Catheter-Related Blood Stream Infections

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Junior Resident

PGIMER

- What is it?
- Is it common?
- How to diagnose?
- How to treat?
- How to prevent?

Case Scenario

- A 58 year old male known diabetic and hypertensive admitted in ICU 5 days back. He was diagnosed as a case of Influenza-B related ARDS intubated and mechanically ventilated. Central line placed at outside hospital. Now he started developing new onset fever however there is no increase in O2 requirement. His repeat bedside xray showed no new infiltrates. Treating physician suspected CRBSI in clinical grounds after excluding alternative source of fever.

- What should be our next step?
- Does the patient warrants empiric antibiotics?
- Do we really need to remove the catheter?
- What should be the duration of therapy?

- And many more unresolved doubts!!!

Clinical Definitions

- **CRBSI** – Bacteremia/ fungemia in an patient with an intravascular catheter with clinical manifestations of infections (fever, chills, and/or hypotension) and no apparent source of BSI except the catheter and diagnosed by Quantitative culture of catheter tip or by the difference in growth between central and peripheral blood culture**.(IDSA)**

Clinical suspicion **Microbiological evidence** **No alternative source**

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

Surveillance Definition

- **CLABSI –** A primary BSI occuring in a patient with a central line in place for at least 2 consecutive calendar days with the following signs or symptoms including fever, chills, and/or hypotension and meeting at least one of the Laboratory confirmed BSI criteria (at least one blood culture showing non-commensal or at least two blood culture commensals collected on different days or from different sites)**.(CDC)**

Centers for Disease Control and Prevention,*2011*.

- **Exit site infection** - Erythema, induration, and/or tenderness within 2 cm of the catheter exit site; may be associated with other signs and symptoms of infection, such as fever or purulent drainage emerging from the exit site, with or without concomitant bloodstream infection

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

- **Tunnel infection** - Tenderness, erythema, and/or induration >2 cm from the catheter exit site, along the subcutaneous tract of a tunneled catheter (e.g., Hickman or Broviac catheter), with or without concomitant bloodstream infection

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

- **Pocket infection -** Infected fluid in the subcutaneous pocket of a totally implanted intravascular device; often associated with tenderness, erythema, and/or induration over the pocket; spontaneous rupture and drainage, or necrosis of the overlying skin, with or without concomitant bloodstream infection

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

Types of catheters

Type of intravascular device	Comment
Peripheral venous catheter	Usually inserted into the veins of the forearm or the hand; the most commonly used short-term intravascular device
Peripheral arterial catheter	For short-term use; commonly used to monitor hemodynamic status and to determine blood gas levels of critically ill patients; risk of bloodstream infection may approach that of CVCs
Midline catheter	Peripheral catheter (size, 7.6–20.3 cm) is inserted via the antecubital fossa into the proximal basilic or cephalic veins, but it does not enter central veins; it is associated with lower rates of infection, compared with CVCs
Short-term CVC	Most commonly used CVC; accounts for the majority of all catheter-related bloodstream infections
Pulmonary artery catheter	Inserted through a teflon introducer and typically remains in place for an average duration of only 3 days
Pressure-monitoring system	Used in conjunction with arterial catheter; associated with both epidemic and endemic nosocomial bloodstream infections
Peripherally inserted central catheter	Provides an alternative to subclavian or jugular vein catheterization; is inserted via the peripheral vein into the superior vena cava, usually by way of cephalic and basilar veins; similar risk of infection as CVCs in patients hospitalized in intensive care units
Long-term CVC	Surgically implanted CVC (e.g., Hickman, Broviac, or Groshong catheter) with the tunneled portion exiting the skin and a dacron cuff just inside the exit site; used to provide vascular access to patients who require prolonged chemotherapy, home-infusion therapy, or hemodialysis
Totally implantable device	A subcutaneous port or reservoir with self-sealing septum is tunneled beneath the skin and is accessed by a needle through intact skin; associated with low rates of infection

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

Burden of disease

- An estimated **250,000 bloodstream infections** occur annually, and most are related to the presence of intravascular device
- In 2019, over **18,000 cases** of central line associated bloodstream infections (CLABSI) were reported in acute care hospitals in the USA.
- Catheter-related bloodstream infections (CRBSI) were associated with sub-stantial morbidity, increased hospital length of stay, mortality and an estimated attributable cost of **US $45,814** per event

Severine et al Infect Dis Ther (2021) 10:1591–1605

- WHO reported that in high-income countries, the CLABSI rate was **3.5** CLABSI per 1,000 CL-days, while in LMICs, it was **12.2**
- In the United States, the CLABSI rate is **0.8** per 1000 central line days.
- In Europe, **36.5%** of intensive care unit (ICU)-acquired bloodstream infections (BSIs) were linked to intravascular catheters and rates of CLABSI ranged from **1.7 to 4.8** episodes per 1000 catheter days.

Severine et al Infect Dis Ther (2021) 10:1591–1605

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Systematic review

Impact of central-line-associated bloodstream infections and catheter-related bloodstream infections: a systematic review and meta-analysis

S. Elangovan [a], J.J. Lo [b], Y. Xie [a], B. Mitchell [c], N. Graves [a], Y. Cai [a,*]

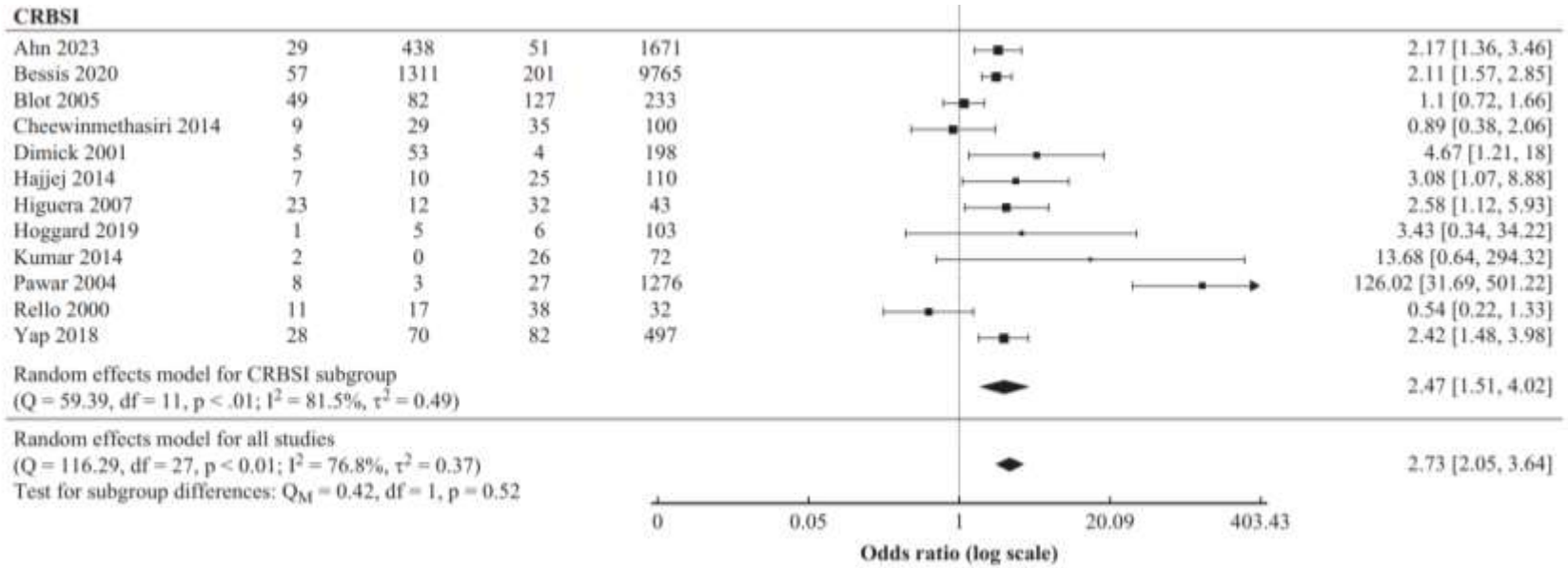

Figure 2. Pooled odds ratios for all-cause mortality in CLABSI and CRBSI patients. CLABSI, central-line-associated bloodstream infection; CRBSI, catheter-related bloodstream infection; CI, confidence interval; I^2, heterogeneity estimate; Q, Cochran's Q statistic; τ^2, variance estimate; Q_M, Omnibus test for moderator effect.

Elangovan et al J Hosp Infect. 2024 Oct;152:126-137

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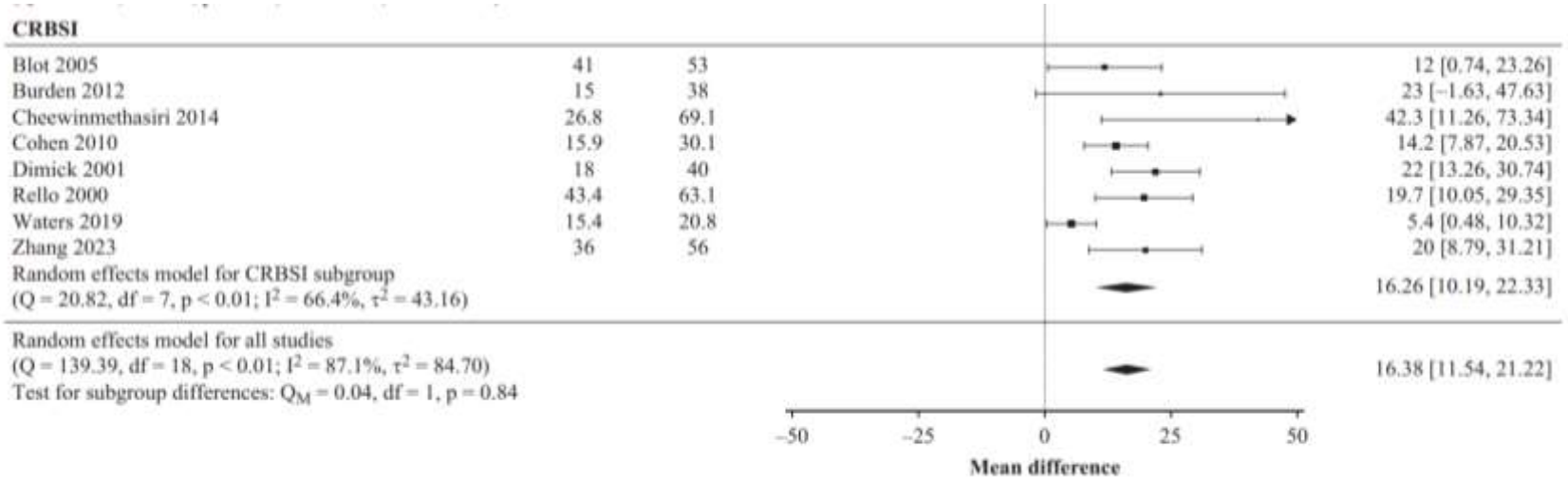


Figure 3. Pooled mean differences for hospital length of stay in CLABSI and CRBSI patients. CLABSI, central-line-associated bloodstream infections; CRBSI, catheter-related bloodstream infections; CI, confidence interval; I^2, heterogeneity estimate; LoS, length of stay; MD, mean difference; Q, Cochran's Q statistic; τ^2, variance estimate; Q_M, Omnibus test for moderator effect.

Elangovan et al J Hosp Infect. 2024 Oct;152:126-137

INFECTION CONTROL & HOSPITAL EPIDEMIOLOGY FEBRUARY 2016, VOL. 37, NO. 2

ORIGINAL ARTICLE

Device-Associated Infection Rates in 20 Cities of India, Data Summary for 2004–2013: Findings of the International Nosocomial Infection Control Consortium

Yatin Mehta, MD;[1] Namita Jaggi, MD;[2] Victor Daniel Rosenthal, MD;[3] Maithili Kavathekar, MD;[4] Asmita Sakle, MD;[5] Nita Munshi, MD;[6] Murali Chakravarthy, MD;[7] Subhash Kumar Todi, MD;[8] Narinder Saini, MD;[9] Camilla Rodrigues, MD;[10] Karthikeya Varma, MD;[11] Rekha Dubey, MD;[12] Mohammad Mukhit Kazi, MSC;[13] F. E. Udwadia, MD;[14] Sheila Nainan Myatra, MD;[15] Sweta Shah, MD;[16] Arpita Dwivedy, MD;[17] Anil Karlekar, MD;[18] Sanjeev Singh, MD;[19] Nagamani Sen, MD;[20] Kashmira Limaye-Joshi, MD;[21] Bala Ramachandran, MD;[22] Suneeta Sahu, MD;[23] Nirav Pandya, MD;[24] Purva Mathur, MD;[25] Samir Sahu, MD;[26] Suman P. Singh, MD;[27] Anil Kumar Bilolikar, MD;[28] Siva Kumar, MD;[29] Preeti Mehta, MD;[30] Vikram Padbidri, MD;[31] N. Gita, MD;[32] Saroj K. Patnaik, MD;[33] Thara Francis, MD;[34] Anup R. Warrier, MD;[35] S. Muralidharan, MD;[36] Pravin Kumar Nair, MD;[37] Vaibhavi R. Subhedar, MD;[38] Ramachadran Gopinath, MD;[39] Afzal Azim, MD;[40] Sanjeev Sood, MD[41]

- Multi-centric prospective cohort surveillance
- 84 adult or pediatric ICUs or NICUs from 40 hospitals in 20 cities of India
- 5.1 CLABSI/ 1000 CL days 9.5 days

Mehta et al Infect Control Hosp Epidemiol. 2016 Feb;37(2):172-81.

Health-care-associated bloodstream and urinary tract infections in a network of hospitals in India: a multicentre, hospital-based, prospective surveillance study

Purva Mathur, Paul Malpiedi*, Kamini Walia, Padmini Srikantiah, Sunil Gupta, Ayush Lohiya, Arunaloke Chakrabarti, Pallab Ray, Manisha Biswal, Neelam Taneja, Priscilla Rupali, Veeraraghavan Balaji, Camilla Rodrigues, Vijaya Lakshmi Nag, Vibhor Tak, Vimala Venkatesh, Chiranjay Mukhopadhyay, Vijayshri Deotale, Kanne Padmaja, Chand Wattal, Sanjay Bhattacharya, Tadepalli Karuna, Bijayini Behera, Sanjeev Singh, Reema Nath, Raja Ray, Sujata Baveja, Bashir A Fomda, Khumanthem Sulochana Devi, Padma Das, Neeta Khandelwal, Prachi Verma, Prithwis Bhattacharyya, Rajni Gaind, Lata Kapoor, Neil Gupta, Aditya Sharma, Daniel VanderEnde, Valan Siromany, Kayla Laserson, Randeep Guleria, on behalf of the Indian Healthcare Associated Infection Surveillance Network collaborators†*

- multicentre, hospital-based, prospective surveillance study
- 26 tertiary-level hospitals from 20 states and Uts

	Adult ICUs	Paediatric ICUs	Neonatal ICUs	All ICUs combined
ICUs	62/89 (69·7%)	16/89 (18·0%)	11/89 (12·4%)	..
Bloodstream infections	1859/2622 (70·9%)	247/2622 (9·4%)	516/2622 (19·7%)	..
CLABSI	1023/1859 (55·0%)	116/247 (47·0%)	58/516 (11·2%)	1197/2622 (45·7%)
Primary bloodstream infections not associated with a central line	387/1859 (20·8%)	102/247 (41·3%)	451/516 (87·4%)	940/2622 (35·9%)
Secondary bloodstream infections	449/1859 (24·2%)	29/247 (11·7%)	7/516 (1·4%)	485/2622 (18·5%)
UTIs	656/737 (89·0%)	81/737 (11·0%)	..	..
CAUTI	637/656 (97·1%)	67/81 (82·7%)	..	704/737 (95·5%)
UTIs not associated with a urinary catheter	19/656 (2·9%)	14/81 (17·3%)	..	33/737 (4·5%)
Central line days	118 866	12 216	2341	133 423
Urinary catheter days	225 045	14 699	..	239 744
Patient days	291 501	47 266	53 883	392 650

Data are n/N (%) or n. UTI=urinary tract infection. ICU=intensive care unit. CLABSI=central-line-associated bloodstream infection. CAUTI=catheter-associated UTI.

Table 3: **Bloodstream infections and UTIs reported by ICU type**

Purva et al lancet 2022 Sep;10(9):e1317-e1325.

Risk Factors

PATIENT RELATED	PROVIDER RELATED	DEVICE RELATED
• Elderly and neonatal • Immunocompromised/ neutropenic • Severe skin burns • Malnourished • Prolonged hospital stay • Chronic illness including DM	• Incomplete adherence to asepsis protocol • Failure to remove unnecessary catheters • Excessive device manipulations • Low nurse to patient ratio • Emergency non-ICU insertion	• Type of catheter non-tunneled > tunneled • Site of insertion femoral > jugular > subclavian • Number of lumens • Indication of insertion (TPN Chemotherapy)

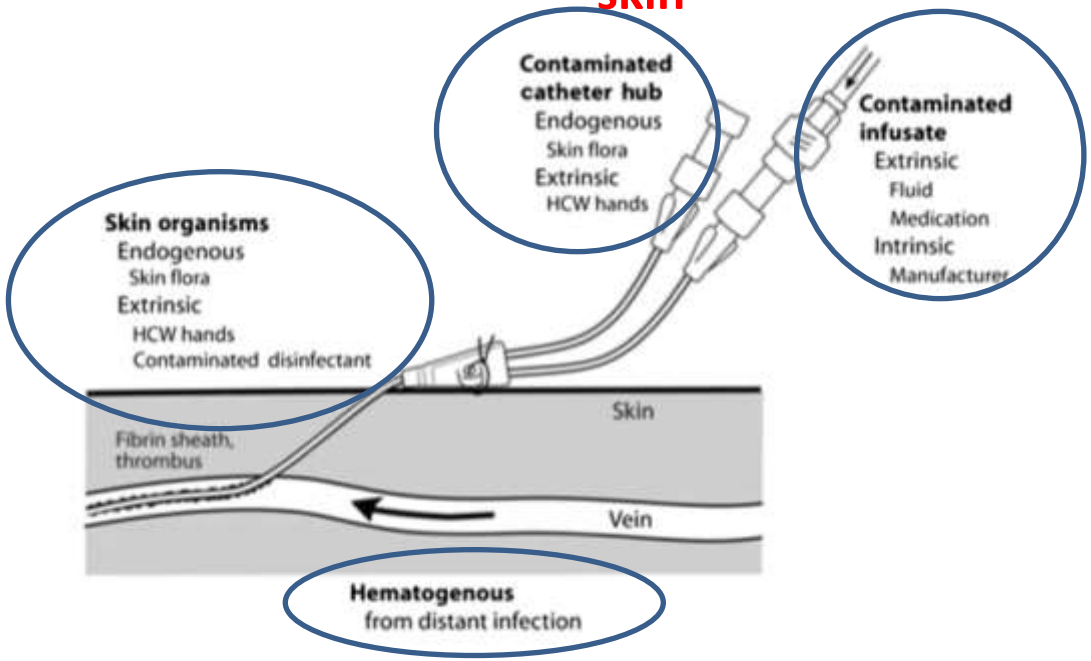
Centers for Disease Control and Prevention,*2024*

Pathogenesis

Day 1
Catheter
Placed

Initial phase
Extra-luminal
spread from
skin

Later phase
Intraluminal spread by
infusate and hub
contamination



Others
Distant seeding by
hematogenous
spread

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

Causative Pathogens

Table 4. The Top 15 CLABSI Pathogens Reported to NHSN, by Location Type, Adults, 2018-2021

	Acute Care Hospitals (n=2,988 hospitals)											
	Hospital ICUs			Hospital Wards[1]			Hospital Oncology Units[2]			LTACHs[3] (n=420 hospitals)		
Pathogen	# Pathogens	% Pathogens	Rank	# Pathogens	% Pathogens	Rank	# Pathogens	% Pathogens	Rank	# Pathogens	% Pathogens	Rank
Coagulase-negative staphylococci	7,553	17.0	1	4,181	10.9	2	2,380	10.6	2	886	10.7	3
Enterococcus faecalis[4]	5,539	12.5	2	3,344	8.7	4	970	4.3	8	1,088	13.2	1
Candida albicans[4]	5,363	12.1	3	2,574	6.7	6	260	1.2	16	451	5.5	7
Other *Candida* spp.[4]	3,813	8.6	4	2,287	5.9	7	631	2.8	10	818	9.9	5
Staphylococcus aureus	3,288	7.4	5	5,914	15.4	1	1,307	5.8	6	910	11.0	2
Enterococcus faecium[4]	3,200	7.2	6	1,884	4.9	8	1,974	8.8	4	487	5.9	6
Candida glabrata[4]	3,126	7.0	7	1,677	4.4	9	328	1.5	14	343	4.2	9
Select *Klebsiella* spp.	2,074	4.7	8	3,519	9.1	3	1,824	8.2	5	874	10.6	4
Escherichia coli	1,323	3.0	9	2,601	6.8	5	3,923	17.5	1	335	4.1	10
Pseudomonas aeruginosa	1,316	3.0	10	1,644	4.3	10	1,011	4.5	7	414	5.0	8

Indian Data

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Purva Mathur, Paul Malpiedi*, Kamini Walia, Padmini Srikantiah, Sunil Gupta, Ayush Lohiya, Arunaloke Chakrabarti, Pallab Ray, Manisha Biswal, Neelam Taneja, Priscilla Rupali, Veeraraghavan Balaji, Camilla Rodrigues, Vijaya Lakshmi Nag, Vibhor Tak, Vimala Venkatesh, Chiranjay Mukhopadhyay, Vijayshri Deotale, Kanne Padmaja, Chand Wattal, Sanjay Bhattacharya, Tadepalli Karuna, Bijayini Behera, Sanjeev Singh, Reema Nath, Raja Ray, Sujata Baveja, Bashir A Fomda, Khumanthem Sulochana Devi, Padma Das, Neeta Khandelwal, Prachi Verma, Prithwis Bhattacharyya, Rajni Gaind, Lata Kapoor, Neil Gupta, Aditya Sharma, Daniel VanderEnde, Valan Siromany, Kayla Laserson, Randeep Guleria, on behalf of the Indian Healthcare Associated Infection Surveillance Network collaborators†*

	All bloodstream infections*		CLABSI*		All UTIs†		CAUTI†	
	Rank	Pathogens (n=2828)	Rank	Pathogens (n=1341)	Rank	Pathogens (n=809)	Rank	Pathogens (n=773)
Klebsiella spp‡	1	701 (24·8%)	1	295 (22·0%)	4	108 (13·3%)	4	99 (12·8%)
Acinetobacter spp	2	601 (21·3%)	2	252 (18·8%)	6	42 (5·2%)	6	41 (5·3%)
Candida spp	3	333 (11·8%)	3	165 (12·3%)	1	238 (29·4%)	1	229 (29·6%)
Staphylococcus spp	4	248 (8·8%)	7	85 (6·3%)	14	3 (0·4%)	14	3 (0·4%)
Enterococcus spp	5	208 (7·4%)	6	100 (7·5%)	2	147 (18·2%)	2	141 (18·2%)
Pseudomonas spp	6	190 (6·7%)	5	107 (8·0%)	5	64 (7·9%)	5	64 (8·3%)
Escherichia spp	7	143 (5·1%)	8	61 (4·5%)	3	142 (17·6%)	3	133 (17·2%)
Burkholderia spp	8	122 (4·3%)	4	110 (8·2%)	15	1 (0·1%)	15	1 (0·1%)
Enterobacter spp	8	84 (3·0%)	9	51 (3·8%)	10	9 (1·1%)	10	9 (1·2%)
Citrobacter spp	10	41 (1·4%)	11	20 (1·5%)	8	11 (1·4%)	10	9 (1·2%)
Proteus spp	14	11 (0·4%)	14	5 (0·4%)	8	11 (1·4%)	8	11 (1·4%)
Providencia spp	27	1 (<0·1%)	18	1 (0·1%)	7	14 (1·7%)	7	14 (1·8%)
All other pathogens	..	145 (5·1%)	..	89 (6·6%)	..	19 (2·3%)	..	19 (2·5%)

Data are n (%). ICU=intensive care unit. UTI=urinary tract infection. CLABSI=central-line-associated bloodstream infection. CAUTI=catheter-associated UTIs. *Includes adult, paediatric, and neonatal ICUs. †Includes adult and paediatric ICUs. ‡Includes *Klebsiella aerogenes* (formerly *Enterobacter aerogenes*).

Table 5: **Commonly reported pathogens in bloodstream infections and UTIs**

Purva et al lancet 2022 Sep;10(9):e1317-e1325

Anti-biogram PGI 2023

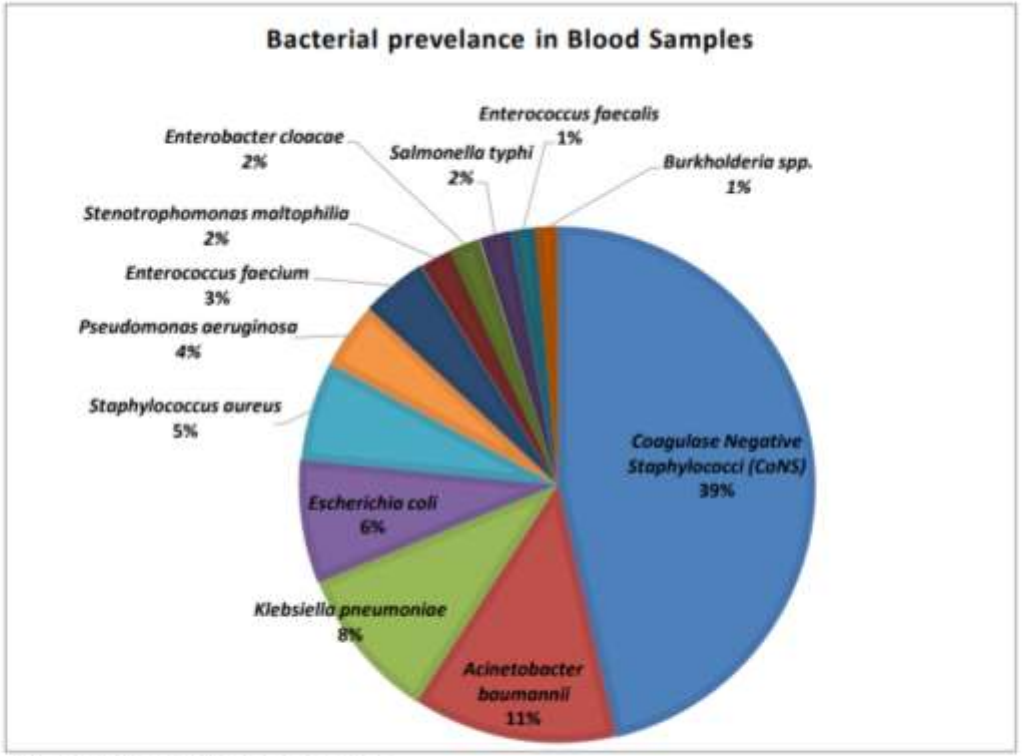
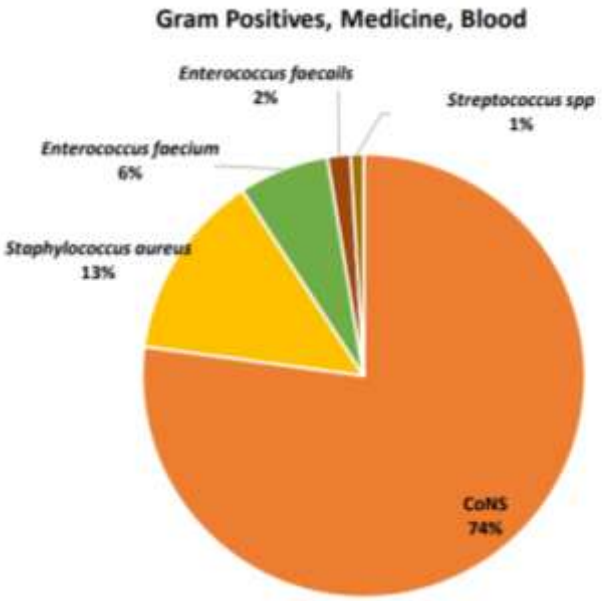
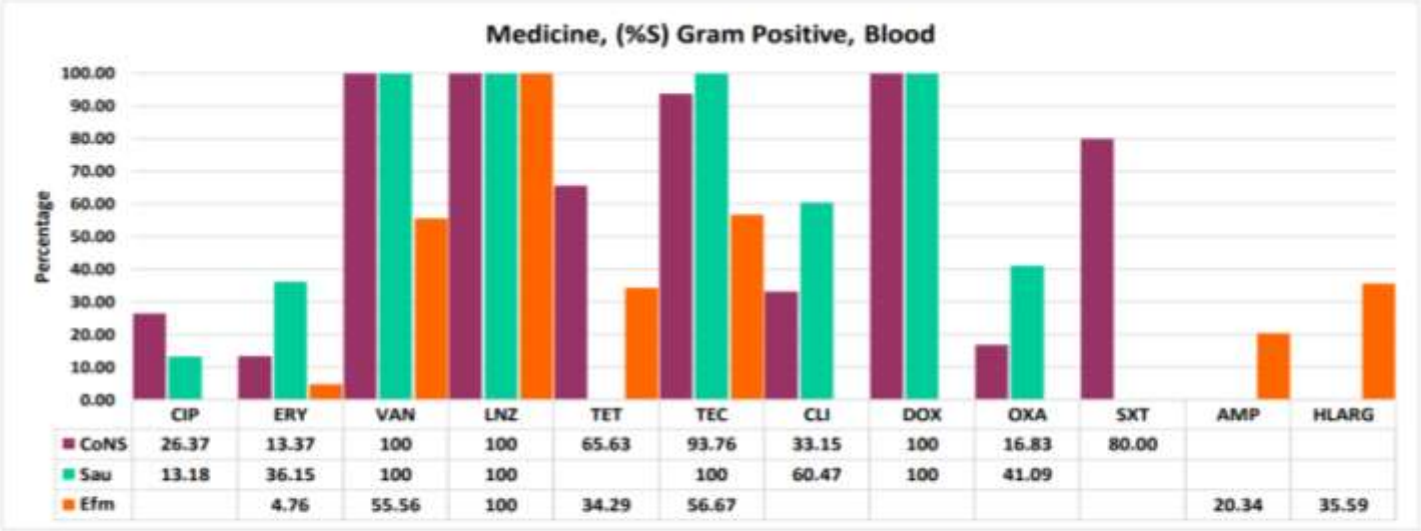


Figure 2: Cumulative presence of bacteria in blood samples.

The pie-chart shows the cumulative prevalence of various bacteria in the blood samples obtained from different departments at PGIMER, Chandigarh in the year 2023. Coagulase negative staphylococci (CoNS) are emerging as a very common blood isolate.



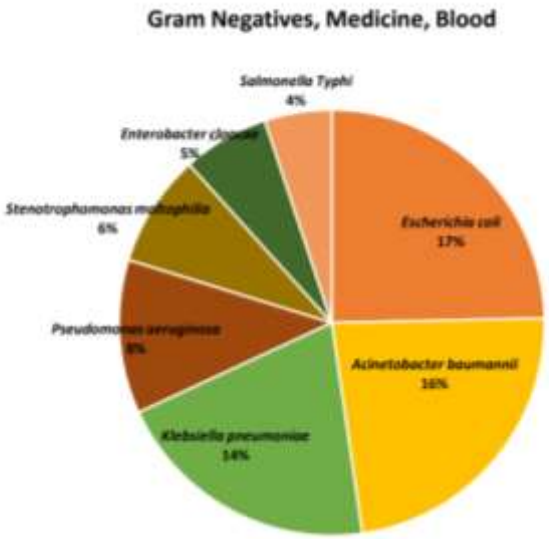
Medicine Department



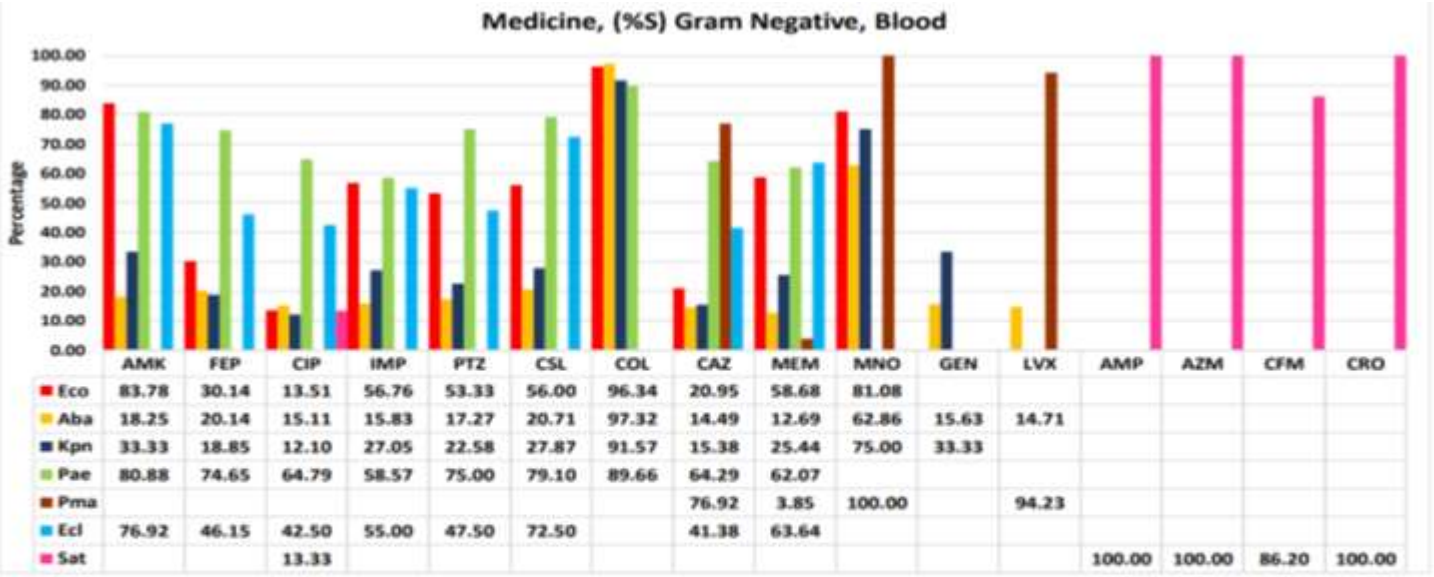
	CIP	ERY	VAN	LNZ	TET	TEC	CLI	DOX	OXA	SXT	AMP	HLARG
CoNS	26.37	13.37	100	100	65.63	93.76	33.15	100	16.83	80.00		
Sau	13.18	36.15	100	100		100	60.47	100	41.09			
Efm		4.76	55.56	100	34.29	56.67					20.34	35.59

Figure 12: Percentage sensitivity (%S) of gram-positives in blood samples from different areas of Medicine Department.

CIP, ciprofloxacin; ERY, erythromycin; VAN, vancomycin; LNZ, linezolid; TET, tetracycline; TEC, teicoplanin; CLI, clindamycin; DOX, doxycycline; OXA, oxacillin; SXT, cotrimoxazole; AMP, ampicillin; HLARG, gentamicin HLAR. CoNS, coagulase negative *Staphylococci*, Sau, *Staphylococcus aureus*; Efm, *Enterococcus faecium*.

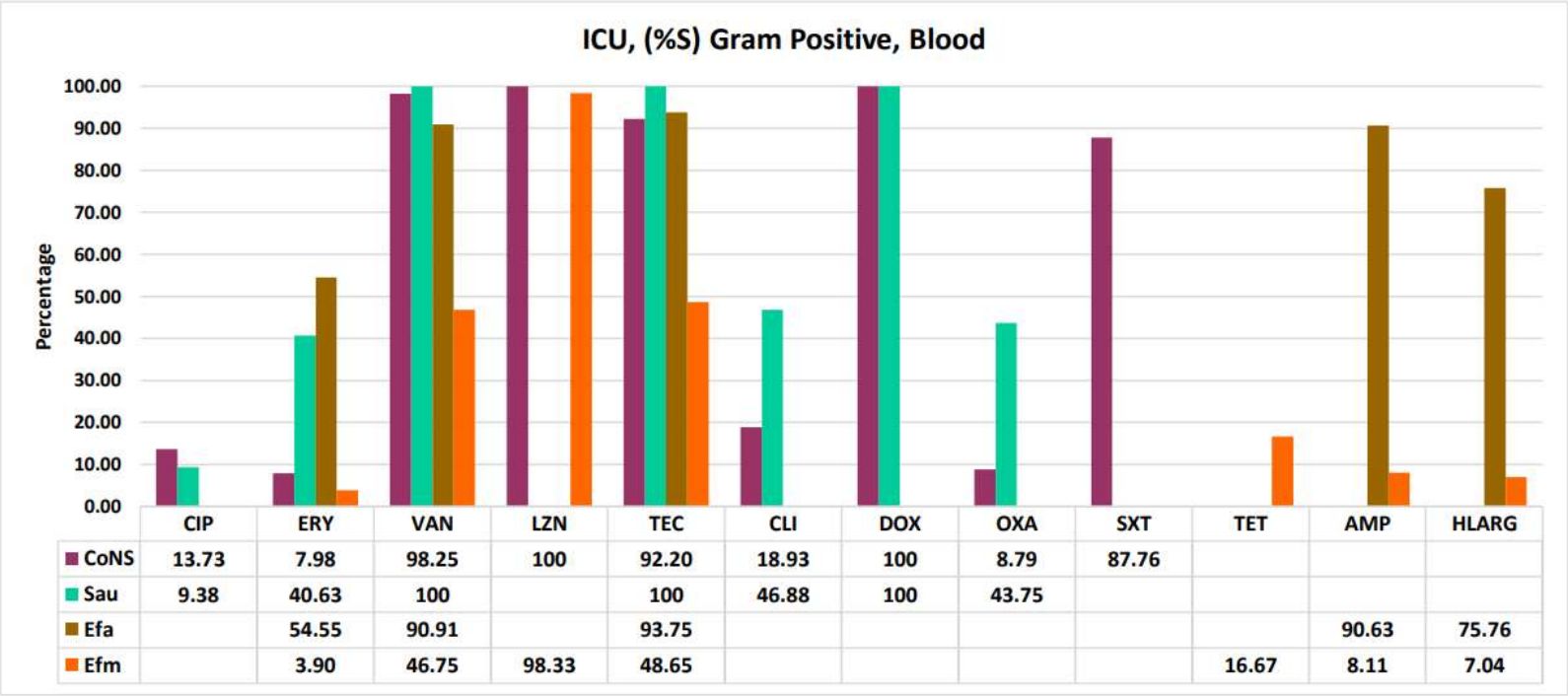


Medicine Department



	AMK	FEP	CIP	IMP	PTZ	CSL	COL	CAZ	MEM	MNO	GEN	LVX	AMP	AZM	CFM	CRO
Eco	83.78	30.14	13.51	56.76	53.33	56.00	96.34	20.95	58.68	81.08						
Aba	18.25	20.14	15.11	15.83	17.27	20.71	97.32	14.49	12.69	62.86	15.63	14.71				
Kpn	33.33	18.85	12.10	27.05	22.58	27.87	91.57	15.38	25.44	75.00	33.33					
Pae	80.88	74.65	64.79	58.57	75.00	79.10	89.66	64.29	62.07							
Pma								76.92	3.85	100.00		94.23				
Ecl	76.92	46.15	42.50	55.00	47.50	72.50		41.38	63.64							
Sat			13.33										100.00	100.00	86.20	100.00

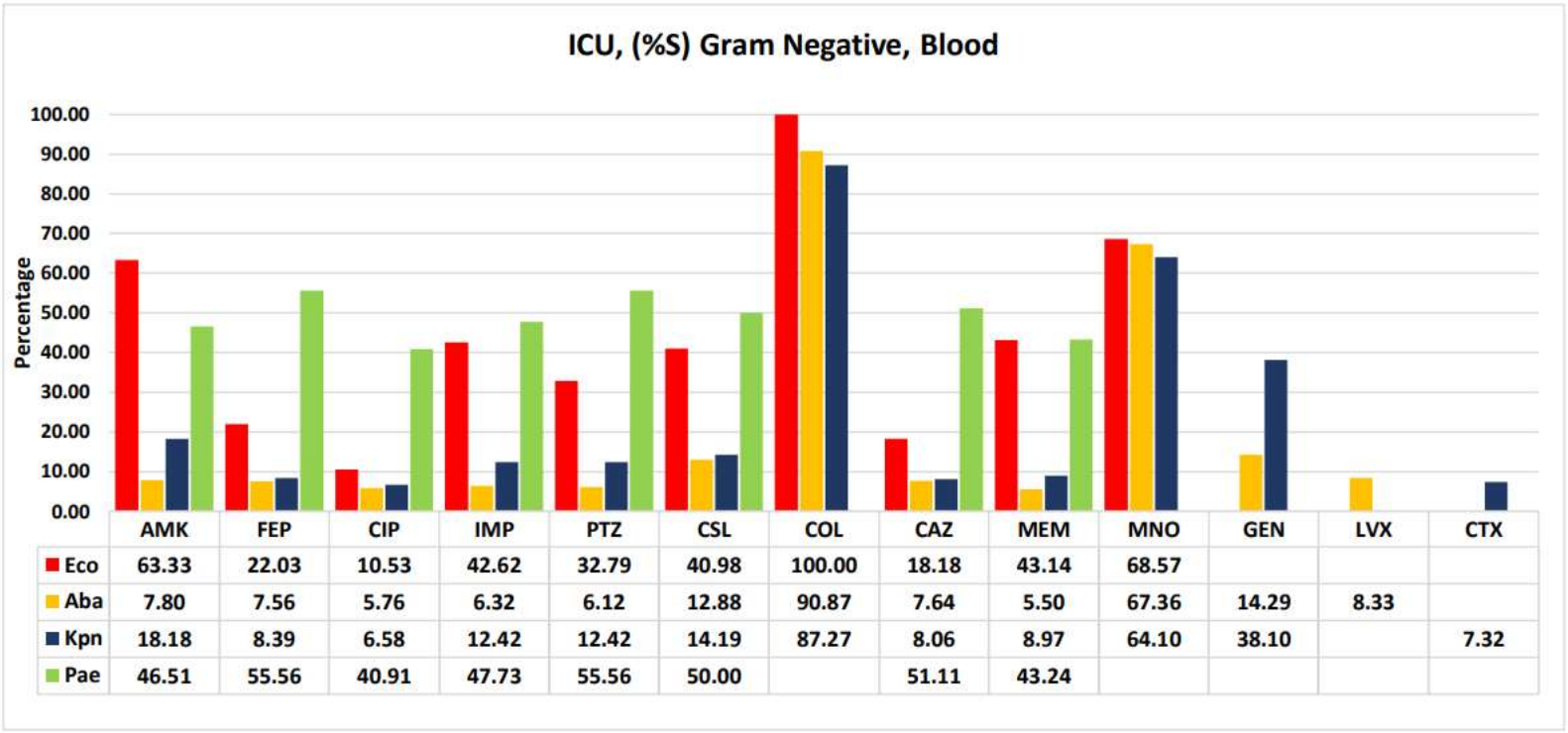
Figure 5: Percentage sensitivity (%S) of gram-negatives in blood samples from different areas of Medicine Department.
AMK, amikacin; FEP, cefepime; CIP, ciprofloxacin; IMP, Imipenem; PTZ, piperacillin-tazobactam; CSL, cefoperazone-sulbactam; COL, colistin; CAZ, ceftazidime; MEM, meropenem; MNO, minocycline; GEN, gentamicin; LVX, Levofloxacin; CTX, cefotaxime; AMP, ampicillin; AZM, azithromycin, CFM, cefixime; CRO, ceftriaxone. Eco, *Escherichia coli*; Aba, *Acinetobacter baumannii*; Kpn, *Klebsiella pneumoniae;* Pae, *Pseudomonas aeruginosa;* Pma, *Stenotrophomonas maltophilia*; Ecl, *Enterobacter cloacae*; Sat, *Salmonella* Typhi.



	CIP	ERY	VAN	LZN	TEC	CLI	DOX	OXA	SXT	TET	AMP	HLARG
CoNS	13.73	7.98	98.25	100	92.20	18.93	100	8.79	87.76			
Sau	9.38	40.63	100		100	46.88	100	43.75				
Efa		54.55	90.91		93.75						90.63	75.76
Efm		3.90	46.75	98.33	48.65					16.67	8.11	7.04

Figure 16: Percentage sensitivity (%S) of gram-positives in blood samples from different areas of ICU.

CIP, ciprofloxacin; ERY, erythromycin; VAN, vancomycin; LNZ, linezolid; TEC, teicoplanin; CLI, clindamycin; DOX, doxycycline; OXA, oxacillin; SXT, cotrimoxazole; TET, tetracycline; AMP, ampicillin; HLARG, gentamicin HLAR; CRO, ceftriaxone; LVX, levofloxacin. CoNS, coagulase negative *Staphylococci*; Sau, *Staphylococcus aureus*; Efm, *Enterococcus faecium*; Efa, *Enterococcus faecalis.*



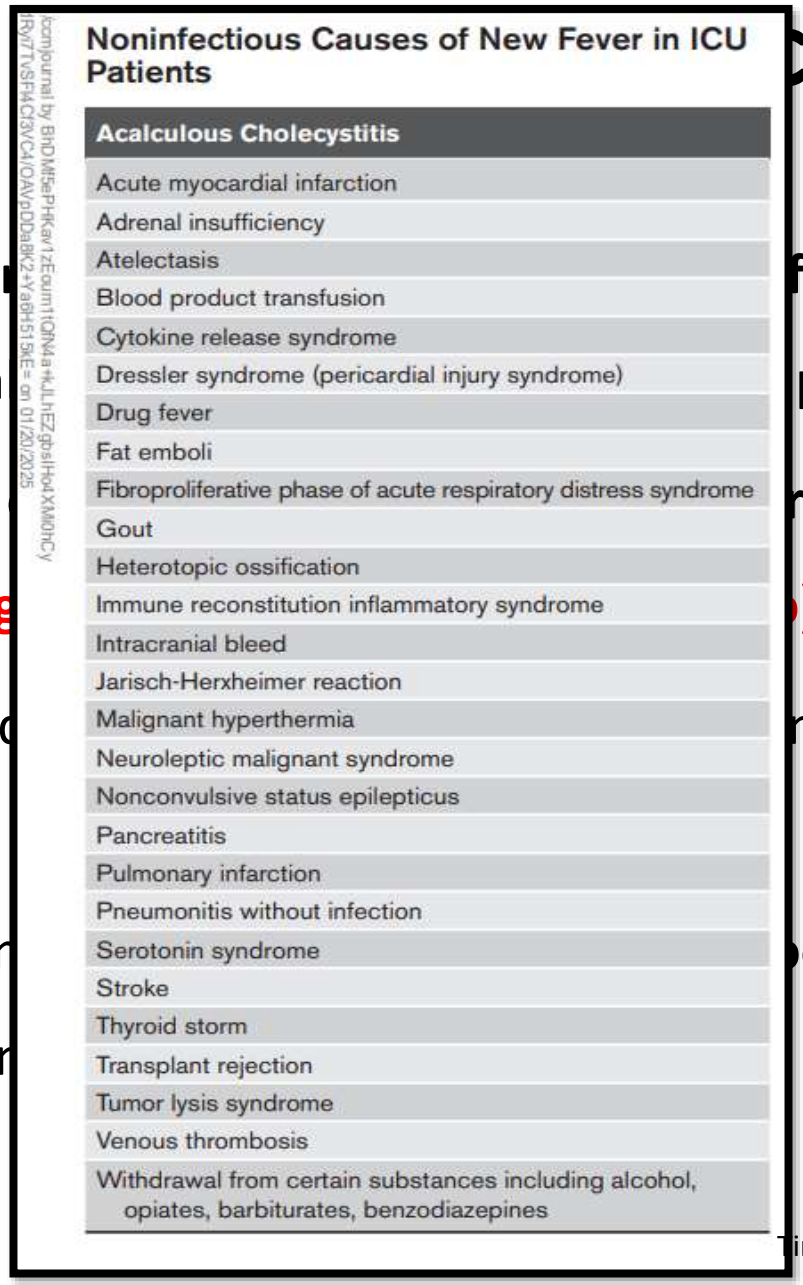
	AMK	FEP	CIP	IMP	PTZ	CSL	COL	CAZ	MEM	MNO	GEN	LVX	CTX
Eco	63.33	22.03	10.53	42.62	32.79	40.98	100.00	18.18	43.14	68.57			
Aba	7.80	7.56	5.76	6.32	6.12	12.88	90.87	7.64	5.50	67.36	14.29	8.33	
Kpn	18.18	8.39	6.58	12.42	12.42	14.19	87.27	8.06	8.97	64.10	38.10		7.32
Pae	46.51	55.56	40.91	47.73	55.56	50.00		51.11	43.24				

Figure 8: Percentage sensitivity (%S) of gram-negatives in blood samples from different areas of ICU.

AMK, amikacin; FEP, cefepime; CIP, ciprofloxacin; IMP, Imipenem; PTZ, piperacillin-tazobactam; CSL, cefoperazone-sulbactam; COL, colistin; CAZ, ceftazidime; MEM, meropenem; MNO, minocycline; GEN, gentamicin; LVX, Levofloxacin; CTX, cefotaxime. Eco, *Escherichia coli*; Aba, *Acinetobacter baumannii*; Kpn, *Klebsiella pneumoniae;* Pae, *Pseudomonas aeruginosa*.

ct?

- **New onset or** **function** in a patient with a centra pparent source
- Clinical signs **catheter infusion** **(It may be allerg)**
- Erythema, inc m of the catheter exit site
- For long-term **od or poor flow** are risk factors ar



Noninfectious Causes of New Fever in ICU Patients

Acalculous Cholecystitis
Acute myocardial infarction
Adrenal insufficiency
Atelectasis
Blood product transfusion
Cytokine release syndrome
Dressler syndrome (pericardial injury syndrome)
Drug fever
Fat emboli
Fibroproliferative phase of acute respiratory distress syndrome
Gout
Heterotopic ossification
Immune reconstitution inflammatory syndrome
Intracranial bleed
Jarisch-Herxheimer reaction
Malignant hyperthermia
Neuroleptic malignant syndrome
Nonconvulsive status epilepticus
Pancreatitis
Pulmonary infarction
Pneumonitis without infection
Serotonin syndrome
Stroke
Thyroid storm
Transplant rejection
Tumor lysis syndrome
Venous thrombosis
Withdrawal from certain substances including alcohol, opiates, barbiturates, benzodiazepines

Timsit et al. Ann. Intensive Care (2020) 10:118

How to diagnose?

Definite CRBSI

CRITERIA-1

- Growth of **same** pathog
  blood culture of peri
  from **culture of CV**
  quantitative (>15
  segment) or quant
  per catheter segme

AND

- Growth of **same** pathogen from blood culture of CVC and from blood culture of **peripheral vein**

CRITERIA-2

unt of microbes grown from
ed through the catheter
ast **3-fold greater** than
t from blood obtained
al vein

DTP, growth of microbes from a blood sample drawn from a catheter hub **at least 2 h** before microbial growth is detected in a blood sample obtained from a peripheral vein

No role for routine catheter tip culture and routine blood culture surveillance for diagnosing CRBSI
Prefer to treat patients than reports

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

Methods	Sensitivity	Specificity
Paired Quantitative Blood Cultures	75-93 %	97-100%
Quantitative Catheter Culture	82 -83%	89-97%
Differential time to Positivity	89-90%	72-87%

Ann intern Med 2005;142(6):451-466

Case -1

- A 44 year old female suspected to have CRBSI on clinical grounds after excluding alternative source of fever. Paired Blood cultures sent from central line and peripheral line.

Postgraduate Institute of Medical Education & Research
Chandigarh
Department of Medical Microbiology

DUPLICATE COPY

Laboratory : Blood Culture Lab **Sample :** Blood Culture-PL

CR No :
Patient Name : [redacted] **Age/Sex** : 44 Yr/F
Dept-Unit : Internal Medicine-E M OPD **Req. Date** : 23/10/2024
Ward : Respiratory Icu Ward **Room No**: Respiratory Room **Bed**: Bed 5
Clinician :
Test : Extended Sensitivity bactec culture **Lab Sample No.** : 29499
Diagnosis :

Culture shows -

Sensitivity Blood Culture Report

Organism: Klebsiella
Species: pneumoniae
Culture result: -

Antibiotics / Organism	Klebsiella Pneumoniae
Amikacin	R
Ceftazidime	R
Cefepime	R
Imipenem	R
Colistin	R
Meropenem	R
Ciprofloxacin	R
Cefoperazone-sulbactam	R
Minocycline	S
Aztreonam	R
Piperacillin/tazobactam	R

Antimicrobial Susceptibility
Interpretation:
S: Sensitive , R: Resistance , IS: Intermediate Sensitive and -:Not Done

Remark: PL TTP: 5 hrs 16 mins Resistant to ceftazidime-avibactam, synergy present between ceftazidime avibactam and aztreonam.
Report Status: FINAL
Dispatch Date & Time: -

Postgraduate Institute of Medical Education & Research
Chandigarh
Department of Medical Microbiology

DUPLICATE COPY

Laboratory : Blood Culture Lab **Sample :** Blood Culture-CL

CR No : 202404424619
Patient Name : [redacted] **Age/Sex** : 44 Yr/F
Dept-Unit : Internal Medicine-E M OPD **Req. Date** : 23/10/2024
Ward : Respiratory Icu Ward **Room No**: Respiratory Room **Bed**: Bed 5
Clinician :
Test : Extended Sensitivity bactec culture **Lab Sample No.** : 29501
Diagnosis :

Culture shows -

Sensitivity Blood Culture Report

Organism: Klebsiella
Species: pneumoniae
Culture result: -
Antimicrobial Susceptibility
Remark: Same as 29499 CL TTP: 1 hr 18 mins
Report Status: FINAL
Dispatch Date & Time: -

Clinical suspicion + BSI with DTP >2hr + no alternative =

Definite CRBSI

Case - 2

- A 26 year old male admitted at private ward with a diagnosis of GI vasculitis with central line in situ for the last 4 days. He got a phone call from microbiology department for culture positivity.

CR No	: 202305258729		
Patient Name	[redacted]	**Age/Sex**	: 21 Yr/M
Dept-Unit	: Internal Medicine-Unit 3	**Req. Date**	: 18/12/2023
Ward	: Private Ward 4th D **Room No**: Room 28	**Bed**: Bed 28	
Clinician	:		
Test	: Extended Sensitivity bactec culture	**Lab Sample No.**	: 35942
Diagnosis	:		

Sensitivity Blood Culture Report

Culture shows -

Organism	Staphylococcus
Species	haemolyticus
Culture result	-

Antimicrobial Susceptibility

Antibiotics / Organism	**Staphylococcus haemolyticus**
Ciprofloxacin	R
Clindamycin	R
Erythromycin	R
vancomycin	S
Oxacillin	R
Doxycycline	S

Interpretation:
S: Sensitive , R: Resistance , IS: Intermediate Sensitive and -:Not Done

Remark -

Is it a contaminant or an infection?

IDSA

38. If a catheterized patient has a single positive blood culture that grows coagulase-negative *Staphylococcus* species, then additional cultures of blood samples obtained through the suspected catheter and from a peripheral vein should be performed before the initiation of antimicrobial therapy and/or catheter removal to be certain that the patient has true bloodstream infection and that the catheter is the likely source (A-II).

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

ORIGINAL ARTICLE

When is coagulase-negative Staphylococcus bacteraemia clinically significant?

ELISA GARCÍA-VÁZQUEZ[1,2], ANA FERNÁNDEZ-RUFETE[1], ALICIA HERNÁNDEZ-TORRES[1], MANUEL CANTERAS[3], JOAQUÍN RUIZ[4] & JOAQUÍN GÓMEZ[1,2]

From the [1]Servicio de MI-Infecciosas, Hospital Clínico Universitario Virgen de la Arrixaca, [2]Departamento de Medicina Interna, Facultad de Medicina, Universidad de Murcia, [3]Departamento de Bioestadística, Facultad de Medicina, Universidad de Murcia, and [4]Servicio de Microbiología, Hospital Universitario Virgen de la Arrixaca, Madrid–Cartagena, El Palmar, Murcia, Spain

- Single centre retrospective study
- CDC definition for clinically significant bacteremia
- Predictors of CSB
  - Time to positivity < 16 hours
  - Neutropenic patients
  - Presence of Catheter
  - Pitts and charlson score
  - Staph epidermidis

Scand J Infect Dis 2013 Sep;45(9):664-71

.

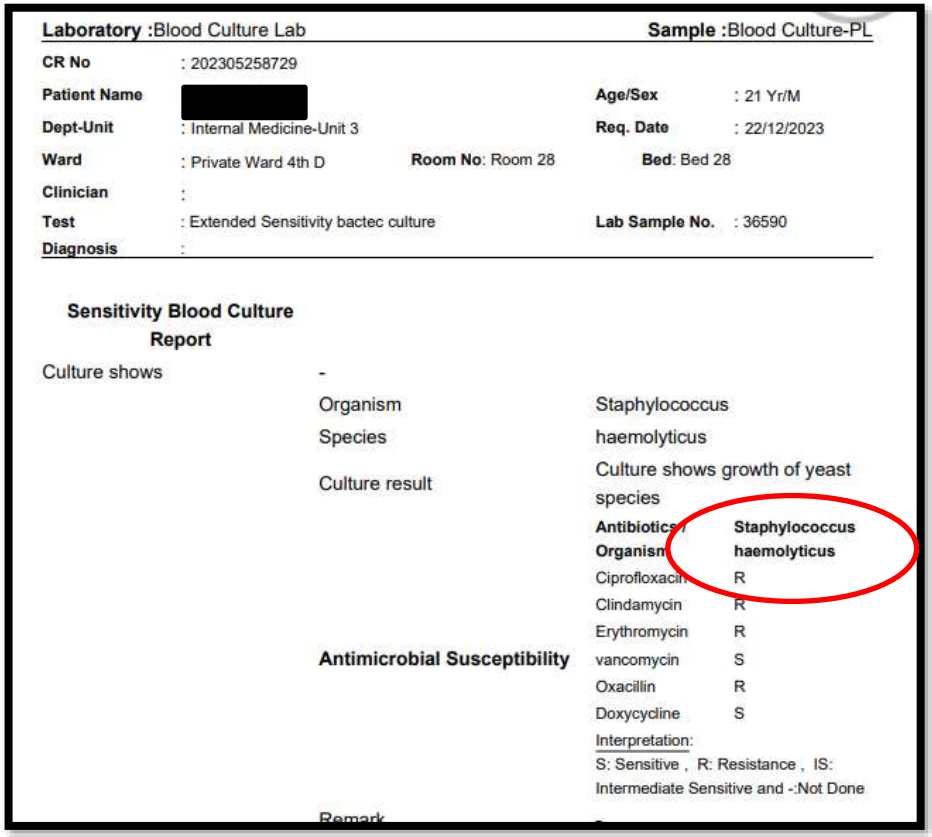
Contaminant vs Infection

- Analyze case by case and take a clinical call

Contaminant	CRBSI
asymptomatic	Symptomatic
Single blood culture showing skin commensals	Multiple persistent culture positivity
Does not satisfy the IDSA criteria	Satisfy the IDSA criteria
No response to treatment	Response to treatment

Coming back to our case -2

- He had persistent fever with chills and more during infusion and post infusion period
- With high pretest clinical probability paired blood cultures were sent after following CRBSI diagnostic protocols



Laboratory : Blood Culture Lab **Sample :**Blood Culture-PL

CR No : 202305258729

Patient Name [redacted] **Age/Sex** : 21 Yr/M

Dept-Unit : Internal Medicine-Unit 3 **Req. Date** : 22/12/2023

Ward : Private Ward 4th D **Room No**: Room 28 **Bed**: Bed 28

Clinician :

Test : Extended Sensitivity bactec culture **Lab Sample No.** : 36590

Diagnosis :

Sensitivity Blood Culture Report

Culture shows -

Organism Staphylococcus

Species haemolyticus

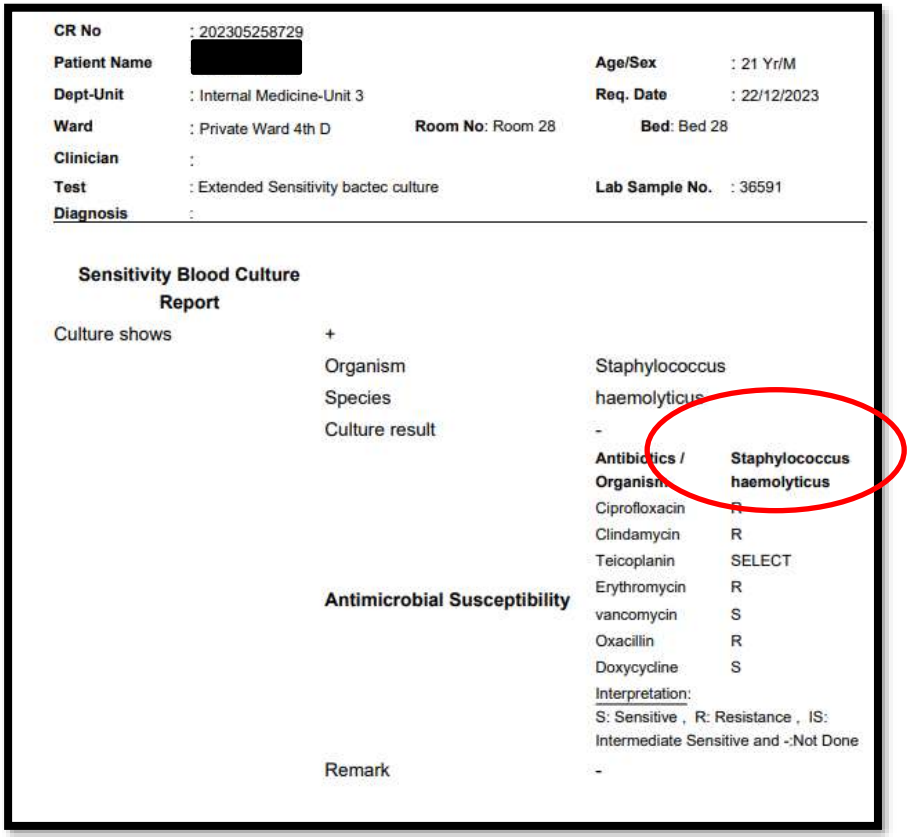
Culture result Culture shows growth of yeast species

Antibiotics / Organism	Staphylococcus haemolyticus
Ciprofloxacin	R
Clindamycin	R
Erythromycin	R
vancomycin	S
Oxacillin	R
Doxycycline	S

Antimicrobial Susceptibility

Interpretation:
S: Sensitive , R: Resistance , IS: Intermediate Sensitive and -:Not Done

Remark -



CR No : 202305258729

Patient Name [redacted] **Age/Sex** : 21 Yr/M

Dept-Unit : Internal Medicine-Unit 3 **Req. Date** : 22/12/2023

Ward : Private Ward 4th D **Room No**: Room 28 **Bed**: Bed 28

Clinician :

Test : Extended Sensitivity bactec culture **Lab Sample No.** : 36591

Diagnosis :

Sensitivity Blood Culture Report

Culture shows +

Organism Staphylococcus

Species haemolyticus

Culture result -

Antibiotics / Organism	Staphylococcus haemolyticus
Ciprofloxacin	R
Clindamycin	R
Teicoplanin	SELECT
Erythromycin	R
vancomycin	S
Oxacillin	R
Doxycycline	S

Antimicrobial Susceptibility

Interpretation:
S: Sensitive , R: Resistance , IS: Intermediate Sensitive and -:Not Done

Remark -

Clinical suspicion + Persistent blood culture positivity (more than or equal to 2) + no alternative cause

To treat in lines of CRBSI

How to prevent contaminations?

- Diagnostic stewardship – obtain blood cultures for right patient at right clinical settings
- Proper Blood culture technique
- Aseptic protocol and hand hygiene
- Dedicated phlebotomy team
- Surveillance of BCC and feedback
- Diversion devices

ASM Journals Clinical Microbiology Reviews Vol. 33, No. 1

Blood c

American Journal of Infection Control 47 (2019) 1255–1262

Contents lists available at ScienceDirect

American Journal of Infection Control

journal homepage: www.ajicjournal.org

State of the Science Review

Chlorhexidine disinfectant can reduce the risk of central venous catheter infection compared with povidone: a meta-analysis

Yu Shi BS, Ning Yang, Li Zhang, Ming Zhang, Hong-Hong Pei MD *, Hai Wang MSc *

Department of Emergency Medicine, The Second Affiliated Hospital of Xi'an Jiaotong University, Xi'an, Shaanxi, China

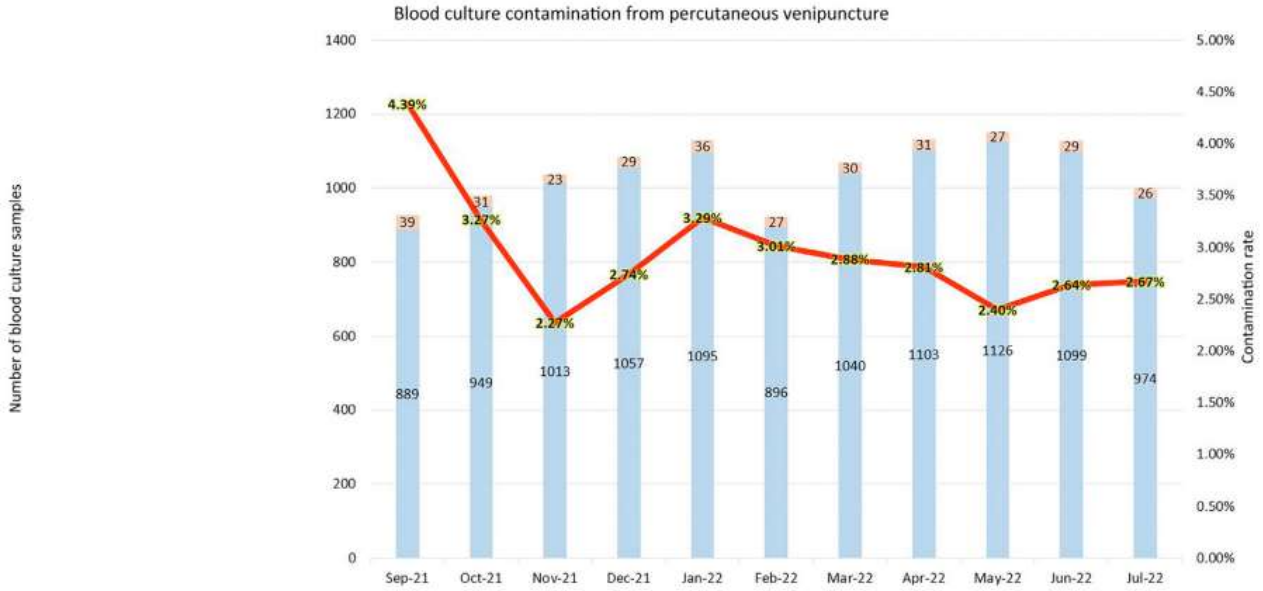
- Hand Hygiene
- Sterile glove No touch
- Prepare the bottle – label and clean
- Prepare the site – **2% Chlorhexidine based solution** (alcohol based)
- Two paired sample (prefer two peripheral unless CRBSI suspected)
- From central line – disinfect the hub with chlorhexidine alcohol preparation and **do not discard the sample**

https://www.cdc.gov/lab-quality/php/preventing-adult-blood-culture-contamination/collect.html1

Journal of perianesthesia nursing 36(2021) 328 - 333

A Quality Improvement Initiative on Reducing Blood Culture Contamination in the Emergency Department

Authors: Charlotte Marcelino, MAN, RN, CEN, SSBB, CPHQ, and Jan Shepard, MSN, RN, NPD-BC, CCRN-k, CSSGB, Sacramento, CA
Section Editor: Amber Adams, DNP, RN, CEN



	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22
Number of contaminated blood culture samples from percutaneous venipuncture	39	31	23	29	36	27	30	31	27	29	26
Number of blood culture samples from percutaneous venipuncture	889	949	1013	1057	1095	896	1040	1103	1126	1099	974
Contamination rate from percutaneous venipuncture	4.39%	3.27%	2.27%	2.74%	3.29%	3.01%	2.88%	2.81%	2.40%	2.64%	2.67%

Marcelino et al J Emerg Nurs. 2023 Mar;49(2):162-171

Case - 3

- A 15 year old female presented with fever burning micturition and shock. Central line was placed in outside hospital and she was referred to PGI in view of persistent symptoms. Blood cultures and urine cultures were sent.

Laboratory :Blood Culture Lab **Sample** :Blood Culture-CL

CR No	: 202501136533		
Patient Name	: [redacted]	**Age/Sex**	: 15 Yr/M
Dept-Unit	: Internal Medicine-E M OPD	**Req. Date**	: 16/01/2025
Ward	: Respiratory Icu Ward	**Room No**: Respiratory Room	**Bed**: Bed 1
Clinician	:		
Test	: BACTEC Culture	**Lab Sample No.**	: 41244
Diagnosis	:		

Culture Report

Culture shows	-
Organism	Klebsiella
Species	pneumoniae
Culture result	Subsequent report to follow
Remark	-
Report Status	PRELIMINARY
Dispatch Date & Time	-

Department of Medical Microbiology

Laboratory :Blood Culture Lab **Sample** :Blood Culture-PL

CR No	: 202501136533		
Patient Name	: [redacted]	**Age/Sex**	: 15 Yr/M
Dept-Unit	: Internal Medicine-E M OPD	**Req. Date**	: 16/01/2025
Ward	: Respiratory Icu Ward	**Room No**: Respiratory Room	**Bed**: Bed 1
Clinician	:		
Test	: BACTEC Culture	**Lab Sample No.**	: 41243
Diagnosis	:		

Culture Report

Culture shows	-
Organism	Klebsiella
Species	pneumoniae
Culture result	Subsequent report to follow
Remark	-
Report Status	PRELIMINARY
Dispatch Date & Time	-

Laboratory :Blood Culture Lab **Sample** :Blood Culture-CL

CR No	: 202501136533		
Patient Name	: [redacted]	**Age/Sex**	: 15 Yr/M
Dept-Unit	: Internal Medicine-E M OPD	**Req. Date**	: 16/01/2025
Ward	: Respiratory Icu Ward	**Room No**: Respiratory Room	**Bed**: Bed 1
Clinician	:		
Test	: Extended Sensitivity bactec culture	**Lab Sample No.**	: 41244
Diagnosis	:		

Culture shows -

Sensitivity Blood Culture Report

Organism Klebsiella

Species	pneumoniae
Culture result	-
Antimicrobial Susceptibility	
Remark	SAME AS 41243 41243 PL TTP - 8HRS 5MINS 41244 CL TTP - 7HRS 14MINS
Report Status	FINAL
Dispatch Date & Time	-

NOT A CRBSI

Case - 4

- A 32 year old male admitted for Viral encephalitis in ward. He was suspected to have CRBSI and paired blood cultures was sent

Central cathet		on
Positive		SI
Negative		out alternative source
Positive		heter colonizer

UNRESOLVED ISSUES

- Prior guidelines call for negative TEE findings for all patients with *S. aureus* CRBSI to allow for a treatment duration of only 2 weeks [1]. However, some experts believe that a TEE is not needed for patients without intravascular hardware who have rapid resolution of bacteremia and signs and symptoms of acute infection.
- The true value and optimal duration of antimicrobial lock solutions as an adjunctive to systemic antibiotic therapy administered through the catheter remains unknown.
- Can antimicrobial therapy for CRBSI due to coagulase-negative staphylococci be safely omitted for patients who are at low risk for complications (i.e., those who no intravascular foreign body) when clinical signs and symptoms have resolved promptly after catheter removal?
- The clinical impact of culturing and reporting colonized catheters for patients without bacteremia or fungemia is unclear.
- What is the optimal duration of therapy for *S. lugdunensis* CRBSI?
- It remains unclear which strategy—CVC change over a guidewire, insertion of a new CVC at a new site, or watchful waiting—is preferred among patients with suspected but unconfirmed catheter-related infection, pending blood culture results.
- How should patients be treated who have positive catheter-drawn blood culture results and negative percutaneous blood culture results?

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

Likely possibilities

- Contamination
- Colonization
- Intermittent Seeding
- Improper techniques

Open Forum Infect Dis. 2024 Jun 17;11(7):

Open Forum Infectious Diseases
MAJOR ARTICLE

Impact of Catheter-Drawn Blood Cultures on Patient Management: A Multicenter, Retrospective Cohort Study

Rebecca Wales,[1] Winston McCormick,[2] Andrés Blanco-Di Matteo,[3,4] José L. Del Pozo,[3,4] Phinnara Hao,[5] and Leonard A. Mermel[6,7]

[1]Warren Alpert Medical School of Brown University, Providence, Rhode Island, USA, [2]Department of Medicine, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA, [3]Division of Infectious Diseases, Clínica Universidad de Navarra, Pamplona, Spain, [4]Division of Infectious Diseases, Instituto de Investigación Sanitaria de Navarra, Pamplona, Spain, [5]Lifespan Biostatistics Department, Providence, Rhode Island, USA, and [6]Division of Infectious Diseases, Department of Medicine, Warren Alpert Medical School of Brown University, Providence, Rhode Island, USA

- Two ce
- 143 ep

Outcome	Common Skin Contaminant (n = 100)	Potentially Pathogenic Microorganism (n = 43)	P Value
Time to positivity, h (CVC-drawn culture)			
Mean (SD)	30 (32)	27 (32)	.048[a]
Median (IQR)	20 (15–27)	15 (8–32)	
Min–Max	2–158	0.9–168	
Death			
Yes	21 (21)	6 (14)	.36[b]
Follow-up percutaneously-drawn blood culture obtained within 48 h			
Yes	93 (93)	40 (93)	.04[b]
Microorganism isolated from follow-up percutaneously-drawn cultures obtained within 48 h			
Yes	15 (16)	13 (33)	
Infection at another time with same microorganism			
Yes	17 (18)	12 (33)	.09[b]
CVC removed	71 (71)	33 (77)	
Timing of CVC removal			
≤8 d	25 (35)	21 (64)	.01[a]
≥7 d	46 (65)	12 (36)	
Received antimicrobial therapy after initial positive CVC-drawn blood culture			
Yes	47 (47)	36 (84)	<.001[b]
Antimicrobial therapy			
None	54 (54)	8 (19)	<.001[b]
IV	37 (37)	28 (65)	
ALT + IV	8 (8)	6 (14)	
ALT	1 (1)	0 (…)	
Oral	0 (…)	1 (2)	
Duration of antimicrobial therapy, d			
Mean (SD)	13 (12)	18 (12)	.02[a]
Median (IQR)	8 (6–15)	12 (8–28)	
Min–Max	1–42	2–42	
Duration of hospitalization, d			
Mean (SD)	31 (41)	27 (32)	.16[a]
Median (IQR)	22 (15–35)	18 (9–33)	
Min–Max	2–332	2–190	
ID consultation obtained during the hospitalization			
Yes	38 (38)	24 (56)	.07[b]

Reason for blood cult			
Fever		57 (75)	<.001[b]
HDI		3 (4)	
Previous positive bl		3 (4)	
Other		9 (12)	
Leukocytosis		0 (…)	
Sepsis/shock		1 (1)	
Pretransplant		3 (4)	

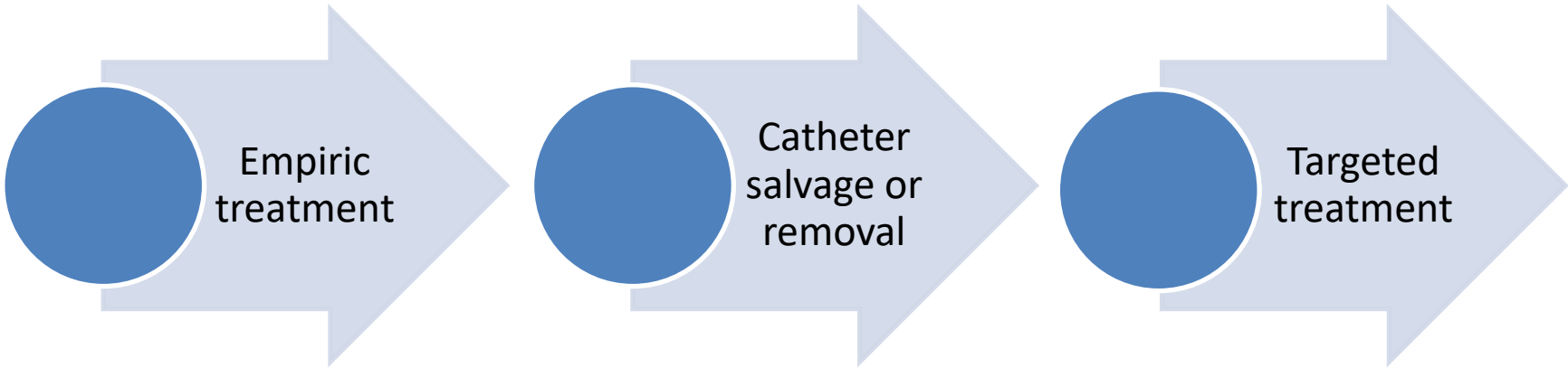
Open Forum Infect Dis 2024 Jun 17;11(7):

- Never neglect
- Take a clinical call
- Repeat multiple percutaneous cultures and decide
- Pathogenic organism – appropriate settings initiate treatment

In a nutshell

- Always send paired blood culture
- Rule out alternative cause
- In case of skin commensals send multiple peripheral and central line blood cultures and take decision clinically

How to treat


Empiric treatment
Catheter salvage or removal
Targeted treatment

General Considerations

1. What should be the empirical drug of choice?
2. When should we remove catheter empirically?
3. After culture reports, What should we do if previously the catheter was not removed?
4. How to deescalate the empiric regimen and What is its duration?

1.What should be the empirical drug of choice?

- Select antibiotics based on
  - Local ICU protocol
  - Local epidemiology
  - Patients clinical profile

Gram positive	Gram negative	Antifungal
• Usually recommended empiric treatment for CRBSI • Vancomycin is recommended if MRSA isolates with MIC values >2 mg/mL	• Not recommended as usual empiric treatment • Only indicated for Neutropenic patients, burns, previous GNB and severe hemodynamically unstable patients	• Not recommended as usual empiric treatment • Reserved for patients receiving TPN, prolonged use of broad-spectrum antibiotics, hematologic malignancy, receipt of bone marrow or solid-organ transplant, femoral catheterization, or colonization due to Candida species at multiple sites

These are only empirical therapy and always deescalate as per culture sensitivity

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

2. When should v
empirically?


REVIEW Open Access

Expert consensus-based clinical practice guidelines management of intravascular catheters in the intensive care unit

Jean-François Timsit[1,2], Julien Baleine[3], Louis Bernard[4], Silvia Calvino-Gunther[5], Michael Darmon[6], Jean Dellamonica[7], Eric Desruennes[8,9], Marc Leone[10], Alain Lepape[11,12], Olivier Leroy[13,14], Jean-Christophe Lucet[15,16], Zied Merchaoui[17], Olivier Mimoz[18,19,20], Benoit Misset[21], Jean-Jacques Parienti[22,23], Jean-Pierre Quenot[24,25,26], Antoine Roch[27,28], Matthieu Schmidt[29,30], Michel Slama[31], Bertrand Souweine[32], Jean-Ralph Zahar[33,34], Walter Zingg[35], Laetitia Bodet-Contentin[36] and Virginie Maxime[37*]

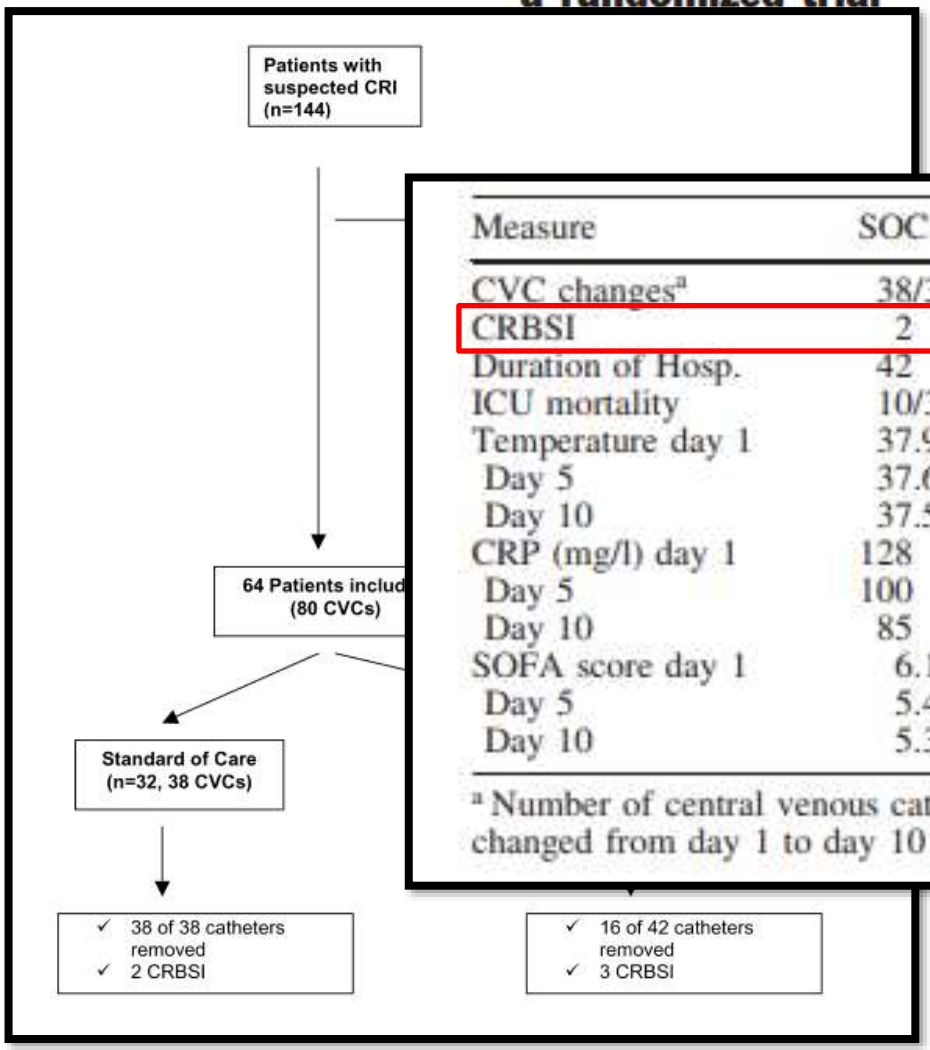
- IDSA – Remove catheter if seriously ill – hypotension and organ failure

- Expert opinion - remove if Hemodynamically unstable neutropenic immunosupressive organ transplant recipient or frank induration/erythema

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45
Timsit et al. Ann. Intensive Care (2020) 10:118

Bart J. Rijnders
Willy E. Peetermans
Charles Verwaest
Alexander Wilmer
Eric Van Wijngaerden

Watchful waiting versus immediate catheter removal in ICU patients with suspected catheter-related infection: a randomized trial



Measure	SOC	WW	
CVC changes[a]	38/38	16/42	$P<0.01$
CRBSI	2	3	$P>0.2$
Duration of Hosp.	42	34	$P>0.2$
ICU mortality	10/32	8/32	$P>0.2$
Temperature day 1	37.9	38.4	$P=0.02$
Day 5	37.6	37.6	$P>0.2$
Day 10	37.5	37.4	$P>0.2$
CRP (mg/l) day 1	128	155	$P>0.2$
Day 5	100	134	$P>0.2$
Day 10	85	104	$P=0.15$
SOFA score day 1	6.1	6.9	$P>0.2$
Day 5	5.4	6.2	$P>0.2$
Day 10	5.3	5.8	$P>0.2$

[a] Number of central venous catheters (including dialysis catheters) changed from day 1 to day 10 after inclusion

Rajinder et al Intensive Care Med. 2004 Jun;30(6):1073-80.

3. What should we do if previously the catheter was not removed?

- Depends on
  - Virulence of organism
  - Clinical profile of the patient
  - Response to antibiotics

- IDSA general recommendations
  - For short term catheters prefer removal over salvage
  - For long term catheters try salvage in selected conditions

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

Central venous catheter–related infections in hematology and oncology: 2020 updated guidelines on diagnosis, management, and prevention by the Infectious Diseases Working Party (AGIHO) of the German Society of Hematology and Medical Oncology (DGHO)

Catheter removal

- All Complicated BSI which i
  Supurative thrombophlebitis, endocarditis, osteomyelitis, or possible me
  her
- Und
  viru
  neg
  , ca
- Les
  to e
  Micrococcus species, or Propionibacteria)

caused by low virulent organisms including CoNS and corynebacterium

- Early CVC removal is always recommended in patients with CRBSI due to *S. aureus* (AIIt).
- Early catheter removal is always recommended in patients with CRBSI due to *Candida* spp. (AIIt).
- Catheter removal within 48–72 h is recommended in case of CRBSI caused by Gram-negative bacteria (BIIt).
- Preservation of CVC may be initially attempted in clinically stable patients in the presence of coagulase-negative staphylococci or *Corynebacterium jeikeium* (BIIt).

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45
Boris et al Annals of Hematology (2021) 100:239–259

Catheter salvage therapy

- When there is limited access and risk outweighs the benefit
  - Antibiotic lock therapy
  - Guidewire exchange

Antibiotic Lock Therapy

- Prevents Intraluminal spread
- Used along with systemic Antibiotic
- Dwell time
- Mixed with heparin or NS
- Do not flush
- Success rate

Table 9. Final concentrations of antibiotic lock solutions used for the treatment of catheter-related bloodstream infection.

Antibiotic and dosage	Heparin or saline, IU/mL	Reference(s)
Vancomycin, 2.5 mg/mL	2500 or 5000	[100, 275]
Vancomycin, 2.0 mg/mL	10	[275]
Vancomycin, 5.0 mg/mL[a]	0 or 5000	[276, 277]
Ceftazidime, 0.5 mg/mL	100	[123]
Cefazolin, 5.0 mg/mL	2500 or 5000	[100, 277]
Ciprofloxacin, 0.2 mg/mL[b]	5000	[130]
Gentamicin, 1.0 mg/mL	2500	[100]
Ampicillin, 10.0 mg/mL	10 or 5000	[275]
Ethanol, 70%[c]	0	[131]

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

Guidewire Exchange

- Not recommended as first line
- Limited evidence
- Inaccessible patients
- Accompanied with systemic and antibiotic lock therapy
- Antibiotic impregnanted catheters
- Remove if no response

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

4.How to deescalate the empiric regimen and What is its duration?

- Deescalate as per culture sensitivity report

Organisms	Duration
Staphylococcus aureus, candida sp	2 weeks
CONS	5 to 7 days or none
Enterococcus	7 to 14 days
Gram negative Species	7 to 14 days
Complicated BSI IE/supurative thrombophlebitis	4 to 6 weeks
Osteomyelitis	6 to 8 weeks

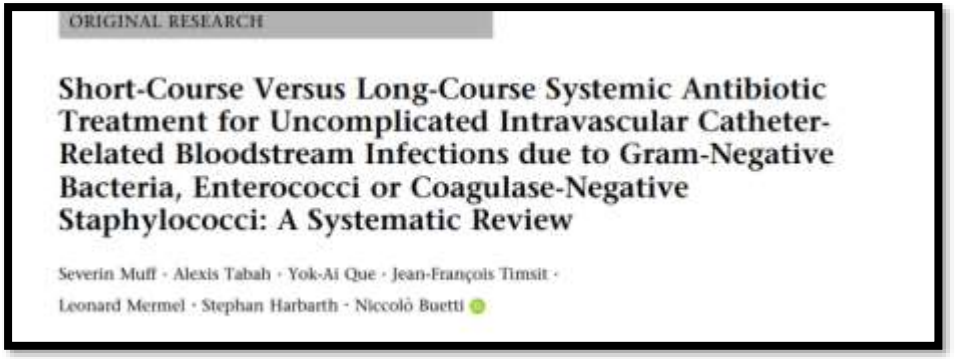
leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

	First author	Journal	Year	Setting	Recommended treatment duration			When prolonged therapy?
					Gram-negative CRBSI/CLABSI	Coagulase-negative staphylococcal CRBSI/ CLABSI	Enterococcal CRBSI/ CLABSI	
German guidelines	Böll	*Ann Hematol*	2021	Oncology	*Pseudomonas* and *Stenotrophomonas*: ≥ 2 weeks	5–7 days after defervescence	5–7 days after defervescence	Complications (endocarditis, osteomyelitis)
French recommendations	Timsit	*Ann Intensive Care*	2020	ICU	Enterobacteriaceae, *Pseudomonas aeruginosa, Acinetobacter baumannii*: 7 days	7 days	7 days	Remote complications
Expert statement	Buetti	*Semin Respir Crit Care Med*	2019	ICU	Enterobacteriaceae: (5–) 7 days *Pseudomonas aeruginosa, Acinetobacter baumannii*: 7 days	(5–) 7 days	(5–) 7 days	Persistent CRBSI, complicated courses (i.e. another vascular line infection, metastatic abscess, septic thrombophlebitis or endocarditis)
Spain recommendations	Chaves	*Med Intensiva*	2018	ICU	≥ 7 days	5–7 days	7–14 days	For CoNS: 10–14 days for patients with intravascular devices, biomedical devices or persistent markers of inflammation after catheter removal
International expert consensus statement	Timsit	*Intensive Care Med*	2018	ICU	7–14 days	5–7 days	7–14 days	Persistent bacteraemia, complications related to bacteraemia (i.e. suppurative thrombophlebitis, endocarditis, osteo myelitis, metastatic infection)

Severine et al Infect Dis Ther (2021) 10:1591–1605

	First author	Journal	Year	Setting	Recommended treatment duration			When prolonged therapy?
					Gram-negative CRBSI/CLABSI	Coagulase-negative staphylococcal CRBSI/ CLABSI	Enterococcal CRBSI/ CLABSI	
Expert statement	Rupp	*Infect Dis Clin North Am*	2018	All catheters	*Pseudomonas* or MDR GNB: 10–14 days Other GNB: 7–14 days	5–7 days	7–14 days	Complicated CRBSI (i.e. suppurative thrombophlebitis, persistent bacteraemia, osteomyelitis, infective endocarditis)
IDSA guidelines (USA)	Mermel	*Clin Infect Dis*	2009	All catheters	7–14 days	5–7 days or under certain circumstances observation without antibiotics	7–14 days	Complicated CRBSI (i.e. suppurative thrombophlebitis, osteomyelitis, infective endocarditis)

Severine et al Infect Dis Ther (2021) 10:1591–1605



ORIGINAL RESEARCH

Short-Course Versus Long-Course Systemic Antibiotic Treatment for Uncomplicated Intravascular Catheter-Related Bloodstream Infections due to Gram-Negative Bacteria, Enterococci or Coagulase-Negative Staphylococci: A Systematic Review

Severin Muff · Alexis Tabah · Yok-Ai Que · Jean-François Timsit · Leonard Mermel · Stephan Harbarth · Niccolò Buetti

- No significant mortality or relapse rate with short course vs long course of antibiotics
- Discourage prolonged therapy more than 7 days for GNB and CoNS after catheter removal
- GNB – 7 days CoNS – 3 days
- Enterococci – limited data – 7 to 14 days reasonable.

Severine et al Infect Dis Ther (2021) 10:1591–1605

Case - 5

- A 45 year old female admitted in ICU had unexplained fever with no other cause of alternative source without any clinical instability . The treating team planned to remove the catheter.

- **Controversial and limited data**

Catheter tip culture	Paired Blood culture as per IDSA	Action
Positive	Positive	Treat as CRBSI
Negative	Positive	Treat as CRBSI
Positive	Negative	**Catheter colonizer**

As per IDSA and recent expert opinion catheter colonization is defined as semi-quantitative culture ≥15 CFU or a quantitative culture ≥103 CFU/mL,

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45
Timsit et al. Ann. Intensive Care (2020) 10:118

REVIEW Open Access

Expert consensus-based clinical practice guidelines management of intravascular catheters in the intensive care unit

Jean-François Timsit[1,2], Julien Baleine[3], Louis Bernard[4], Silvia Calvino-Gunther[5], Michael Darmon[6], Jean Dellamonica[7], Eric Desruennes[8,9], Marc Leone[10], Alain Lepape[11,12], Olivier Leroy[13,14], Jean-Christophe Lucet[15,16], Zied Merchaoui[17], Olivier Mimoz[18,19,20], Benoit Misset[21], Jean-Jacques Parienti[22,23], Jean-Pierre Quenot[24,25,26], Antoine Roch[27,28], Matthieu Schmidt[29,30], Michel Slama[31], Bertrand Souweine[32], Jean-Ralph Zahar[33,34], Walter Zingg[35], Laetitia Bodet-Contentin[36] and Virginie Maxime[37*]

Table 3 Unexplained fever, catheter removed and positive microbiology (EXPERT OPINION)

Catheter removed in a context of fever and positive microbiology	Antibiotics and duration
Staphylococcus aureus, *Candida* spp.	
Negative blood culture	3–5 days
Positive blood culture with no remote complications	14 days
Positive blood culture with remote complications	4 to 6 weeks
Enterobacteriaceae, enterococci, coagulase-negative *Staphylococcus*	
Negative blood culture	No antibiotics[a]
Positive blood culture with no distant complications	7 days
Positive blood culture with remote complications	4 to 6 weeks
Pseudomonas aeruginosa, *Acinetobacter baumannii*	
Negative blood culture	3–5 days[a]
Positive blood culture with no distant complications	7 days
Positive blood culture with distant complications	4 to 6 weeks

[a] These proposals are based on poor-quality epidemiological data and are only presented as a guide. They must be modulated according to the presence of signs of clinical sepsis, intravascular devices, and underlying immunosuppression

Timsit et al. Ann. Intensive Care (2020) 10:118

Clinical Response

- With in 24 to 72 hours
- Remove catheter if not don
- Persistent symptoms – rule complications
- Endocarditis – 4 to 6 weeks
- Supurative thrombophlebitis – 3 to 4 weeks ?anticoagulation

- Staph aureus and enterococcus
- Prosthetic heart valve
- Implantable pacemaker and defibrillator
- Persistent bacteremia even after 72 hours of removal

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Candidemia

- Never a commensal and Always treat
- Empirical only in specific set of patients
- Remove the catheter
- **Total duration of 14 days after negative culture report**
- Isolated BDG values – no role
- Fluconazole – azole susceptible
- Echinocandins – previous azole exposure C. glabrata and C.krusei

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

Exit site infections

- Suspect with signs of infection at catheter site with absence systemic symptoms and no blood culture positivity
- Take swab from exit site
- Step by step approach
- Topical, systemic and catheter removal
- Duration and response not defined

leonard et al clin infect dis. 2009 Jul 1;49(1):1-45

Our Current Understanding

Tip culture	Central line With DTP/high count	Peripheral line	Decision	Action
Positive	Positive	Positive	CRBSI	Treat
Negative	Positive	Positive	CRBSI	Treat
Positive	Negative	Negative	Catheter colonizer	**Treat with less duration**
-	Positive	Negative	?Catheter Colonizer	**Clinical call**
-	Negative	Positive	Look for alternative source	-

- Still many more doubts prevails both in the treatment and diagnosis of CRBSI

- Need for More RCTs and evidences

- **ALWAYS A CLINICAL CALL AND CASE BY CASE BEDSIDE DECISION IS ESSENTIAL**

How to Prevent

During Insertion

- Hand hygiene
- Maximum Sterile barrier precautions
- Skin antisepsis – Chlorhexidine based solutions
- Dressing - Transparent > Gauze (Unless bleeds/diaphoretic)
- Catheter Specific -

1. Peripheral iv catheter
2. Central venous and arterial catheter (material/number of lumens /location/expertise/USG)

Denis et al Frasca et al. Critical Care 2010, 14:212

After Insertion

- Hand hygiene
- Daily inspection and need for c
- Dressing – 7 days for transpare
- Infusion set - 96h to 7days (exc ts)
- Hub care – Chlorhexidine/alcol
- No routine central catheter cha
- Body wash
- Staff education

Denis et al Frasca et al. Critical Care 2010, 14:212

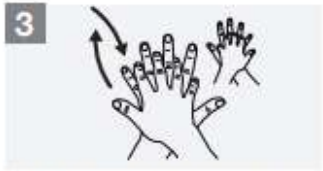
Steps of hand hygiene

Duration of the entire procedure: 40-60 seconds

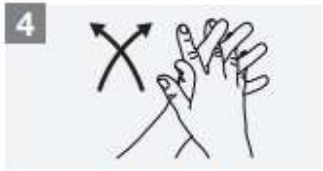
Wet hands with water;

Apply enough soap to cover all hand surfaces;

Rub hands palm to palm;



Right palm over left dorsum with interlaced fingers and vice versa;



Palm to palm with fingers interlaced;

Backs of fingers to opposing palms with fingers interlocked;

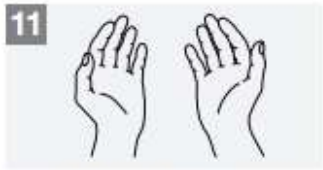
Rotational rubbing of left thumb clasped in right palm and vice versa;

Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;

Rinse hands with water;

Dry hands thoroughly with a single use towel;

Use towel to turn off faucet;



Your hands are now safe.

Moments of hand hygiene

Case Scenario

- A 58 year old male known diabetic and hypertensive admitted in ICU 5 days back. He was diagnosed as a case of Influenza-B related ARDS intubated and mechanically ventilated. Central line placed at outside hospital. Now he started developing new onset fever however there is no increase in O2 requirement. His repeat bedside xray showed no new infiltrates. Treating physician suspected CRBSI in clinical grounds after excluding alternative source of fever.

- Paired blood cultures were sent and **started on vancomycin** and the catheter was not removed as there is no indications.
- Blood cultures turned out to be **Staph aureus with colony count 3 fold greater than peripheral line**
- Catheter is **removed** and inj. vancomycin was continued.
- Patient became afebrile with in 72 hours of catheter removal and antibiotics continued for 14 days

Take home message

- Diagnose CRBSI based on clinical suspicion paired blood cultures and after excluding alternative source.
- Delaying catheter removal may reduce the treatment success.
- Assessment of IV line and need for Central line has to done on daily basis.
- Prevention is always better than cure