

NATIONAL STANDARD METHOD

INVESTIGATION OF EAR SWABS AND ASSOCIATED SPECIMENS

BSOP 1

Issued by Standards Unit, Department for Evaluations, Standards and Training
Centre for Infections



Association of Medical Microbiologists
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INVESTIGATION OF EAR SWABS AND ASSOCIATED SPECIMENS

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National Standard Methods, which include standard operating procedures (SOPs), algorithms and guidance notes, promote high quality practices and help to assure the comparability of diagnostic information obtained in different laboratories. This in turn facilitates standardisation of surveillance underpinned by research, development and audit and promotes public health and patient confidence in their healthcare services. The methods are well referenced and represent a good minimum standard for clinical and public health microbiology. However, in using National Standard Methods, laboratories should take account of local requirements and may need to undertake additional investigations. The methods also provide a reference point for method development.

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AMENDMENT PROCEDURE

Controlled document reference	BSOP 1
Controlled document title	Investigation of ear swabs and associated specimens

Each National Standard Method has an individual record of amendments. The current amendments are listed on this page. The amendment history is available from standards@hpa.org.uk.

On issue of revised or new pages each controlled document should be updated by the copyholder in the laboratory.

Amendment Number/ Date	Issue no. Discarded	Insert Issue no.	Page	Section(s) involved	Amendment
10/ 13.10.08	8.1	8.2	9 All 14	Culture media, conditions and organisms All Appendix	Incubation time for swabs when looking for anaerobes amended. ESL replaced with DEST Flowchart inserted

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INVESTIGATION OF EAR SWABS AND ASSOCIATED SPECIMENS

Types of specimens: Ear swab
Middle ear effusion

SCOPE OF DOCUMENT

This document describes the bacteriological investigation of ear swabs and associated specimens.

INTRODUCTION

Infections of the ear can be divided into otitis externa and otitis media².

Otitis externa

In general, infection of the external auditory canal resembles infection of skin and soft tissue elsewhere. However, there are some notable differences. The canal is narrow and, as a result, foreign materials and fluid that enter can become trapped, causing irritation and maceration of the superficial tissues. Otitis externa can be subdivided into categories: acute localised; acute diffuse; chronic; and invasive ('malignant'). However, except for invasive, they are rarely differentiated as such in clinical practice.

Acute localised otitis externa

Acute localised otitis externa is usually caused by *Staphylococcus aureus* and may result in a furuncle or pustule of a hair follicle. Erysipelas due to Group A Streptococcus may be found in the concha and canal.

Acute diffuse otitis externa

Acute diffuse otitis externa is a common disease in adults with frequent recurrence of infections³. It is also known as "swimmer's ear" and is mainly encountered in hot, humid conditions. Many different bacteria cause this infection, the most common being *Pseudomonas aeruginosa* and *S. aureus*⁴. Anaerobes are frequently associated with polymicrobial infections. Anaerobes involved in ear infections usually originate from the oropharynx³.

Chronic otitis externa

Chronic otitis externa is due to colonisation with 'coliforms' and fungi which is best treated by topical cleansing, and not antibiotics.

Malignant otitis externa

Clinically the most important condition to identify is invasive ('malignant') otitis externa. Malignant otitis externa is a severe necrotising infection that spreads from the squamous epithelium of the canal into surrounding soft tissues, blood vessels, cartilage and bone. Patients at risk include people with diabetes, the elderly and patients who are immunocompromised. It is a life-threatening condition with significant risk of neurological involvement and facial nerve paralysis. It is almost always caused by *P. aeruginosa*⁵.

Otitis media

Acute otitis media is defined by the co-existence of fluid in the middle ear and signs and symptoms of acute illness. It can occur when oropharyngeal flora ascends the Eustachian tube and are not eliminated by the defence mechanisms of the middle ear. Otitis media is a common disease in children with frequent recurrence of infections. It is important to treat otitis media because possible complications include the loss of hearing. This could have adverse effects on the development of speech and behaviour in children³.

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Symptomatic relief is suggested as the initial form of treatment with antibiotic therapy prescribed only upon re-occurrence of infection^{6,7,8}. The role of antibiotic treatment at the first presentation of infection is a contentious issue as most infections are of viral origin. However, common bacteria causing otitis media, such as *Streptococcus pneumoniae* and *Haemophilus influenzae* can be isolated from ear swabs if the tympanic membrane has perforated. Often the strains of *S. pneumoniae* exhibit reduced susceptibility to penicillin⁹ although this is not common in the UK. Other less common causes include *S. aureus*, *S. pyogenes* and *Moraxella catarrhalis*.

Although uncommon in adults, the causative organisms and treatment of otitis media are the same as in children¹⁰. An external ear swab is not useful in the investigation of otitis media unless there is perforation of the eardrum. Tympanocentesis, to sample middle ear effusion, is rarely justified.

Acute otitis media infection

Acute otitis media infection is defined by the co-existence of fluid in the middle ear and signs and symptoms of acute illness. It occurs when oropharyngeal flora ascend the Eustachian tube and are not eliminated by the defence mechanisms of the middle ear. Organisms that cause this type of infection are *S. pneumoniae*, *H. influenzae* and *M. catarrhalis*. Less frequent causes are *S. pyogenes*, *S. aureus*, and Gram-negative bacilli¹¹⁻¹³. Respiratory syncytial virus and parainfluenza viruses have been isolated from middle ear effusions and may have a role in the aetiology of otitis media especially in children.

Chronic suppurative otitis media

Chronic suppurative infections are very destructive, persistent and can produce irreversible adverse outcomes such as hearing loss. The most common bacterial isolates are pseudomonads closely followed by meticillin-resistant *Staphylococcus aureus* (MRSA), with anaerobic bacteria found in 25% of patients^{14,15}. *P. aeruginosa* usually only colonises the ear canal and is rarely isolated from the middle ear.

Mycotic infection

Mycotic infection of the ear is a superficial, chronic or subacute infection of the external auditory canal. Partial deafness can occur due to occlusion of the ear canal by hyphae. Fungi associated with ear infection include *Aspergillus* species, *Scedosporium apiospermum* (*Pseudallescheria boydii*) and other moulds and yeasts.

Other organisms

Unusual pathogens such as *Alloiococcus otitidis*^{16,17}, *Turicella otitidis*¹⁸ and coryneform species have been isolated in pure culture from fluids collected by tympanocentesis, suggesting that these organisms may be responsible for acute otitis media.

Surveillance screening of neonates may include an ear swab (see [BSOP 23 - Investigation of gastric aspirates and infection screen swabs from neonates](#)). Tympanocentesis should not be performed.

TECHNICAL INFORMATION/LIMITATIONS

N/A

1 SAFETY CONSIDERATIONS¹⁹⁻³⁰

1.1 SPECIMEN COLLECTION

N/A

1.2 SPECIMEN TRANSPORT AND STORAGE

Swabs

Sealed plastic bag

Middle ear effusion

Sterile leak proof container in a sealed plastic bag

1.3 SPECIMEN PROCESSING

Containment Level 2

All work that is likely to generate aerosols should be performed in a microbiological safety cabinet.

The above guidance should be supplemented with local COSHH and risk assessments.

2 SPECIMEN COLLECTION

2.1 OPTIMAL TIME FOR SPECIMEN COLLECTION

Before antimicrobial therapy where possible

When pus or exudate is present

2.2 CORRECT SPECIMEN TYPE AND METHOD OF COLLECTION

Swab any pus or exudates

For investigation of fungal infection, scrapings of material from the ear canal are preferred although swabs can also be used

2.3 ADEQUATE QUANTITY AND APPROPRIATE NUMBER OF SPECIMENS

N/A

3 SPECIMEN TRANSPORT AND STORAGE

3.1 TIME BETWEEN SPECIMEN COLLECTION AND PROCESSING

Specimens should be transported and processed as soon as possible

3.2 SPECIAL CONSIDERATIONS TO MINIMISE DETERIORATION

Swabs should be transported in Amies transport medium with charcoal³¹

If processing is delayed, refrigeration is preferable to storage at ambient temperature. Delays of over 48 h are undesirable

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4 SPECIMEN PROCESSING

4.1 TEST SELECTION

N/A

4.2 APPEARANCE

N/A

4.3 MICROSCOPY

(See [BSOPTP 39 – Staining Procedures](#))

Gram's stained smear if middle ear effusion is sent

Using a sterile pipette place one drop of fluid on a clean microscope slide

Spread this with a sterile loop to make a thin smear for Gram's staining

4.4 CULTURE AND INVESTIGATION

4.4.1. PRE-TREATMENT

N/A

4.4.2 SPECIMEN PROCESSING

Swabs

Inoculate each agar plate with swab (see [QSOP 52 - Inoculation of Culture Media](#))

For the isolation of individual colonies, spread inoculum with a sterile loop

Swabs taken from the nasopharynx for diagnosis of ear infections are inappropriate and should be discarded according to local protocols

Middle ear effusion

Using a sterile pipette inoculate each agar plate with specimen (see [QSOP 52 - Inoculation of Culture Media](#))

For the isolation of individual colonies, spread inoculum with a sterile loop

4.4.3 CULTURE MEDIA, CONDITIONS AND ORGANISMS

Clinical details/ conditions	Standard media	Incubation			Cultures read	Target organism(s)
		Temp °C	Atmos	Time		
All swabs: Otitis externa Otitis media	Chocolate agar with bacitracin*	35-37	5-10 % CO ₂	40-48 h	daily	<i>H. influenzae</i> <i>M. catarrhalis</i> <i>S. pneumoniae</i> Other organisms in pure growth may be significant
	Staph/strep selective agar	35-37	air	40-48 h	daily	Lancefield group A streptococcus <i>S. aureus</i>
	Neomycin fastidious anaerobe agar with metronidazole 5 µg disc	35-37	anaerobic	48 h	≥40 h	Anaerobes ³²
	CLED/MacConkey agar	35-37	air	16-24 h	≥16 h	Enterobacteriaceae Pseudomonads
	Sabouraud agar	35-37	air	40-48 h [†]	≥40 h	Fungi
Middle ear effusion	Chocolate agar	35-37	5-10 % CO ₂	40-48 h	daily	Any organism
	Fastidious anaerobe agar with metronidazole 5 µg disc	35-37	anaerobic	7-14 d	≥40 h	Anaerobes ³²
Optional media		Incubation			Cultures read	Target organism(s)
		Temp °C	Atmos	Time		
Blood agar		35-37	5-10% CO ₂	40-48 h	daily	<i>M. catarrhalis</i> <i>S. pneumoniae</i>
<p>*may include either a bacitracin 10 unit disc or bacitracin incorporated in the agar³³</p> <p>Note: if chocolate agar with bacitracin incorporated into the agar is used then blood agar incubated in 5 - 10% CO₂ must be included for the isolation of <i>M. catarrhalis</i> and <i>S. pneumoniae</i></p> <p>†incubation may be extended to 5 days. In such cases plates should be read at ≥40h and then left in the incubator/cabinet until day 5. Certain opportunistic pathogens will require extended incubation.</p>						

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4.5 IDENTIFICATION

4.5.1 MINIMUM LEVEL IN THE LABORATORY

Anaerobes	"anaerobes" level BSOPID 14 - Identification of non-sporing, non-branching anaerobes BSOPID 8 - Identification of Clostridium species BSOPID 25 - Identification of anaerobic Gram-negative rods
Coliforms	"coliform" level
Fungi	genus level
H. influenzae	species level
β-haemolytic streptococci	Lancefield group level
M. catarrhalis	species level
Neisseria	species level
Pseudomonads	"pseudomonads" level
S. aureus	species level
S. pneumoniae	species level
Yeasts	"yeasts" level

Organisms may be further identified if clinically or epidemiologically indicated

4.5.2 REFERRAL TO REFERENCE LABORATORIES

For information on the tests offered, turn around times, transport procedure and the other requirements of the reference laboratory [click here for user manuals and request forms](#).

Isolates associated with outbreaks, where epidemiologically indicated and organisms with unusual or unexpected resistance and whenever there is a laboratory or clinical problem or anomaly that requires elucidation should be sent to the appropriate reference laboratory.

4.6 ANTIMICROBIAL SUSCEPTIBILITY TESTING

See [BSOP 45 - Susceptibility Testing](#)

5 REPORTING PROCEDURE

5.1 MICROSCOPY

Middle ear effusion - report on WBCs and organisms detected

5.1.1 MICROSCOPY REPORTING TIME

Urgent microscopy results to be telephoned or sent electronically when available

Written report, 16 – 72 h

5.2 CULTURE

Report clinically significant organisms isolated or

Report other growth, eg no significant growth or

Report absence of growth

5.2.1 CULTURE REPORTING TIME

Clinically urgent culture results to be telephoned or sent electronically when available

Written report, 16 – 72 h stating, if appropriate, that a further report will be issued

5.3 ANTIMICROBIAL SUSCEPTIBILITY TESTING

Report susceptibilities as clinically indicated

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6 REPORTING TO THE HPA³⁴ (LOCAL AND REGIONAL SERVICES AND CENTRE FOR INFECTIONS)

Refer to the following:

Individual NSMs on organism identification

Health Protection Agency publications:

"Laboratory reporting to the HPA .A guide for diagnostic laboratories"

"Hospital infection control : Guidance on the control of infection in hospitals"

Local Memorandum of Understanding

Current guidelines on CDSC and COSURV reporting

Local guidelines

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7 ACKNOWLEDGEMENTS AND CONTACTS

This National Standard Method has been developed, reviewed and revised by the National Standard Methods Working Group for Clinical Bacteriology (http://www.hpa-standardmethods.org.uk/wg_bacteriology.asp). The contributions of many individuals in clinical bacteriology laboratories and specialist organisations who have provided information and comment during the development of this document, and final editing by the Medical Editor are acknowledged.

The National Standard Methods are issued by Standards Unit, Department for Evaluations, Standards and Training, Centre for Infections, Health Protection Agency, London.

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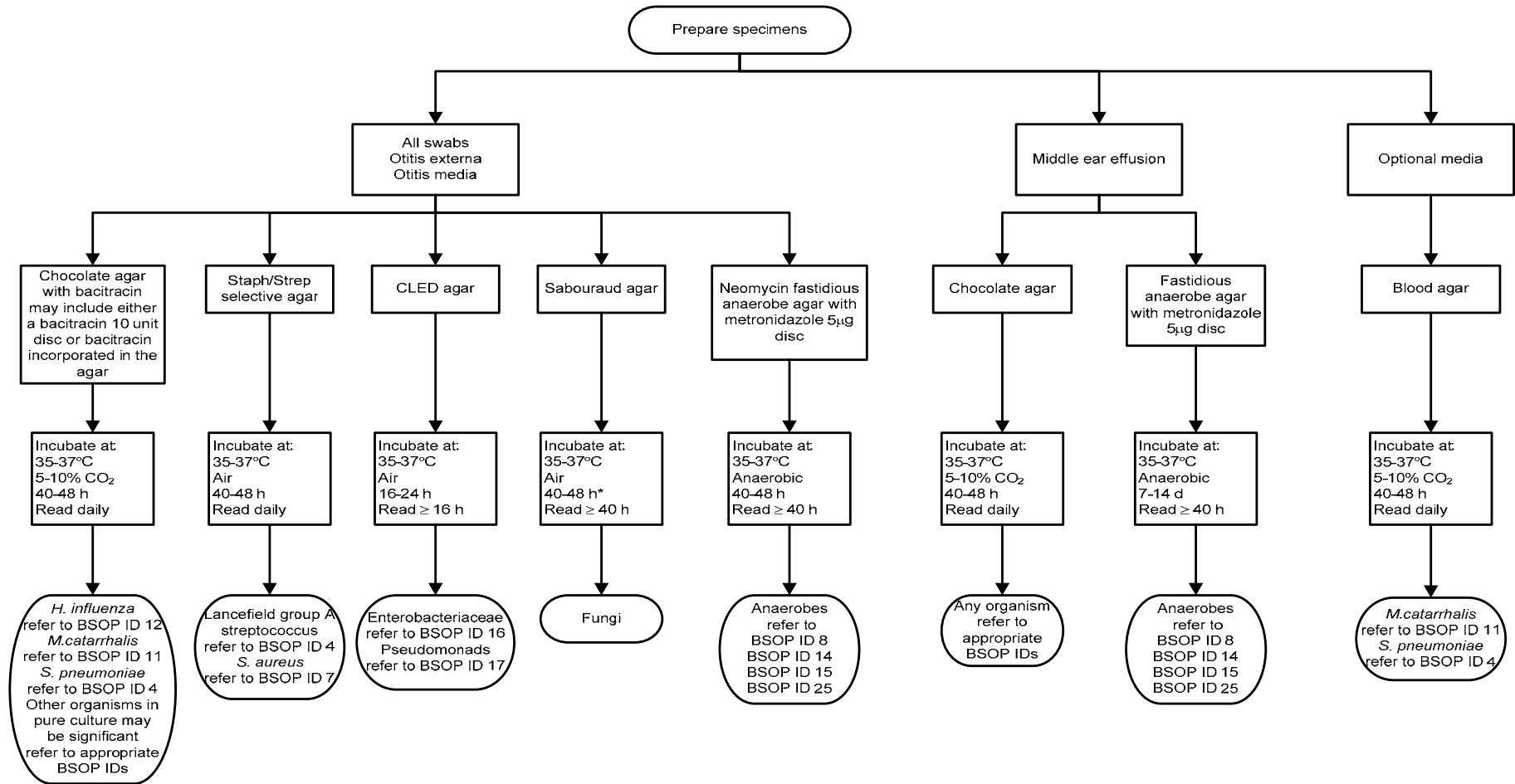
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APPENDIX



*Incubation may be extended to 5 days. In such cases plates should be read at ≥ 40h and then left in the incubator / cabinet until day 5.

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