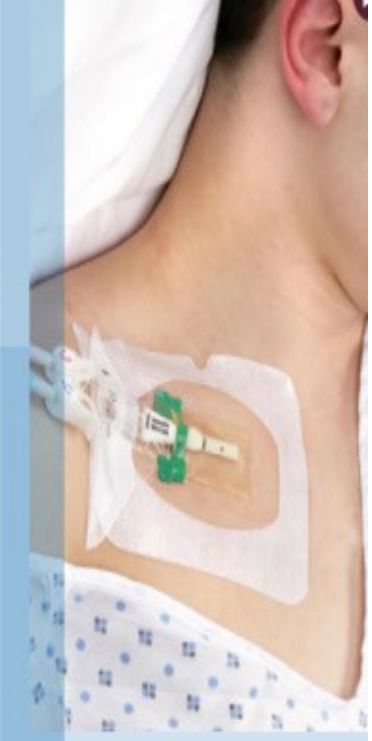

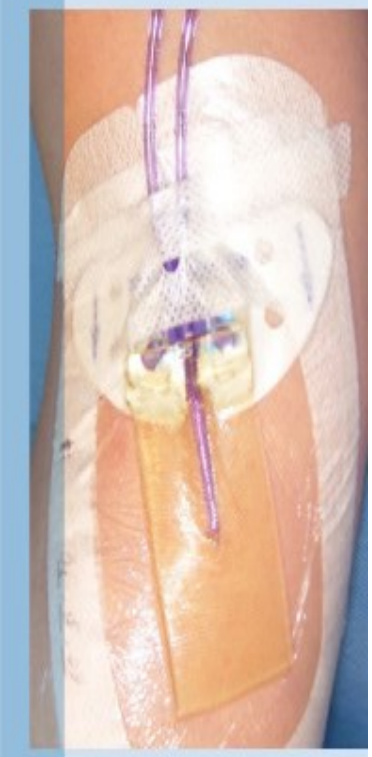

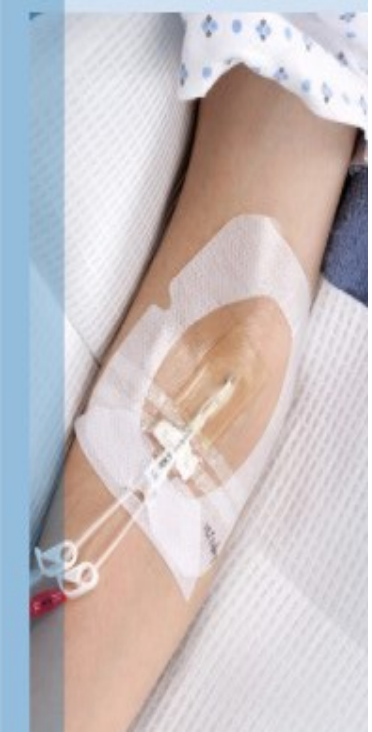

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Methods for Diagnosing CRBSI in the Clinical Microbiology Laboratory

Catheter related bloodstream infection (CRBSI) is a sepsis usually caused by contaminated indwelling intravenous (i.v) catheter. The aetiology in descending order of frequency are staphylococci (both *Staphylococcus aureus* and coagulase-negative staphylococci), enterococci, aerobic Gram-negative bacilli and yeast [2]. Amongst many, the most prevalent contaminated catheter is percutaneous, tunnelled long-term central venous catheter (CVC) [2]. This is because the catheter hub is easily contaminated with skin microbiome [5, 6] before and during needle insertion. Per contra, an unusual cause of CRBSI are contaminated infusates [5, 7] and haematogenous seeding from a distant infection [2, 5].

CRBSI inflicts many issues. Ultimately, it is the commonest cause of nosocomial infection, increases medical costs per patient, biofilm production by microorganisms renders antimicrobial therapy and prone to contamination by skin flora. Though common, there is no microbiologic gold standard to diagnose CRBSI [3]. Available data is not sufficient to conclude the diagnostic techniques [3]. However, a significant indication of CRBSI can be based upon the manifestation of bacteraemia [1, 3]. Diagnosis is based on the following where presumptive CRBSI is often made based on one or two of these criteria [1]:

i) The presence of CVC
ii) Signs of catheter insertion site infection
iii) Clinical symptoms and signs of bacteraemia
iv) Resolution of the symptoms and signs of bacteraemia after removal of the suspect CVC
v) Positive blood culture; and
vi) Growth of the same organism from the catheter

Physicians normally try to salvage the catheter until results are conclusive (unless the patient's condition is rapidly deteriorating). This decision depends on the severity of the situation. Ultimately, it is essential to prove that the infection is really caused by the catheter [3]. The organism cultured from the catheter must be of the same organism cultured from the peripheral venipuncture. However, a major diagnostic problem is the necessity to remove the catheter in question. Over 80% of withdrawn catheters are negative after culture, thus deemed unnecessary. These fallouts oftentimes put a risk of patient's comfortability and mechanical compilations of inserting another catheter [1]. Re-insertion can result in serious complications and risks, especially in patients with limited vascular access [4]. Due to this fact, there is an urge on developing *in situ* methods [1]. The best practice is a coupled diagnostic method (one blood culture set from catheter and one set from peripheral venipuncture).

The following are diagnostic methods for CRBSI:

	Diagnostic Method	Description	Criteria for positivity
Methods not requiring catheter removal	Paired quantitative blood culture	Collect paired peripheral and catheter blood cultures	Both cultures positive with catheter blood culture yielding 5-fold higher or more organisms than peripheral blood culture
	Differential time to positivity	Collect paired peripheral and catheter blood cultures. These needs to be processed in a continuous-monitoring blood culture system	Both cultures positive with catheter blood culture positive ≥ 2h earlier than peripheral BC
Methods requiring catheter removal	Qualitative catheter segment culture	Culture catheter inside a nutrient broth, simultaneously with BC drawn by peripheral venipuncture	Any growth
	Semiquantitative catheter segment culture	This is the archetypal method in any clinical microbiology laboratory when diagnosing CRBSI. Basically, culture a catheter distal (5cm) tip by rolling on agar (Maki method), simultaneously with BC drawn by peripheral venipuncture	Both cultures positive with catheter-segment culture positive ≥ 15 colony-forming units
	Qualitative catheter culture	Endoluminal brush sampling: this is another modification to Maki method. It uses a tiny brush and is passed down the catheter lumen. The brush is then examined microbiologically by culture. This test is highly sensitive and specific but burdened by the possibility of dislodging the organisms that might lead to bacteraemia	Any growth

Table 1. Diagnosis of CRBSI [1, 3]

Yet, there are a few concerns regarding catheter segment culture. Firstly, it only detects extraluminal microbes whilst intraluminal are missed. Secondly, it needs proper aseptic techniques (in order to minimize contamination) and thirdly, the length of the distal catheter tip must be accurate. Modification of Maki method includes vortexing the catheter tip [3].

In conclusion, it is very essential to carry out proper prevention steps in order to reduce number of CRBSI cases. Prevention and management is virtue when it comes to catheter. The phlebotomists needs to select the right catheter type and good catheter insertion site. They must also conduct proper aseptic techniques during needle insertion and handle catheter site care. CRBSI is an iatrogenic problem that results in significant morbidity and mortality. Every clinical microbiology laboratory should establish a protocol to minimize these cases.

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BMS DIAGNOSTICS (M) SDN BHD (485573-V)
19, Jalan 4/62A, Bandar Menjalara, Kepong, 52200 Kuala Lumpur, Malaysia.
Website: www.bmsd.com.my Email: info@bmsd.com.my
Tel: +603- 6272 0236 Fax: +603- 6277 0750

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