobacteriaceae, and 85 (5.8%; 95% CI 4.6%, 7.1%) were colonized with MRSA. The prevalence of colonization with MDR bacteria was high (750/1472; 50.9%; 95% CI 48.4%, 53.5%). Women who were ≥30 years of age had higher odds of being colonized with MDR bacteria compared to women aged 20–24 years (OR 1.6; 95% CI 1.1, 2.2).
Conclusion: Most of the women included in our study were vaginally colonized with potentially pathogenic MDR and other clinically important AMR bacteria. The high prevalence of colonization with these bacteria is likely to further increase the incidence of difcult-to-treat neonatal sepsis.

Note

Code: JMKR010R01

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