Interpretation of Microbiology Lab Reports

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MBChB (UCT), DTM&H (Wits), FC Path (SA) (Microbiology), MMed (Microbiology) (Wits)

OVERVIEW

1. Specimen selection & collection
2. Blood cultures
3. Catheter tip cultures
4. Cerebrospinal fluid (CSF) cultures
5. Respiratory cultures
6. Fluid/aspirate cultures
7. Urine cultures
8. Pus swabs
9. Septic Markers

1. Specimen selection & collection

- **A properly selected & collected specimen is the single most important step in the diagnosis of any infectious disease**
- General rules for all specimens:
  1. The **quantity** of the specimen must be adequate
  2. It should be **representative** of the infectious process
  3. **Avoid** specimen **contamination** by using sterile containers & observing aseptic technique
  4. Take samples **before** administering **antibiotics**
  5. **Prompt transportation** to the laboratory

Miller JM, et al. A guide to utilization of the microbiology laboratory for diagnosis of infectious diseases: 2018 update by the Infectious Diseases Society of America and the American Society for Microbiology. CID 2018;67(6):e1-e94.

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2. Blood Cultures

- **Blood cultures must ALWAYS be collected using an aseptic technique**

  (i.e. Sterile pack and sterile gloves, NOT box gloves and alcohol swabs)

- **Blood cultures are incubated in automated, continuous-monitoring systems**
- Once cultures become positive, an alarm & flashing light alert the lab staff
- A Gram stain is done immediately on a positive blood culture – this is useful in determining the possible aetiology of the bloodstream infection

- **Contamination of blood cultures is a common problem & occurs with:**
  - Skin flora: Coagulase-negative staphylococci, corynebacteria, *Actinomyces* spp., *Micrococcus*, *S. viridans*, *Cutibacterium acnes*
  - Environmental flora: *Bacillus* spp., *Moraxella* spp., *Aerococcus* spp.

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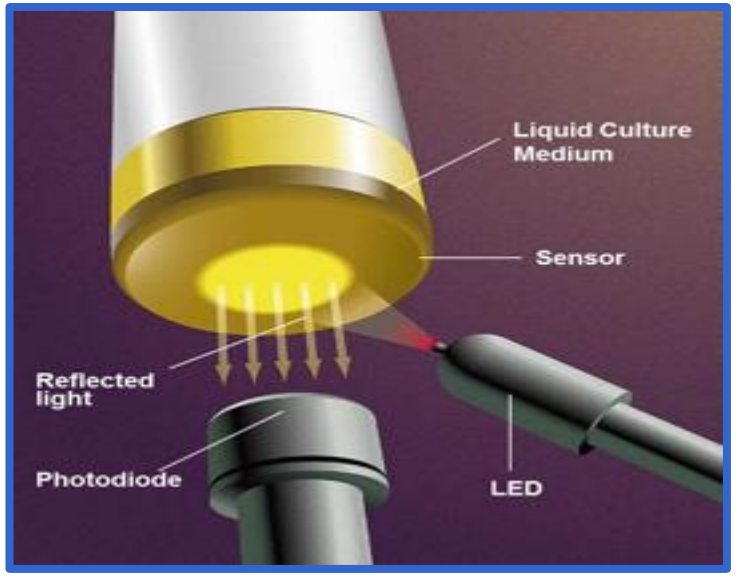
Blood Cultures

- CO_2 sensor bonded to bottom of each blood culture bottle & separated from the broth medium by a semi-permeable membrane
- Sensor is impregnated with water vapour when bottles are autoclaved during manufacturing process
- Unidirectional membrane is impermeable to most ions & to components of media & blood, but is freely permeable to CO_2
- Micro-organisms multiply in the media, generating CO_2 which diffuses across the membrane into the sensor & dissolves in the water, thereby generating hydrogen ions
- Free hydrogen ions interact with the sensor, which is dark green in the alkaline state
- As CO_2 is produced & dissolves in the water, the concentration of hydrogen ions increases & the pH decreases causing the sensor to become lighter green & eventually yellow, which results in an increase of red light reflected by the sensor



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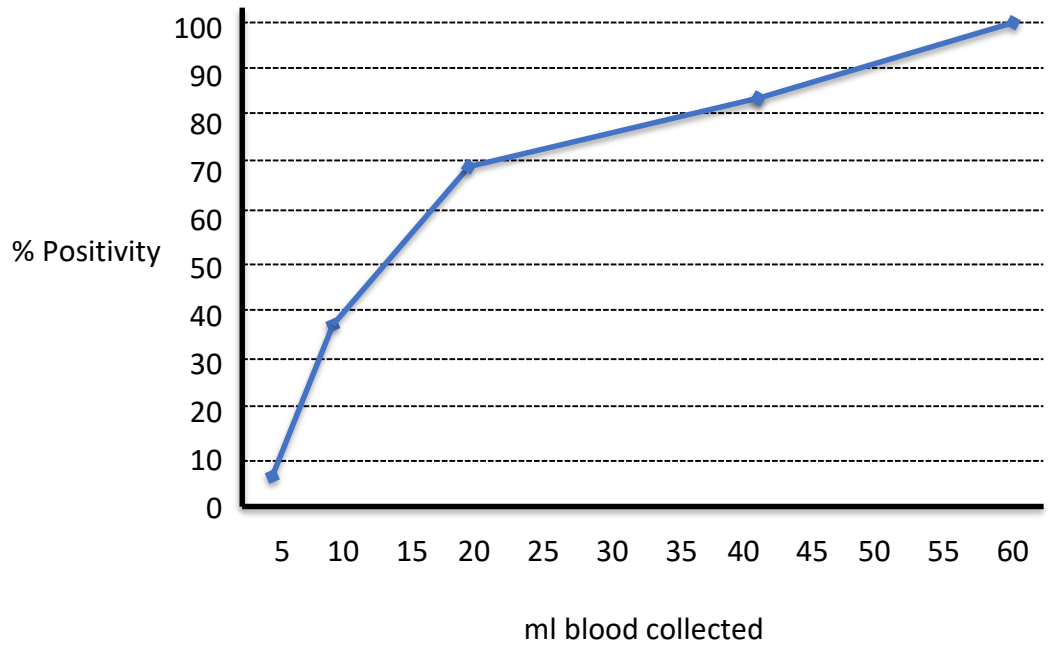
Blood Cultures

- **The volume of blood obtained for each blood culture is the most important variable** in recovering bacteria & fungi from patients with bloodstream infections
- **For adults: 20–30 mL of blood per culture set** is recommended & requires 2 -3 bottles
- For children: Weight-appropriate volume of blood should be cultured



Miller JM, et al. A guide to utilization of the microbiology laboratory for diagnosis of infectious diseases: 2018 update by the Infectious Diseases Society of America and the American Society for Microbiology. CID 2018;67(6):e1-e94.

AMPATH LABORATORIES

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Recommended Volumes of Blood for Culture in Paediatric Patients			
Weight of patient	**Culture set No. 1**	**Culture set No. 2**	**Total Volume for culture**
≤ 1 kg	2 ml	-	2 ml
1.1 – 2 kg	2 ml	2 ml	4 ml
2.1 – 12.7 kg	4 ml	2 ml	6 ml
12.8 – 36.3 kg	10 ml	10 ml	20 ml
> 36.3 kg	20-30 ml	20-30 ml	40-60 ml
When ≤ 10 ml blood is collected, it should be inoculated into a single aerobic culture bottle			

Miller JM, et al. A guide to utilization of the microbiology laboratory for diagnosis of infectious diseases: 2018 update by the Infectious Diseases Society of America and the American Society for Microbiology. CID 2018;67(6):e1-e94.

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Blood Culture Bottles

	Bottle Type	Purpose	Specimen Type
SA	BacT/ALERT SA	Standard Aerobic	Blood or SBF
SN	BacT/ALERT SN	Standard Anaerobic	Blood or SBF
FA	BacT/ALERT FA	FAN® Aerobic	Blood or SBF
FN	BacT/ALERT FN	FAN® Anaerobic	Blood or SBF
PF	BacT/ALERT PF	Paediatric FAN®	Blood only

SBF = Sterile body fluid

Fill window and volume markers

<u>For patient's on antibiotics</u>

FAN® = Fastidious Antimicrobial Neutralization

- Adsorbent Polymeric Beads (APB) to neutralize antimicrobials

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Blood Cultures

Coagulase negative staphylococci

- Coagulase negative staphylococci are skin commensals and frequent blood culture contaminants
- Exceptions include:
  - Premature babies
  - Patients with central lines
  - Severely neutropaenic patients
- Look at the following to ascertain significance:
  - How long did it take for the culture to become positive?
    - > 1 day ➔most likely a skin contaminant
    - How many blood culture bottles were positive & from how many venepuncture sites?
    - Only a single bottle ➔most likely a skin contaminant
    - Don't treat with antibiotics

S. aureus

- *S. aureus* is NEVER a contaminant on blood cultures
- Always look for the source:
  - Central lines (remove if CLABSI suspected)
  - Infective endocarditis (always do echo)
  - SSTI (requires surgical debridement)
  - Osteomyelitis (requires surgery)
  - Pneumonia
  - Abscesses (requires drainage)
- Repeat blood cultures must be done every 2 days until blood cultures are negative

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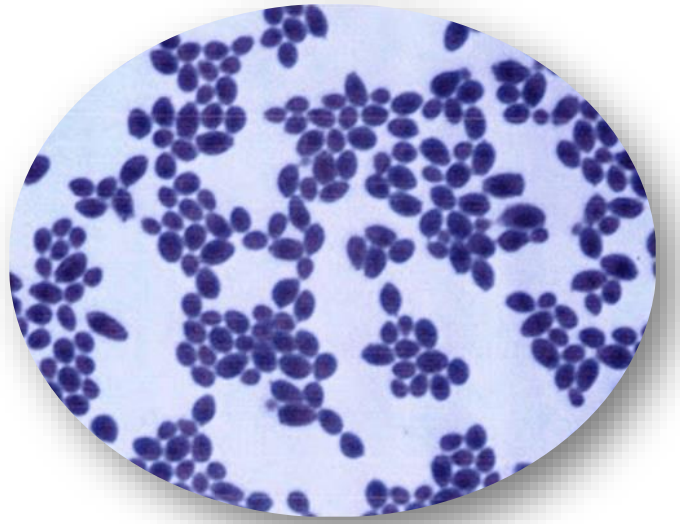
Blood Cultures

Gram-negative bacteria

- The *Enterobacteriales* are NEVER contaminants on blood cultures
- The following Gram negative bacteria are sometimes contaminants (i.e. pseudo-bacteraemia):
  - *S. maltophilia*
  - *Acinetobacter baumannii/ jejuni/nosocomialis*
  - *B. cepacia*
  - *Chryseobacterium* spp.
  - *Moraxella* spp.
- Always look for the source:
  - Central lines (remove if CLABSI suspected)
  - HAP/VAP
  - Intra-abdominal sepsis
  - UTI

Candida spp.

- *Candida* spp. are NEVER a contaminant on blood cultures
- Always investigate the source:
  - Central lines (remove if CLABSI suspected)
  - Intra-abdominal sepsis
- Repeat blood cultures must be done every 2 days until blood cultures are negative



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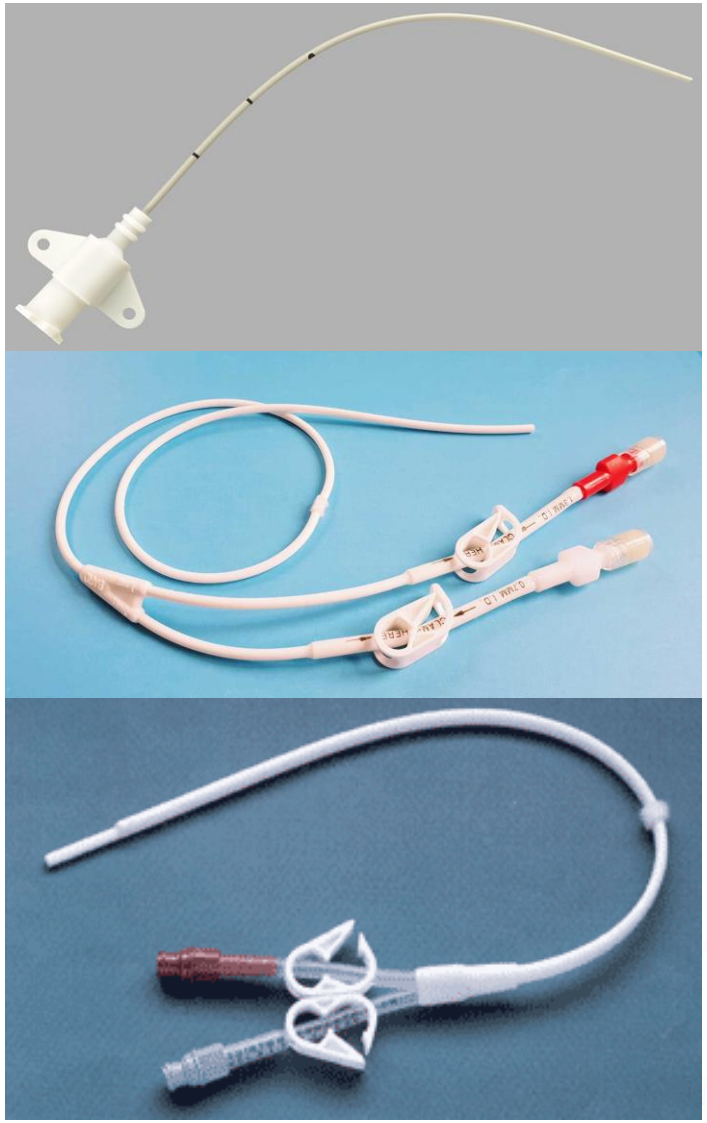
3. Catheter Tip Cultures

- The isolation of any micro-organism from an intravenous indwelling catheter tip may represent either:
  1. Colonisation - this is not significant and doesn't require treatment
  2. A source of central-line associated blood-stream infection (CLABSI)
- Significance of an isolate is interpreted by considering the clinical findings & also by finding the same organism in blood cultures taken at the time the catheter is removed
- **In the absence of a positive blood culture, no clinical significance can be established from a positive catheter tip culture result**

- Colony counts of less than 1,000 CFU/ml are considered possible contamination or the early stages of colonisation
- Coagulase negative staphylococci: Removal of the line itself is sufficient to resolve a CLABSI. *No antibiotics required!*
- **<u>DO NOT</u> send the following for culture: Urine catheter tips, pigtail tips, EVD tips, endotracheal tube tips**



4. Cerebrospinal Fluid (CSF)

- **Bacterial meningitis is usually associated with a purulent CSF (> 100 polymorphs)**
- **Most common bacterial pathogens:**
  - *N. meningitidis* (Gram-negative diplococci)
  - *S. pneumoniae* (Gram-positive diplococci)
  - *H. influenzae* (Gram-negative bacilli)
- **Key pathogens in the neonate:**
  - Group B beta-haemolytic streptococcus
  - *E. coli*
  - *Listeria monocytogenes* (Gram-positive bacilli)
- **Empiric treatment : cefotaxime/ceftriaxone**
  - Covers all except *Listeria* which is inherently resistant
  - If *Listeria* is suspected, ampicillin should be added

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Cerebrospinal Fluid (CSF)

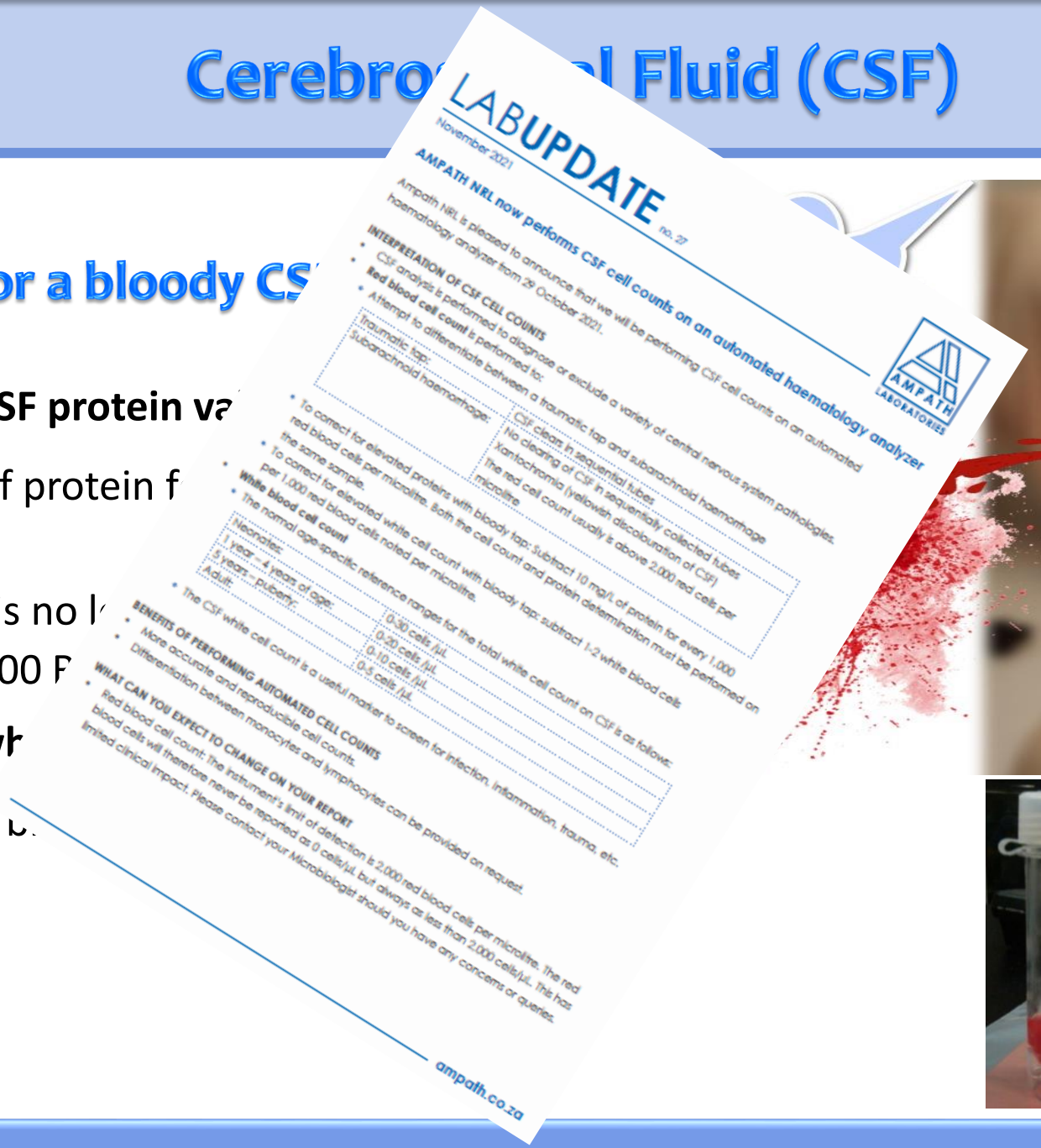
Normal CSF Values				
CSF Total Protein	150 – 450 mg/l	Leucocytes	Neonates	0 - 30 cells/µl
CSF Glucose	2.2 – 3.9 mmol/l <60% of simultaneously determined plasma concentration (CSF: serum ratio <0.6)		1 year – 4 years of age	0 - 20 cells/µl
			5 years - puberty	0 - 10 cells/µl
			Adult	0 - 5 cells/µl

	White cell count (cells/µl)	Primary cell type	Glucose (mmol/l)	Protein (mg/l)
Viral	50-1000	Mononuclear	> 4,5	< 200
Acute bacterial	100-5000	Polymorph	< 4	100-500
TB meningitis	0-300	Mononuclear	< 4,5	50-300
Cryptococcus	0-500	Mononuclear	< 4	> 450

Cerebro l Fluid (CSF)

Correcting values for a bloody CS

- **Correcting elevated CSF protein va**
  - Subtract 10 mg/l of protein f
    red blood cells/µl
  - CSF protein result is no l
    when there is > 3000 F
- **Correcting elevated wh**
  - Subtract 1-2 white b
    RBC/µl


LABUPDATE
November 2021 no. 27

AMPATH NRL now performs CSF cell counts on an automated haematology analyzer

Ampath NRL is pleased to announce that we will be performing CSF cell counts on an automated haematology analyzer from 29 October 2021.

INTERPRETATION OF CSF CELL COUNTS

- CSF analysis is performed to diagnose or exclude a variety of central nervous system pathologies.
- **Red blood cell count** is performed to:
  - Attempt to differentiate between a traumatic tap and subarachnoid haemorrhage
    - Traumatic tap: CSF clears in sequential tubes
    - Subarachnoid haemorrhage: No clearing of CSF in sequentially collected tubes. Xanthochromia (yellowish discolouration of CSF). The red cell count usually is above 2,000 red cells per microlitre
  - To correct for elevated proteins with bloody tap: Subtract 10 mg/L of protein for every 1,000 red blood cells per microlitre. Both the cell count and protein determination must be performed on the same sample.
  - To correct for elevated white cell count with bloody tap: subtract 1-2 white blood cells per 1,000 red blood cells noted per microlitre.
- **White blood cell count**
  - The normal age-specific reference ranges for the total white cell count on CSF is as follows:

Neonates:	0-30 cells /µL
1 year – 4 years of age:	0-20 cells /µL
5 years – puberty:	0-10 cells /µL
Adult:	0-5 cells /µL

  - The CSF white cell count is a useful marker to screen for infection, inflammation, trauma, etc.

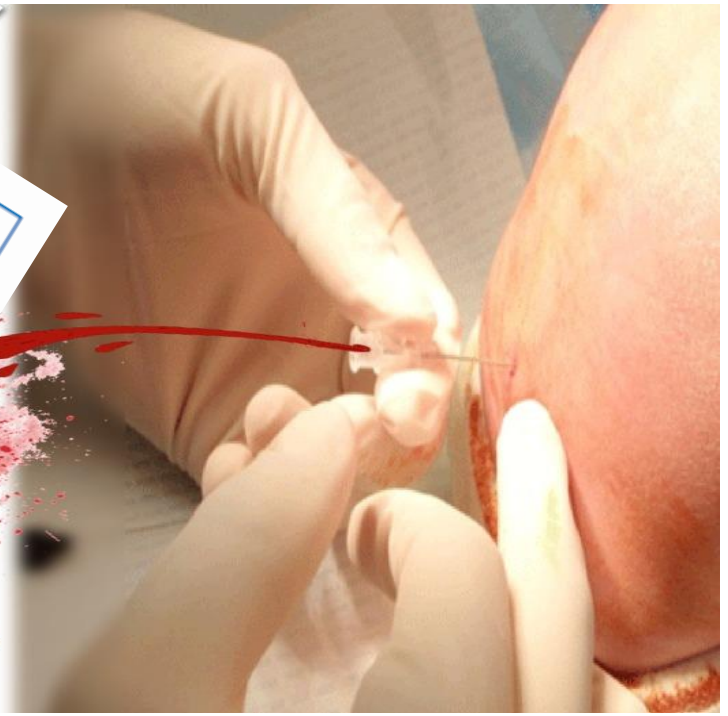
BENEFITS OF PERFORMING AUTOMATED CELL COUNTS

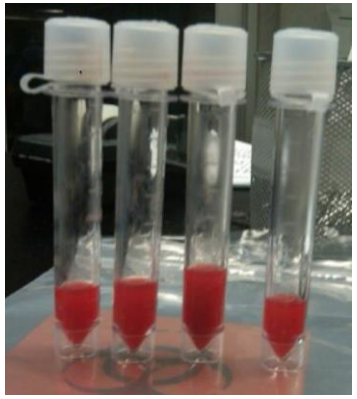
- More accurate and reproducible cell counts.
- Differentiation between monocytes and lymphocytes can be provided on request.

WHAT CAN YOU EXPECT TO CHANGE ON YOUR REPORT

- Red blood cell count: The instrument's limit of detection is 2,000 red blood cells per microlitre. The red blood cells will therefore never be reported as 0 cells/µL but always as less than 2,000 cells/µL. This has limited clinical impact. Please contact your Microbiologist should you have any concerns or queries.

ampath.co.za





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Cerebrospinal Fluid (CSF)

AMPATH LABORATORIES

Drs Du Buisson, Kramer, Swart, Bouwer Inc.
Registration number: 2007/018337/21
PR0520005200431

Pathology Report

24hr Contact No. 083 557 8198

Patient: [redacted]

Doctor:
Dr T Law
8 Sturdee Avenue
Ground Floor
Rosebank, JHB 2021

FINAL REPORT
Req: [redacted]
Specimen: 19:PU0147855S

[redacted]

Collected: 2019-10-13 15:55
Received: 2019-10-13 16:10
Printed: 2021-11-17 13:23
Batch: Email 436953 STD

Copy Doctor: Adre Lourens, Hosp Wilmedpark Locum Ongevalle, Wilmedpark Infection Control, Mr Apteek Wilmedpark

Ordered: CSF MCS, TB culture, TB culture, Cerebrospinal Fluid Chemistry, CSF Chloride, CSF Lactate, India ink stain, Bacterial Antigen, Cryptococcus antigen, Xanthochromic Index, Adenosine Deaminase, GeneXpert TB PCR

PROCEDURE		RESULT
Specimen: Cerebrospinal fluid		**Description:**
>MACROSCOPY		
Colour	:	Clear
Clot	:	Absent
Appearance of supernatant	:	Clear
>CELL COUNT		
Total white cell count	:	105 cells / ul
Polymorphs	:	70 cells / ul
Mononuclear cells	:	35 cells / ul
Red blood cells	:	65 cells / ul
>MICROSCOPY		
Bacteria	:	Gram positive cocci present
Yeast cells	:	Absent
>AEROBIC CULTURE		
Streptococcus pneumoniae		
Growth	:	Profuse
Id sens	:	Final

AMPATH LABORATORIES

Drs Du Buisson, Kramer, Swart, Bouwer Inc.
Registration number: 2007/018337/21
PR0520005200431

Pathology Report

24hr Contact No. 083 557 8198

[redacted]

Doctor:
Dr T Law

FINAL REPORT
Req: [redacted]
Specimen: 19:PU0147855S

Collected: 2019-10-13 15:55
Received: 2019-10-13 16:10
Printed: 2021-11-17 13:23
Batch: Email 436953 STD

>AEROBIC CULTURE

	S.pneumo
BETA-LACTAMS	
Ampicillin	S
Ceftriax/Cefota	S
Ceftaroline	S
QUINOLONES	
Levofloxacin	S
Moxifloxacin	S
MLS	
Clindamycin	S
Ery/Cla/Azi	S
Telithromycin	S
OTHER	
Cotrimoxazole	R
Tetracycline	S
Vancomycin	S
Linezolid	S

>ANTIMICROBIAL ACTIVITY
Test not performed

>INDIA INK STAIN

Cryptococcus	:	Absent

>BACTERIAL ANTIGEN

Streptococcus group B	:	Negative
H. influenzae B	:	Negative
Streptococcus pneumoniae	:	Positive
N. mening A,C,Y,W135	:	Negative
N. mening B/E.coli K1	:	Negative

>CRYPTOCOCCUS ANTIGEN

Cryptococcus antigen test	:	Negative

This is an outdated useless test, that wastes precious CSF. Rather request bacterial PCR.

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Cerebrospinal Fluid (CSF)

- Usually 3 - 4 tubes of CSF are collected by lumbar puncture for diagnostic studies
- The 1st tube has the highest potential for contamination with skin flora & should not be sent to the microbiology laboratory

- **Bacterial antigen testing on CSF is no longer recommended and should not be ordered nor should the laboratory provide this service**
- **It is an outdated test that wastes precious amounts of CSF. Rather request bacterial PCR**

- Because the sensitivity of PCR for *M. tuberculosis* in non-respiratory specimens may be poor, culture should also always be requested
- The reported sensitivity of culture for diagnosing tuberculous meningitis is 25%–70%
- The highest yields for AFB smear & AFB culture occur when large volumes (≥5 mL) of CSF are used to perform the testing

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5. Respiratory Tract Cultures

- **Interpretation of culture results must take the following into consideration:**
  - **QUALITY of the specimen on microscopy**
    - Few/no polymorphs & many epithelial cells (from mucous membrane of the mouth) indicate specimen consists of or contains saliva ➡ culture results will therefore not be reliable
    - Lab comment: **The presence of >25 epithelial cells per LPF indicates a sputum with probable oropharyngeal contamination.**
    - Numerous polymorphs with only scanty epithelial cells & culture results that correlate with Gram stain ➡ indicate a 'good' specimen
  - **Quantitation of growth (heavy, moderate, or light)**
    - True pathogens are generally present in moderate or heavy amounts
  - **ALWAYS correlate clinically and radiological for significance**
  - *Candida* spp. does NOT cause pneumonia (exception: neonates)
- Rates of pathogen detection vary among studies:
  - Good quality specimens: 73% (95% CI 26-96%)
  - Lower quality specimens: 36% (95% CI 22-53%)

Klompas M. UpToDate 2021.

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Molecular Testing of Respiratory Pathogens

	Core respiratory virus multiplex PCR	Comprehensive respiratory pathogens multiplex PCR	Triplex respiratory virus multiplex PCR
Components	**Viruses** Influenza A&B RSV A&B Adenovirus Metapneumovirus Parainfluenza 1-4 Rhinovirus SARS-CoV-2	**Viruses** Influenza A&B RSV A&B Adenovirus Metapneumovirus Parainfluenza 1-4 Rhinovirus Enterovirus Coronavirus 229E Coronavirus NL63 Coronavirus OC43 Bocavirus **Bacteria** *B. pertussis* *B. parapertussis* *C. pneumoniae* *M. pneumoniae* *Legionella* spp.	**Viruses** Influenza A&B RSV A&B SARS-CoV-2
Mneumonic	RVCORPCR	RPCOMPCR	COVTRIPCR

- Highly sensitive & specific viral PCRs have become the diagnostic "gold standard" in clinical virology
- Several of the newest assays also detect & identify the most common causes of "atypical" bacterial pneumonia
- **Not all positive results indicate current active infection**

AMPATH LABORATORIES

Biofire® FilmArray® Pneumonia Panel plus (Biomérieux)

- FDA-approved multiplexed PCR for simultaneous detection of multiple respiratory viral & bacterial pathogens in respiratory specimens (sputum, endotracheal aspirate & bronchoalveolar lavage)
  - 18 bacteria (11 Gram negative, 4 Gram positive and 3 atypical),
  - 7 antibiotic resistance markers
  - 9 viruses

- Results are rapidly available - run time of approximately 1 hour from loading on the instrument
- **Utility of the panel is most relevant to ICU admissions**
- The 15 typical bacteria are semi-quantified to the nearest whole log as DNA copies/mL: 10^4, 10^5, 10^6, and $\geq 10^7$
  - Can assist in distinguishing between an actual pathogen versus a coloniser
- Few limitations:
  - Nosocomial pathogens not covered: e.g. *S. maltophilia*, *Aspergillus* spp. & *Pneumocystis jirovecii*
  - Detection of DNA doesn't imply the presence of a viable pathogen
  - Susceptibilities of the organisms not known

Gastli N, et al. Multicentric evaluation of BioFire FilmArray Pneumonia Panel for rapid bacteriological documentation of pneumonia. CMI 2020. doi.org/10.1016/j.cmi.2020.11.014

AMPATH LABORATORIES

Biofire® FilmArray® Pneumonia Panel plus

Semi-Quantitative Bacteria

Gram Negative Bacteria

- Enterobacteriales:
  - *Enterobacter cloacae* complex
  - *Escherichia coli*
  - *Klebsiella pneumoniae* group
  - *Klebsiella oxytoca*
  - *Klebsiella aerogenes*
  - *Proteus* spp.
  - *Serratia marcescens*
- Non-lactose fermenters:
  - *Acinetobacter calcoaceticus-baumannii* complex
  - *Pseudomonas aeruginosa*
- *Haemophilus infuenzae*
- *Moraxella catarrhalis*

Gram Positive Bacteria

- *Staphylococcus aureus*
- *Sreptococcus agalactiae*
- *Streptococcus pneumoniae*
- *Streptococcus pyogenes*

Atypical Bacteria

- *Legionella pneumophila*
- *Mycoplasma pneumoniae*
- *Chamydophila pneumoniae*

Viruses

- Infuenza A
- Influenza B
- RSV
- Hyman Rhinovirus/Enterovirus
- Human Metapneumovirus
- Parainfluenza virus
- Adenovirus
- Coronavirus (endemic)
- MERS

Antimicrobial Resistance Genes

- Methicillin resistance:
  - *mecA/C & MREJ*
- ESBL:
  - *CTX-M*
- Carbapenemases:
  - *OXA-48-like*
  - *NDM*
  - *VIM*
  - *KPC*
  - *IMP*

Gastli N, et al. Multicentric evaluation of BioFire FilmArray Pneumonia Panel for rapid bacteriological documentation of pneumonia. CMI 2020. doi.org/10.1016/j.cmi.2020.11.014

Sputum Cultures

AMPATH LABORATORIES

Drs Du Buisson, Kramer, Swart, Bouwer Inc.
Registration number: 2007/018337/21
PR0520005200431

Pathology Report

24hr Contact No. 011 709 1000

Patient:

Doctor:
Dr T Law
8 Sturdee Avenue
Ground Floor
Rosebank, JHB 2021

FINAL REPORT
Req:
Specimen: 20:RE0037817S

Collected: 2020-10-10 01:07
Received: 2020-10-11 01:07
Printed: 2021-11-17 10:26
Batch: Email 436671 I-STD

Copy Doctor: Ward Solomon Stix Morewa Rehab Ward, Solomon Stix Infection Control
Ordered: Sputum MCS, Sputum microscopy comment
Comments: No collection date/time on the request form
Sputum MCS

PROCEDURE		RESULT
Specimen: Sputum		**Description:**
>MACROSCOPY		
Appearance	:	Mucoid
>MICROSCOPY		
Pus cells	:	< 10 cells / LPF
Squamous epithelial cells	:	> 25 cells / LPF
Gram pos cocci	:	Numerous
Gram neg bacilli	:	Numerous
Gram neg cocci	:	Numerous
Gram neg coccobacilli	:	Moderate
Yeast cells	:	Absent
>MYCOBACTERIUM MICROSCOPY		
Acid fast bacilli	Absent	
>AEROBIC CULTURE		
Acinetobacter nosocomialis		
Growth	:	Scanty
Id sens	:	Final

>COMMENT
The presence of >25 epithelial cells per LPF indicates a sputum with probable oropharyngeal contamination.

AMPATH LABORATORIES

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Registration number: 2007/018337/21
PR0520005200431

Pathology Report

24hr Contact No. 011 709 1000

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Dr T Law
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Batch: Email 436671 I-STD

>AEROBIC CULTURE

	A.noso
BETA-LACTAMS	
Ceftazidime	R
Cefepime	R
Imipenem	R
Meropenem	R
Doripenem	R
AMINOGLYCOSIDES	
Amikacin	R
Gentamicin	R
QUINOLONES	
Ciprofloxacin	R
OTHER	
Colist/Polymyx	S
Col/Poly MIC 2	S
Cotrimoxazole	R
Tigecycline	S

Definitely a coloniser!

>COMMENT
Acinetobacter nosocomialis

Acinetobacter nosocomialis
This is an extensively drug-resistant isolate. Strict isolation, contact precautions and dedicated nursing of colonised and/or infected patients are advised. Please contact your local microbiologist regarding possible treatment options or if further advice if needed.

Tracheal Aspirate Culture

AMPATH LABORATORIES

Drs Du Buisson, Kramer, Swart, Bouwer Inc.
Registration number: 2007/018337/21
PR0520005200431

Pathology Report

24hr Contact No. 011 709 1000

Patient:
[redacted]

Doctor:
Dr T Law
8 Sturdee Avenue
Ground Floor
Rosebank, JHB 2021

FINAL REPORT
Req: [redacted]
Specimen: 21:RE0028998S

[redacted]

Collected: 2021-07-23 14:00
Received: 2021-07-23 15:55
Printed: 2021-11-17 10:39
Batch: Email 436692 I-STD

Copy Doctor: Dr T Law, Rosebank Clinic Infection Cont, Rosebank Clinic ICU
Ordered: Tracheal MCS, Fungal culture, Carbapenemase Cult Screening, Pneumocystis jiroveci PCR, Mycobacterium PCR

PROCEDURE		RESULT
Specimen: Tracheal aspirate		**Description:**
>MACROSCOPY		
Appearance	:	Mucoid
>MICROSCOPY		
Pus cells	:	10 - 25 cells / LPF
Squamous epithelial cells	:	< 10 cells / LPF
Gram neg bacilli	:	Numerous
Yeast cells	:	Absent
>MYCOBACTERIUM MICROSCOPY		
Acid fast bacilli	:	Absent
>AEROBIC CULTURE		
Klebsiella pneumoniae		
Growth	:	Profuse

>COMMENT
Klebsiella pneumoniae

This isolate tested positive for carbapenemase production with PCR. Strict isolation with contact precautions, screening of patient contacts, co-horting of colonised and/or infected patients and dedicated nursing are advised. Treatment with two active drugs is recommended. Please contact your local microbiologist for further advice if needed.

AMPATH LABORATORIES

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Pathology Report

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[redacted]

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Dr T Law

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Batch: Email 436692 I-STD

>AEROBIC CULTURE

	K.pneumo
BETA-LACTAMS	
Ampi/Amox	R
Amox+Clav	R
Pip+Taz	R
Cefuroxime	R
Ceftriax/Cefota	R
Ceftazidime	R
Cef+Avi	S
Cefepime	R
Cef+Taz	R
Imipenem	R
Imipenem MIC 16	R
Meropenem	R
Meropenem MIC 32	R
Ertapenem	R
Doripenem	R
Doripenem MIC 32	R
AMINOGLYCOSIDES	
Amikacin	S
Gentamicin	R
QUINOLONES	
Ciprofloxacin	R
OTHER	
Colist/Polymyx	S
Col/Poly MIC 1	S
Cotrimoxazole	R
Tigecycline	S
CARB	+

Correlate with CXR findings!

6. Fluid/Aspirate Culture

Types of Fluid

- **Pleural fluid/empyema**
- **Peritoneal fluid**
- **Pericardial fluid**
- **Synovial fluid**
- **Peritoneal dialysate**
- **Pus aspirate**
- **Sinus fluid**
- **Middle ear fluid**
- **Drain fluid**
- **Vitreous/aqueous humor**

- Fluids from normally sterile sights can be injected into blood culture bottles
- It is vitally important to always give clinical information on the lab form:
  - Exact site the fluid is from
  - Reason for testing
  - Any specific organisms being looked for e.g. *Nocardia*, TB, fungi

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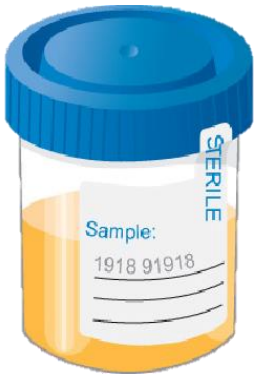
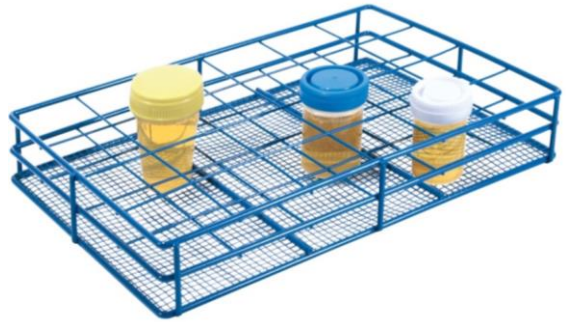
7. Urine Culture

- Positive urinalysis
  - ≥ 10 leukocytes/ul (= pyuria) & positive leukocyte esterase
  - Positive nitrites indicate certain bacteria in urine (*E. coli*, *Proteus* spp., *Klebsiella* spp.)
- Positive urine culture (significant bacteriuria)
  - No catheter: ≥ 100,000 cfu/ml of a urinary pathogen
  - Catheter: ≥ 10,000 cfu/ml of a urinary pathogen



- Catheter samples
  - should be collected aseptically from the catheter sampling port, ***not the collection bag***

- **A contaminated/poorly collected specimen**
  - **usually contains scanty or no leucocytes,**
  - **contains many squamous epithelial cells**
  - **yields mixed growth**



- Sterile pyuria (numerous leucocytes but no bacterial growth) may be due to:
  - presence of antibiotics
  - possible TB
  - vaginitis, Chlamydia, Ureaplasma
  - non-infective causes e.g., recent surgery, foreign bodies in the urinary tract, kidney stones

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Asymptomatic bacteriuria

Asymptomatic bacteriuria is COMMON

Population With ASB	Prevalence of Pyuria
Young women	32%
Pregnant women	30–70%
Women with diabetes	70%
Elderly institutionalized patients	90%
Dialysis patients	90%
Patients with short-term catheters	30–75%
Patients with long-term catheters	50–100%

- Pyuria in patients with asymptomatic bacteriuria is not an indication for antibiotic therapy

- Randomized, controlled trials have demonstrated a LACK of benefit of antibiotic treatment of ASB in the following populations:
  - Healthy, non-pregnant women aged 18–40 years
  - Diabetic women
  - Patients with long-term indwelling catheters
  - Older women in the community
  - Elderly nursing home resisdents
  - Renal transplant patients
  - Patients undergoing orthopaedic surgery

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Urine Cultures

Urine general principles

- Send urinalysis and urine cultures only when patients have signs or symptoms of a UTI
- Do not send cultures for:
  - Foul-smelling or cloudy urine
  - Routinely on admission or pre-operatively
  - Routinely before or after a catheter change
  - As part of a fever workup if there are no signs or symptoms localising to the urinary tract
  - As a test of cure
- Pyuria can be seen in patients with a UTI but is not diagnostic of a UTI in the absence of urinary symptoms

- A UTI is unlikely if there is:
  1. Lack of significant bacteriuria (< 100,000 organisms/ mL)
  2. Lack of significant pyuria (< 10 pus cells/uL)

Candida spp. in urine

- Yeast in urine does not necessarily indicate infection, especially if the patient is asymptomatic
- It can, however, indicate infection ranging from mild infections (urethritis, cystitis) to life threatening systemic infections
- Elimination of predisposing factors, such as indwelling bladder catheters, is recommended whenever feasible

- Candiduria: Treatment with antifungal agents is NOT recommended unless the patient belongs to a group at high risk for dissemination; high-risk patients include:
  - neutropenic patients
  - very low-birth-weight infants (<1500 g)
  - patients who will undergo urologic manipulation

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8. Pus Swabs

- **SWABS ARE VERY POOR SPECIMENS, they pick up surface colonizers/contaminants.**
- **Swabs are inferior to aspirated pus or a tissue biopsy** in the recovery of fastidious and anaerobic organisms, as these organisms may desiccate or die in an aerobic environment
- Appropriate use of swabs:
  - CRE, MRSA, VRE screening swabs
  - Nasopharyngeal swabs for viral pathogens
  - Throat swabs for *S. pyogenes*
  - Vaginal/STI swabs
- **Very important to indicate on the request form:**
  - **site from which a specimen was collected**
  - **was it collected during surgery**
- Superficial wounds are frequently colonised with normal skin flora
  - need skin disinfection & wound debridement before specimens are collected

TRY NOT TO SUBMIT SWAB SPECIMENS!

AMPATH LABORATORIES

9. Septic Markers

1. C-reactive protein (CRP)

- A relatively non-specific marker of inflammation & therefore sepsis
- Levels are increased to some extent in most conditions associated with inflammation
- It is a cheap & widely available test & when levels are raised in a patient with signs suggestive of sepsis, it provides useful supporting evidence
- CRP increases slowly with a peak after 48-72 hours & a slow decrease thereafter

CRP Levels and Need for antibiotic therapy (Lower RTI)

C-Reactive Protein Value (mg/L)	Antibiotic Therapy
<20	Withhold in most patients
21–99	Further assessment needed to determine
≥100	Strongly encouraged

Noviello S, Huang DB. The basics and the advancements in diagnosis of bacterial lower respiratory tract infections. Diagnostics 2019;9:37.

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Septic Markers

2. Procalcitonin (PCT)

- PCT is a more reliable marker of sepsis than CRP
- It is useful in distinguishing bacterial from other forms of infection
- PCT levels rise within 2-4 hours
- PCT kinetics then mirror the severity of infection
- Evidence has shown that PCT is a useful method in guiding the initiation & duration of antibiotic treatment for LRTIs
- PCT levels drop by ± 50% daily when infection is controlled & responds adequately to antibiotics

- **NOTE: ESR is NOT a septic marker!!**

Noviello S, Huang DB. The basics and the advancements in diagnosis of bacterial lower respiratory tract infections. Diagnostics 2019;9:37.

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How to Use PCT

LRTI*

1 EVALUATE

Determine if antibiotics are necessary

< 0.1 ng/mL	Antibiotics are strongly discouraged
0.1-0.25 ng/mL	Antibiotics are discouraged
0.26–0.5 ng/mL	Antibiotics are encouraged
> 0.5 ng/mL	Antibiotics are strongly encouraged

2 MONITOR

Assess therapy effectiveness over time

Test follow-up samples once every 1-2 days, based upon physician discretion, to support decision to discontinue antibiotic therapy.

3 DISCONTINUE

Assess when to discontinue antibiotics

≤ 0.25 ng/mL or ΔPCT > 80%	Discontinuation of antibiotics is encouraged

SEPSIS

1 EVALUATE

Assess sepsis risk & severity

> 2.0 ng/mL	High risk for progression to severe sepsis and/or septic shock
0.5–2.0 ng/mL	Sepsis should be considered
< 0.5 ng/mL	Low risk for progression to severe sepsis and/or septic shock

2 MONITOR

Assess risk over time

Test follow-up samples once every 1-2 days, based upon physician discretion, to support decision to discontinue antibiotic therapy.

3 DISCONTINUE

Assess when to discontinue antibiotics

≤ 0.5 ng/mL or ΔPCT > 80%	Discontinuation of antibiotics is encouraged

AMPATH LABORATORIES

In a nutshell

- Poor-quality specimens may lead to misleading results, inappropriate antimicrobial therapy & delay in diagnosis
- The quality of specimens is interpreted according to the microscopy & culture findings
- The site from where the specimen was collected is important to determine the significance of the organisms isolated
- Organisms from non-sterile sites may be colonisers & not necessarily the cause of infection
- Swabs are inferior to aspirated pus or tissue specimens in the recovery of pathogens

AMPATH LABORATORIES

In a nutshell

- Contamination of blood cultures with skin & environmental flora is a common problem

- To establish the clinical significance of 'contaminants', repeated isolation of the same organism from different sterile sites is required

- If the patient does not respond to antibiotic therapy chosen according to the microbiological susceptibility profile, consider:
  - inadequate therapy for the infection site
  - inadequate dosage
  - poor source control
  - possible selection of resistant mutants

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THANK YOU
?
GeneXpert
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