# Blood culture.

## Transient.

The transient presence of bacteria or fungi in the bloodstream for periods of several minutes may follow manipulation of, or surgical procedures involving infected tissue or the instrumentation of colonised mucosal surfaces. Common examples include dental extraction and urinary catheterization. It may also result from chewing especially if dental hygiene is poor….etc.

## Intermittent

Intermittent infection is "recurrent transient" infection and is characteristically associated with undrained, intra-abdominal abscesses. It occurs early in the course of a variety of systemic and localized infections, eg. pneumococcal bacteraemia in pneumococcal pneumonia. Cultures taken during fevers and after the onset of rigors may miss intermittent bacteraemia as bacteria tend to be cleared by the host defence mechanisms prior to sampling.

## Continuous

Continuous bacteraemia suggests a severe infection that has overwhelmed the host defence. It is also characteristic of intravascular infection such as infective endocarditis or suppurative thrombophlebitis. Occasionally, continuous bacteraemia occurs in association with non-vascular sources, especially in patients who are immunosuppressed.

## Pseudobacteraemia

Pseudobacteraemia occurs when blood culture isolates originate from outside the patient's bloodstream. Blood culture contamination may occur at any stage between taking a blood sample and processing in the laboratory, and can originate from a variety of sources. Outbreaks of pseudobacteraemia with environmental organisms have been described involving contaminated fluids and equipment on wards and laboratories, and incorrect sampling of blood.

## Sepsis

The term Systemic Inflammatory Response Syndrome (SIRS).

describes the early response of the body to injury and may be infective or non–infective in origin. SIRS is present when two or more of the following clinical features are present:

• Body temperature <36°C or >38°C

• Heart rate >90 beats per minute

• Hyperventilation >20 breaths per minute

• White blood cell count >12,000 cells per μL or <4000 cells per μL>

Sepsis was previously referred to as septicaemia. Sepsis is the presence of SIRS caused by infection. It is defined as infection plus a systemic response to, or manifestation of, infection. Around 20% of sepsis cases are associated with bacteraemia, the rest are secondary to infection at other sites in the body. The incidence of sepsis continues to rise with a reported associated mortality rate of 35- 65%35.

**Severe Sepsis**

Severe sepsis is defined as sepsis plus sepsis-induced organ dysfunction or tissue hypoperfusion.

**Septic Shock**

Septic shock is defined as the persistence of sepsis-induced hypotension despite adequate fluid resuscitation. The clinical symptoms are usually attributed to toxic bacterial products and/or the host response to these. Shock is more commonly seen with Gram-negative septicaemia, but shock may also be associated with Gram positive organisms, particularly with fulminant pneumococcal, Lancefield Group A streptococcal and staphylococcal bacteraemia.

Intravenous antibiotic therapy within the first hour of recognition of septic shock and severe sepsis is recommended as antimicrobial agents are of little help in combating the acute effects of shock.

## What is a Blood Culture?

A blood culture is a laboratory test in which blood is injected into bottles with culture media to determine whether microorganisms have invaded the patient’s bloodstream.

**Blood Culture is done to Detect Infectious Diseases**?

Blood culture is a microbiological culture of blood. It is employed to detect infections that are spreading through the bloodstream (such as bacteremia, septicemia amongst others). This is possible because the bloodstream is usually a sterile environment.

**Principles for Collection:**

1. Gloves will be worn in accordance with standard precautions.

•Appropriate verification of the patient's identity, by means of an armband or area specific procedure, will occur before the specimen collection.

•Cultures should be drawn before administration of antibiotics, if possible.

• blood cultures should be drawn from lines, but should be drawn viavenipuncture .

2. Chlorhexidine swabs (1-2 packages).

3. Alcohol swabs.

4. Blood culture bottles (2 bottles per set).

5. 2 syringes (adult: 20 cc, paediatric: 5 cc).

6. 2 needles (adult: 22 gauge or preferably larger butterfly or standard needle; pediatric: 25 or 23 gauge butterfly or standard needle)

7. Gloves (sterile & nonsterile)

8. Tourniquet

9. Sterile gauze pad

10. Adhesive strip or tape

11. Self-sticking patient labels

12. Plastic zip lock specimen bags.

**Method of Blood Collection**: A minimum of 10 ml of blood is taken through venipuncture and injected into two or more "blood bottles" with

specific media for aerobic and anaerobic organisms.

The blood is collected using clean technique. This requires that both the tops of the culture bottles and the venipuncture site of the patient are cleaned prior to collection with alcohol swabs containing 2% Chlorhexidine and 70% isopropyl alcohol. The area of skin is cleaned with a disinfectant, or an alcohol swab. Using sterile gloves, do not wipe away the surgical solution, touch the puncture site, or in any way compromise the sterile process. It is vital that the procedure is performed in as sterile a manner as possible as the persistent presence of skin commensals in blood cultures could indicate endocarditis but they are most often found as contaminants.

**Procedure:**

1. Identify patient.
2. Gather equipment, check expiry date on bottom of culture bottles, a central yellow dot indicates contamination (expired culture bottles may give false negative result).
3. Perform hand hygiene wash hands with soap and water or use ABHR. If the patient has visibly soiled skin, wash area with soap and water and dry.
4. Remove metal caps from bottles and scrub the rubber bung surface of each bottle with a separate 2% chlorhexidine & 70% alcohol wipe, leave wipes on top of bottles during skin, preparation and remove just prior to inoculation the bottle.
5. Apply tourniquet and palpate vein. Identify a suitable venipuncture site first before disinfecting the skin. Release tourniquet.
6. Use a 2% chlorhexidine & 70% alcohol wipe, clean for 30 seconds and allow to air dry. IMPORTANT: skin drying is essential to achieve adequate skin disinfection. Do not palpate vein again after cleaning patient's skin.
7. Prepare safety butterfly needle and vacutainer holder. Re-apply tourniquet.
8. Perform hand hygiene before applying clean non-sterile gloves.
9. Insert butterfly needle into selected vein.
10. Place vacutainer over blood culture bottle and pierce septum.

IMPORTANT: Fill AEROBIC bottle first (blue top) to ensure all air is removed from the butterfly and tubing.

11.Remove gloves and perform hand hygiene using ABHR.

12.Label each blood culture bottle 'Peripheral'. Do not cover bar code on bottles with patient labels.

13.Place in the special blood culture cones / biohazard bags and send to the laboratory with the blood request form.

14.Record the procedure in the patient's clinical notes.

15.Repeat procedure for each set collected.

**Minimum level in the laboratory**: All clinically significant isolates should be identified to species level.

**Note:** Any organism considered to be a contaminant may not require identification to species level.

It is recommended that clinically significant isolates are retained for at least one week.

Storage of isolates on slopes of appropriate media or at -20°C to -80°C for longer periods may need to be considered if further testing is likely (eg. typing isolates from nosocomial infection).

**Critical Control Points in Blood Culture Investigation**:

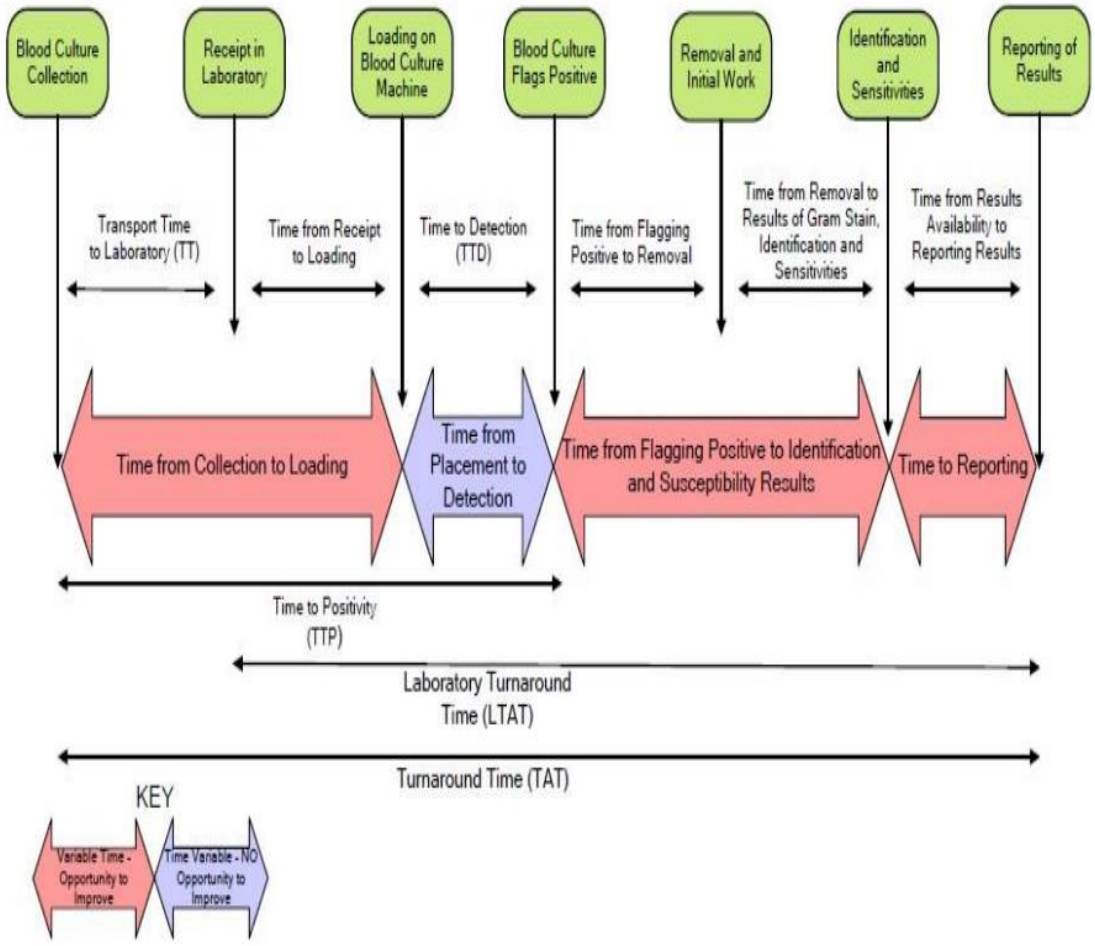
By breaking down the blood culture process, it is possible to identify critical control points where there may be delays or the potential to improve turn around times (TAT).

**The term TAT**, in this context, refers to the time taken from blood culture collection to the time of reporting. Laboratory TAT refers to the time from receipt of the sample in the laboratory to reporting of results. The time taken to achieve each of the following stages of the process has an effect on the overall TAT.

- Time from collection to receipt within the laboratory - Transport Time (TT).
- Time from receipt to loading on blood culture system.

- Time from loading to registering positive - Time to Detection (TTD).
- Time from flagging positive to identification and susceptibility results.
- Time from identification and susceptibility results to reporting.

Decreasing TAT leads to improved clinical outcomes because positive blood culture results provide a second opportunity via reports and clinical liaison to optimise antibiotic treatment where initial empirical therapy has been sub-optimal .



## Culture media, conditions and organisms:

| Clinical details/ conditions | Specimen | Standard media | Incubation | | | Cultures read | Target organism(s) |
|---|---|---|---|---|---|---|---|
| | | | Temp °C | Atmos | Time | | |
| All clinical conditions | Blood | Blood agar† | 35-37 | 5-10% $CO_2$ | 40-48hr* | Daily | Any organism may be significant |
| | | Fastidious anaerobe agar | 35-37 | anaerobic | 40-48hr* | ≥40hr and up to 5d | Any organism may be significant |
| For these situations, add the following: | | | | | | | |
| **Clinical details/ conditions** | **Specimen** | **Supplementary media** | **Incubation** | | | **Cultures read** | **Target organism(s)** |
| | | | **Temp °C** | **Atmos** | **Time** | | |
| Suspected meningo-coccaemia or meningitis<br>Small Gram negative rods or diplococci seen on microscopy | Blood | Chocolate agar† | 35-37 | 5-10% $CO_2$ | 40-48hr | Daily | *Haemophilus* species<br>*N. meningitidis*<br>*N. gonorrhoeae* |
| Gram negative rods seen on microscopy | Blood | MacConkey/ CLED agar or Chromogenic agar | 35-37 | air | 16-24hr | ≥16hr | Enterobacteriaceae<br>Non–fermentative organism<br>*Pseudomonas* species |
| Microscopy suggestive of mixed or anaerobic infection | Blood | Neomycin fastidious anaerobe agar with metronidazole 5µg disc | 35-37 | anaerobic | 5-7d | ≥40hr and at 5d | Anaerobes |
| Systemic fungal infection# | Blood | Sabouraud agar | 28-30 | air | 5d | 2d and at 5d | Yeast<br>Mould |
| Primary culture negative and positive growth curve‡<br>(subculture all bottles) | Blood | Blood agar | 35-37 | micro-aerobic | 5d | ≥3d and at 5d | *Campylobacter* species<br>*Helicobacter* species |
| | | Blood agar with streak of *S. aureus* (NCTC 6571) | 35-37 | 5-10% CO2 | 40-48hr | ≥40hr | *Abiotrophia* species |
| | | Fastidious anaerobe agar | 35-37 | anaerobic | 5d | ≥40hr and at 5d | Cysteine-dependent anaerobic organisms |
| | | MacConkey/ CLED agar | 35-37 | air | 16-24hr | ≥16hr | Cysteine-dependent organisms |

Other organisms for consideration – *Mycobacterium* (B 40) and *Brucella* species: also consider organisms that might be involved in deliberate release.

†an optochin disc may be added if streptococci seen on microscopy.

*incubation may be extended to up to 5 days if false negative likely or as clinically indicated; in such cases plates should be read at ≥40 hours and left in the incubator/cabinet for up to 5 days.

#where clinically indicated, blood culture bottles may require an extended incubation of up to three weeks for *Cryptococcus* species and up to six weeks for *Histoplasma* species[19,192-194].

‡other organisms may need to be considered.