Clinical Microbiology Newsletter
Sir Ganga Ram Hospital
Volume 30 (1) & 31 (1) Published July 2025

Beyond the Throat: Invasive Spinal Osteomyelitis by *Corynebacterium diphtheriae*

ABSTRACT: We report a rare case of spinal osteomyelitis due to Corynebacterium diphtheriae in a 73-year-old woman from India. The organism was identified from vertebral pus using MALDI-TOF MS. The patient underwent surgical decompression and targeted antibiotic therapy. Culture on blood and chocolate agar revealed dry, grey colonies, while MacConkey agar showed no growth. Microscopy showed polymorphonuclear leukocytes with pleomorphic gram-positive bacilli. This case highlights a rarely reported etiology for vertebral osteomyelitis, demanding heightened clinical suspicion.

CASE REPORT: A 73-year-old woman with a history of type 2 diabetes mellitus and hypertension presented with progressive, dull aching back pain that had worsened over several weeks, accompanied by bilateral lower limb weakness (right greater than left). She had been bed-bound for two months following a fall. There was no history of fever, cough, weight loss, or constitutional symptoms. On physical examination, she was afebrile with stable vital signs. Neurological examination showed reduced power in both lower limbs and exaggerated tendon reflexes. Laboratory parameters revealed a total leukocyte count of 11,630/mm³ (N55%, L34%), C-reactive protein was negative, and ESR was elevated at 53 mm/hr. Subsequent MRI spine revealed a D12–L1 compression fracture with enhancement suggestive of adjacent vertebral osteomyelitis. Intraoperative findings revealed purulent material at the D11–L1 intervertebral disc space, and was sent for microbiological examination. Gram stain of pus showed numerous polymorphonuclear leukocytes and few gram-positive, pleomorphic bacilli. Following overnight incubation, culture on blood agar (BA) yielded large, dry, grey-white colonies with irregular margins and no hemolysis. (Figure 1) Chocolate agar (CA) showed similar growth, while MacConkey agar showed no growth. At this stage, the differential diagnosis included skin flora contaminants such as diphtheroids, as well as uncommon pathogens like *Corynebacterium jeikeium* or *Propionibacterium spp.* However, the purity of colonies prompted further identification and was confirmed as *Corynebacterium diphtheriae* using MALDI-TOF (VITEK MS Prime). Albert staining demonstrated bluish metachromatic granules against a green cytoplasm, consistent with *C. diphtheriae.*

Figure 1: *C. diphtheriae* colonies on Blood Agar

Antimicrobial susceptibility testing was performed using the E-test (gradient diffusion method), and minimum inhibitory concentrations (MICs) were interpreted according to the Clinical and Laboratory Standards Institute (CLSI) M45 guidelines for *Corynebacterium* spp.[1] The isolate was sensitive to daptomycin, vancomycin, doxycycline, and meropenem, intermediate sensitive to penicillin and ceftriaxone, but resistant to ciprofloxacin, clindamycin, and erythromycin. Empiric antibiotics were revised to teicoplanin and doxycycline. The patient improved with therapy and was discharged hemodynamically stable.

DISCUSSION: *Corynebacterium diphtheriae*, classically linked to respiratory diphtheria in unvaccinated individuals, has been increasingly identified as a cause of invasive infections such as endocarditis, septic arthritis, and osteomyelitis.[2] While most cases occur in children or immunocompromised individuals, our report is notable for involving an elderly yet relatively immunocompetent patient. The presumed source in this case was hematogenous spread from a previously healed leg ulcer, underscoring the risk posed by skin breaches even in immunized hosts. A recent review has also highlighted a shift in the incidence of *C. diphtheriae cases* from the children to adolescence due to increasing vaccination coverage in children.[3]

Nontoxigenic *C. diphtheriae* strains have gained prominence in recent years due to their association with invasive diseases including osteomyelitis, bacteremia, and pneumonia. These strains are not neutral in pathogenicity and can be aggressive, despite not producing diphtheria toxin. Importantly, the current toxoid-based vaccine does not protect against infection by these strains, nor does it prevent asymptomatic colonization or transmission, which continues even in highly vaccinated populations.[4,5]

Reports from multiple regions have demonstrated that cutaneous carriage-especially in individuals with poor

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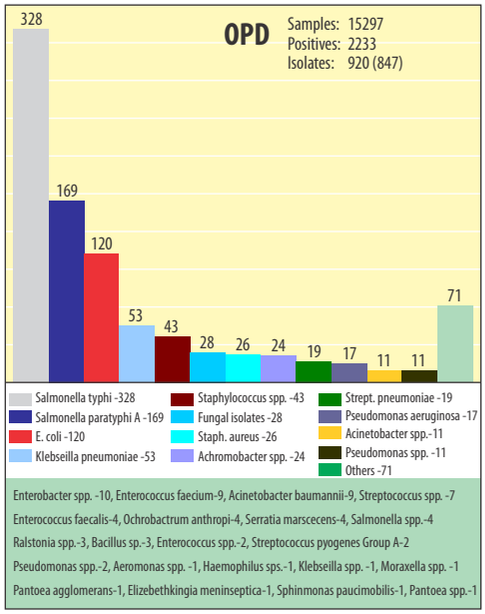
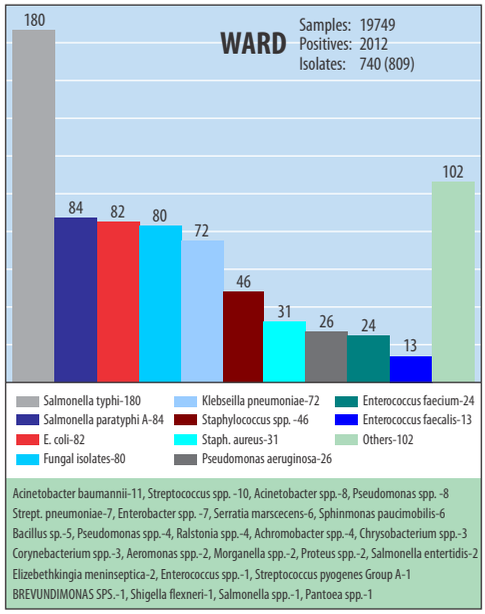
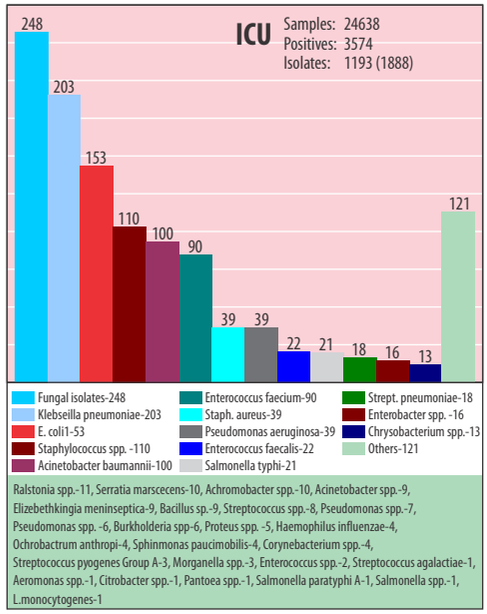
BLOOD

Jan. 2023 - Dec. 2024







Figures in parenthesis are repeat isolates which have been excluded from the data.
Fungal isolates data will be published separately in the next issue.

PERCENTAGE SENSITIVITY

OPD
WARD
ICU

GPC

	No. of Isolates	Penicillin Meningitis	Penicillin Non Meningitis	Ceftriaxone Meningitis	Ceftriaxone non Meningitis	Penicillin	Ampicillin	Cefoxitin/ Oxacillin	Clindamycin	Levofloxacin	Co-Trimoxazole	Gentamicin	High Dose Gentamicin	Glycopeptides	Linezolid	Daptomycin
Staphylococcus spp.	**43**	-	-	-	-	19	-	37	54	-	61	81	-	100	97	100
	46	-	-	-	-	6	-	8	28	-	56	56	-	100	100	100
	110	-	-	-	-	5	-	7	18	-	48	32	-	100	97	100
Staph. aureus	**26**	-	-	-	-	3	-	36	73	-	38	69	-	100	100	100
	31	-	-	-	-	16	-	51	64	-	60	64	-	100	100	100
	39	-	-	-	-	5	-	38	66	-	58	61	-	100	100	100
Enterococci faecium	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	24	-	-	-	-	-	8	-	-	-	-	-	12	33	62	-
	90	-	-	-	-	-	3	-	-	-	-	-	21	46	64	-
Enterococci faecalis	**4**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	13	-	-	-	-	-	92	-	-	-	-	-	15	84	100	100
	22	-	-	-	-	-	95	-	-	-	-	-	22	90	100	75
Strept. pneumoniae	**19**	41	100	83	100	-	-	-	84	83	-	-	-	-	-	-
	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	18	33	100	83	100	-	-	-	64	82	-	-	-	100	-	-

- Not done

GNB

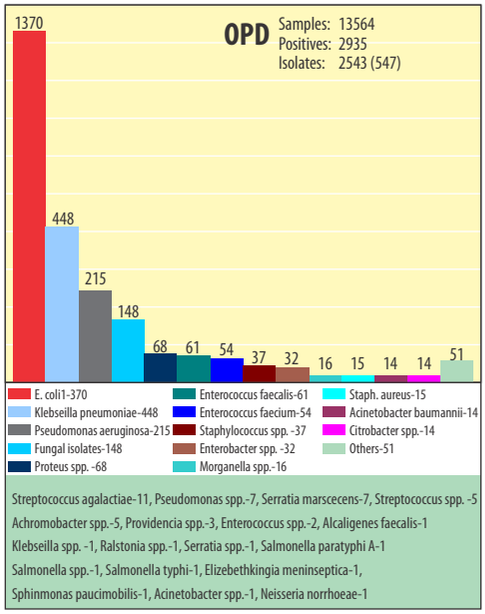
	No. of Isolates	Ampicillin	Cefuroxime	Ceftriaxone	Ceftazidime	Cefepime	Co-Amoxyclav	Ampicillin + Sulbactum	Piperacillin + Tazobactum	Cefoperazone + Sulbactum	Co-Trimoxazole	Chloramphenicol	Quinolones	Gentamicin	Amikacin	Ertapenem	Imipenem/ Meropenem	Azithromycin	Minocycline
Salmonella Typhi	**328**	97	-	100	-	-	-	-	-	-	97	98	0	-	-	-	-	100	-
	180	96	-	100	-	-	-	-	-	-	97	97	0	-	-	-	-	99	-
	21	95	-	95	-	-	-	-	-	-	95	100	0	-	-	-	-	100	-
Salmonella Paratyphi A	**169**	99	-	100	-	-	-	-	-	-	100	100	0	-	-	-	-	-	-
	84	100	-	100	-	-	-	-	-	-	100	100	0	-	-	-	-	-	-
	1	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-
E. coli	**120**	-	12	15	-	31	47	-	75	81	-	-	18	60	79	86	87	-	89
	82	-	8	17	-	35	32	-	60	69	-	-	12	67	76	71	76	-	78
	152	-	5	11	-	29	31	-	48	53	-	-	8	64	75	58	65	-	77
Klebsiella pneumoniae	**53**	-	18	20	-	24	28	-	32	34	-	-	16	43	44	35	35	-	52
	72	-	11	15	-	18	19	-	25	30	-	-	12	27	28	31	33	-	45
	203	-	7	8	-	12	15	-	21	23	-	-	6	29	30	23	23	-	46
Pseudomonas aeruginosa	**17**	-	-	-	76	82	-	-	76	76	-	-	82	0	50	-	82	-	-
	26	-	-	-	64	61	-	-	61	61	-	-	60	50	63	-	64	-	-
	39	-	-	-	58	61	-	-	58	56	-	-	54	37	57	-	58	-	-
Acinetobacter baumannii	**9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	100	-	-	4	3	-	-	3	3	4	-	-	4	6	4	-	3	-	33

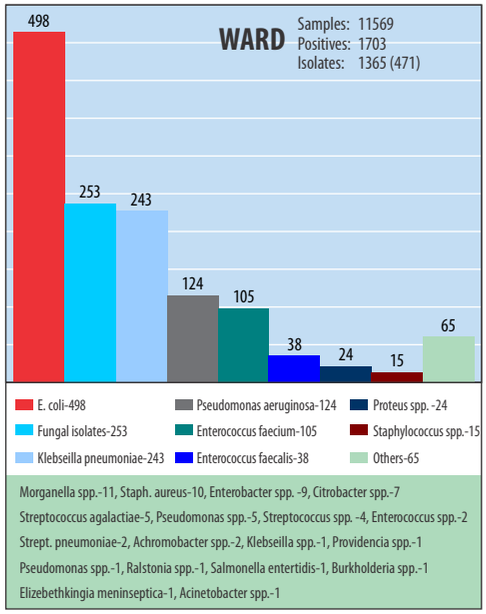
- Not done

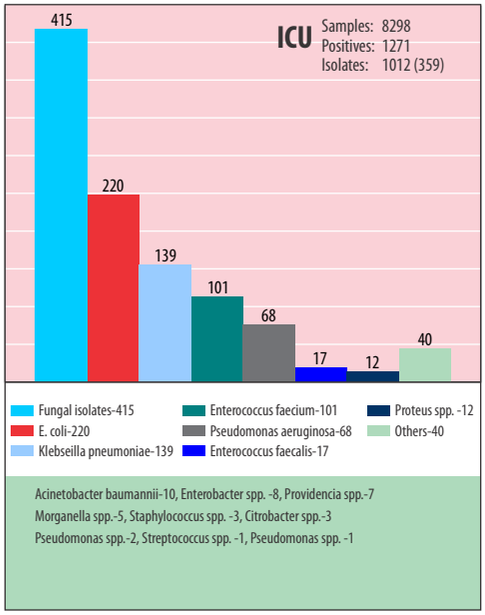
Note: All sensitivities reported here are based on MIC testing using Vitek - 2 according to 2023 & 2024 CLSI guidelines

URINE

Jan. 2023 - Dec. 2024







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OPD
WARD
ICU

PERCENTAGE SENSITIVITY

GPC

	No. of Isolates	Ampicillin	Penicillin	Cefoxitin/ Oxacillin	Nitrofurantoin	Levofloxacin	Glycopeptides	Co-Trimoxazole
Enterococci faecium	**54**	5	-	-	5	0	62	-
	105	0	-	-	2	0	56	-
	101	0	-	-	1	0	37	-
Enterococci faecalis	**61**	90	-	-	83	22	98	-
	37	89	-	-	89	18	100	-
	17	88	-	-	82	11	94	-
Staphylococcus spp.	**37**	-	0	41	100	47	100	62
	15	-	0	33	100	46	93	60
	3	-	-	-	-	-	-	-

- Not done

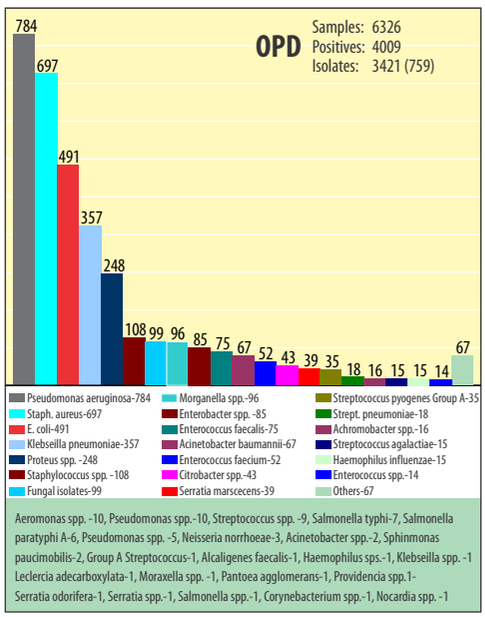
GNB

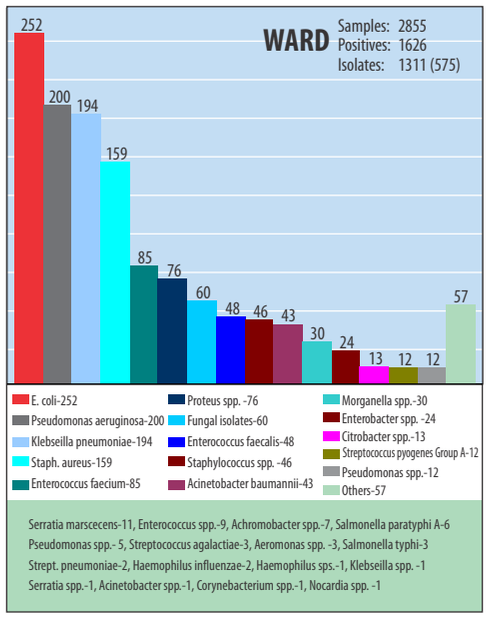
	No. of Isolates	Cefuroxime	Ceftriaxone	Ceftazidime	Cefepime	Nitrofurantoin	Co-Amoxyclav	Piperacillin+ Tazobactum	Cefoperazone+ Sulbactum	Co-Trimoxazole	Gentamicin	Amikacin	Quinolones	Ertapenem	*Imipenem	Meropenem	Fosfomycin	Minocycline
E. coli	**1370**	17	23	-	39	83	49	72	81	40	73	83	36	85	87	87	98	81
	497	14	19	-	33	85	38	56	68	38	68	80	22	73	79	78	99	79
	219	6	11	-	29	75	29	46	57	35	68	76	12	63	69	69	98	75
Klebsiella pneumoniae	**448**	21	27	-	33	21	33	42	47	40	51	52	20	49	52	54	-	57
	243	14	16	-	22	10	25	30	33	30	35	40	13	34	37	39	-	50
	139	12	15	-	17	10	20	23	28	25	28	30	11	27	29	28	-	49
Proteus spp	**68**	50	52	-	64	0	66	98	86	32	47	58	25	89	61	89	-	-
	24	41	41	-	45	0	60	91	70	25	41	54	29	83	54	83	-	-
	12	41	50	-	50	0	41	91	83	33	58	58	16	83	75	83	-	-
Enterobacter spp.	**32**	9	62	-	75	8	-	58	71	68	78	78	53	71	78	75	-	67
	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pseudomonas aeruginosa	**215**	-	-	53	55	-	-	54	45	-	62	53	40	-	49	49	-	-
	124	-	-	37	41	-	-	40	36	-	33	42	33	-	40	37	-	-
	67	-	-	22	23	-	-	25	22	-	25	26	22	-	22	23	-	-

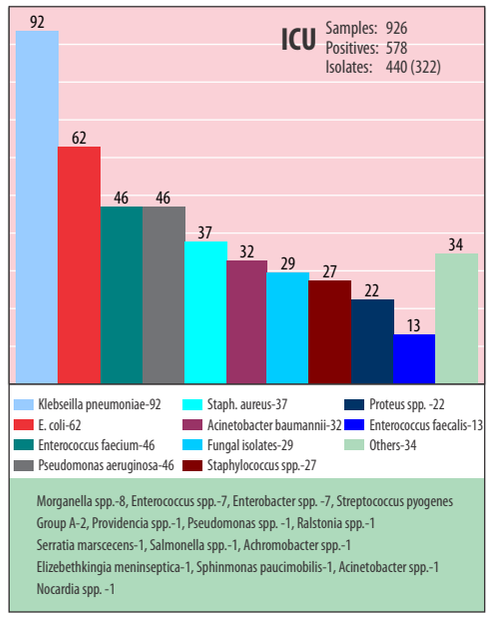
- Not done
** it is advised to perform an alternative method of testing prior for the reporting of results of Imipenem susceptibility tests on Vitek-2 for Proteus spp., Morganella spp., and Providecia spp., as pert he manufacturer's recommendations*

Note: All sensitivities reported here are based on MIC testing using Vitek - 2 according to 2023-24 CLSI guidelines

PUS / TISSUE Jan. 2023 - Dec. 2024







Figures in parenthesis are repeat isolates which have been excluded from the data.
Fungal isolates data will be published separately in the next issue.

PERCENTAGE SENSITIVITY

OPD
WARD
ICU

GPC

	No. of Isolates	Penicillin	Ampicillin	Cefoxitin/ Oxacillin	High Dose Gentamicin	Gentamicin	Erythromycin	Clindamycin	Co-Trimoxazole	Glycopeptides	Linezolid	Tigecycline
Staph. aureus	**697**	3	-	42	-	64	33	61	49	100	100	100
	159	3	-	38	-	64	38	61	43	100	100	100
	37	0	-	27	-	52	37	63	58	100	100	100
Staphylococci spp.	**108**	2	-	10	-	42	10	22	47	96	95	100
	45	0	-	6	-	50	13	17	40	95	95	100
	27	3	-	4	-	29	3	7	29	100	100	100
Enterococci faecium	**52**	-	5	-	16	-	-	-	-	56	61	90
	85	-	7	-	17	-	-	-	-	60	77	98
	46	-	2	-	26	-	-	-	-	60	77	95
Enterococci faecalis	**75**	-	94	-	36	-	-	-	-	97	100	98
	48	-	95	-	52	-	-	-	-	95	100	100
	13	-	100	-	53	-	-	-	-	100	100	100
Streptococcus pyogenes Group A	**35**	100	-	-	-	-	28	51	33	100	-	-
	12	100	-	-	-	-	72	81	100	100	-	-
	2	-	-	-	-	-	-	-	-	-	-	-

- Not done

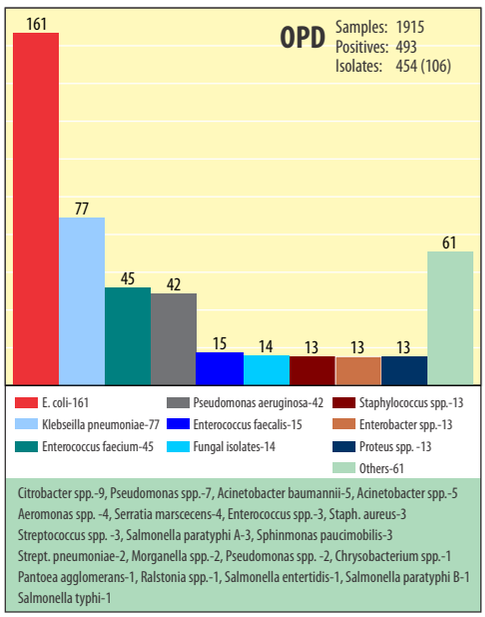
GNB

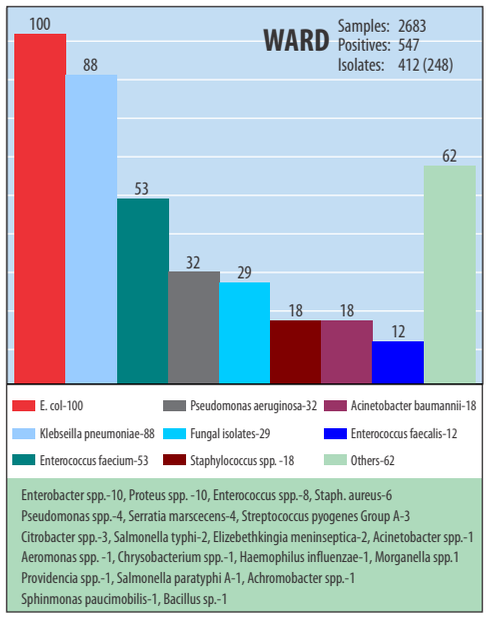
	No. of Isolates	Cefuroxime	Ceftriaxone	Ceftazidime	Cefepime	Co-Amoxyclav	Ampicillin+ Sulbactum	Piperacillin+ Tazobactum	Cefoperazone+ Sulbactum	Co-Trimoxazole	Quinolones	Gentamicin	Amikacin	Ertapenem	*Imipenem	Meropenem	Tigecycline	Minocycline
E. coli	**491**	11	16	-	32	33	-	53	66	34	32	72	78	73	77	76	98	76
	252	11	15	-	30	30	-	43	54	31	26	67	75	63	69	67	99	70
	62	3	8	-	25	22	-	43	48	33	11	70	75	53	64	59	96	66
Klebseilla pneumoniae	**356**	23	30	-	37	32	-	42	50	44	21	50	50	49	51	54	64	54
	194	11	13	-	19	20	-	26	30	35	10	38	39	30	31	32	59	48
	92	7	7	-	11	10	-	11	15	20	9	21	21	14	15	15	44	43
Proteus spp.	**248**	50	65	-	73	74	-	94	88	41	31	54	62	89	59	88	-	8
	76	43	64	-	66	67	-	93	86	32	28	50	59	90	52	89	-	9
	22	36	54	-	68	50	-	95	86	36	36	59	59	95	68	95	-	15
Pseudomonas aeruginosa	**784**	-	-	72	79	-	-	75	62	-	56	69	70	-	73	73	-	-
	200	-	-	65	73	-	-	74	61	-	53	73	70	-	67	66	-	-
	46	-	-	43	50	-	-	52	39	-	36	42	51	-	41	43	-	-
Acinetobacter baumannii	**67**	-	-	-	17	-	21	19	23	18	13	20	18	-	17	17	-	55
	43	-	-	-	2	-	9	6	6	11	6	9	2	-	6	6	-	51
	32	-	-	-	0	-	0	0	0	21	0	0	0	-	0	0	-	31

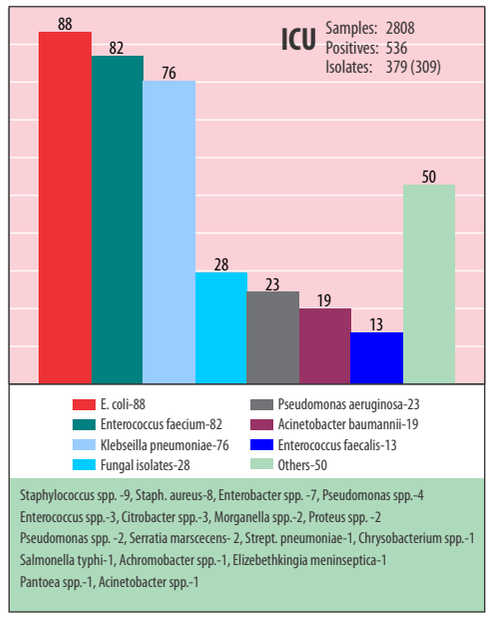
- Not done
** it is advised to perform an alternative method of testing prior for the reporting of results of Imipenem susceptibility tests on Vitek-2 for Proteus spp., Morganella spp., and Providecia spp., as pert he manusfacturer's recommendations*

Note: All sensitivities reported here are based on MIC testing using Vitek - 2 according to 2023 & 2024 CLSI guidelines

BODY FLUIDS Jan. 2023 - Dec. 2024







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PERCENTAGE SENSITIVITY

OPD
WARD
ICU

GPC

	No. of Isolates	Penicillin	Ampicillin	Cefoxitin/ Oxacillin	High Dose Gentamicin	Glycopeptides	Linezolid	Tigecycline
Enterococci faecium	**45**	-	6	-	35	62	77	95
	53	-	3	-	32	58	68	88
	82	-	4	-	20	56	73	93
Staphylococcus spp.	**12**	8	-	0	-	-	100	100
	18	0	-	0	-	-	100	100
	8	-	-	-	-	-	-	-

- Not done

GNB

	No of isolates	Cefuroxime	Ceftriaxone	Ceftazidime	Cefepime	Co-Amoxyclav	Piperacillin + Tazobactum	Cefoperazone+ Sulbactum	Quinolones	Co-Trimoxazole	Gentamicin	Amikacin	Ertapenem	Imipenem/ Meropenem	Minocycline	Tigecycline
Klebsiella pneumoniae	**77**	20	23	-	29	32	46	46	19	48	51	51	45	45	51	63
	87	8	10	-	16	11	20	25	10	24	26	28	24	25	36	44
	76	5	5	-	9	11	13	15	5	21	22	23	15	17	34	41
E. coli	**161**	9	14	-	27	26	36	44	5	40	74	84	54	65	75	99
	99	6	8	-	21	20	27	43	3	38	69	75	54	64	72	97
	88	1	3	-	20	14	22	28	2	30	65	71	43	53	70	100
Pseudomonas aeruginosa	**42**	-	-	54	71	-	69	52	54	-	71	72	-	47	-	-
	32	-	-	46	59	-	51	50	53	-	20	33	-	50	-	-
	23	-	-	41	45	-	45	39	39	-	30	30	-	41	-	-
Acinetobacter baumannii	**5**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	18	-	-	27	27	-	22	33	33	38	33	35	-	22	58	-
	19	-	-	11	0	-	5	10	5	29	5	10	-	0	27	-
Enterobacter spp.	**13**	0	-	-	66	-	58	66	30	75	81	75	58	58	72	100
	10	0	-	-	70	-	40	50	44	70	60	60	60	70	80	77
	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- Not done

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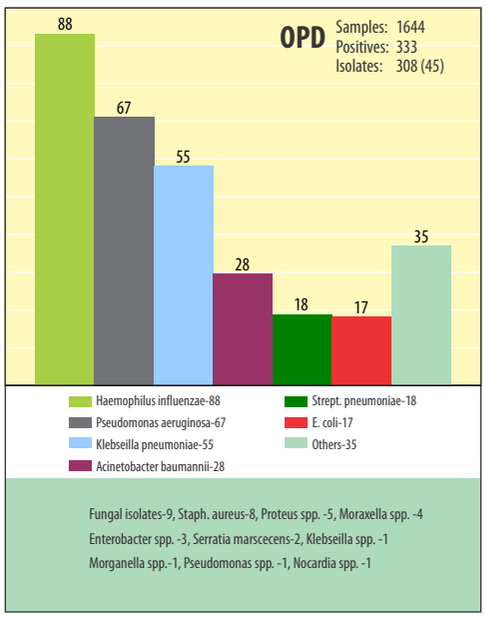
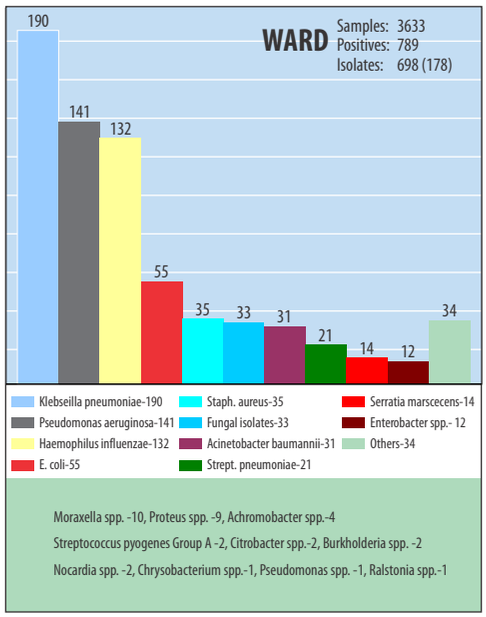
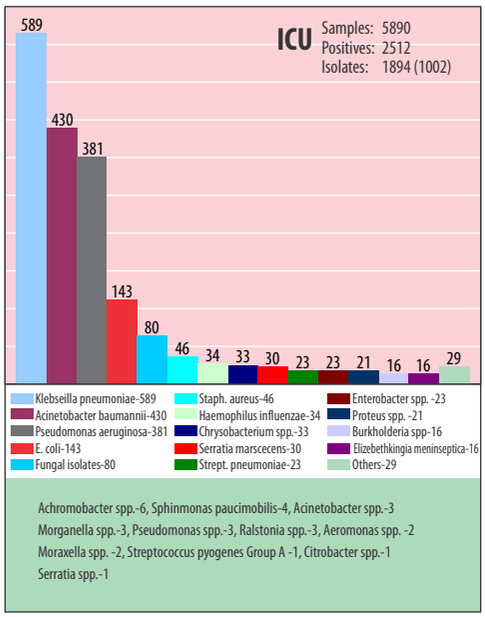
RESPIRATORY SPECIMEN

Jan. 2023 - Dec. 2024







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PERCENTAGE SENSITIVITY

OPD
WARD
ICU

GPC

	No. of Isolates	Penicillin	Cefoxitin/ Oxacillin	Erythromycin	Levofloxacin	Clindamycin	Ceftriaxone	Co-Trimoxazole	Gentamicin	Glycopeptides	Linezolid	Tigecycline
Staph. aureus	**8**	-	-	-	-	-	-	-	-	-	-	-
	35	2	35	22	3	37	-	48	64	100	100	100
	46	2	40	28	4	43	-	58	63	100	100	100
Strept. pneumoniae	**18**	90	-	33	83	38	90	11	-	100	100	-
	21	97	-	50	68	66	97	21	-	100	100	-
	23	85	-	30	69	52	85	26	-	100	100	-

- Not done

GNB

	No. of Isolates	Ampicillin	Cefuroxime	Ceftriaxone	Ceftazidime	Cefepime	Co-Amoxyclav	Ampicillin+ Sulbactum	Piperacillin+ Tazobactum	Cefoperazone+ Sulbactum	Quinolones	Co-Trimoxazole	Gentamicin	Amikacin	Ertapenem	Imipenem	Meropenem	Tigecycline	Minocycline
E. coli	**17**	-	5	5	-	11	29	-	58	70	28	29	52	76	82	82	82	100	58
	55	-	7	5	-	18	18	-	30	40	24	27	65	76	49	63	63	98	67
	143	-	1	1	-	16	16	-	23	26	60	26	58	61	37	45	44	93	60
Klebseilla pneumoniae	**55**	-	23	25	-	32	34	-	40	41	21	47	50	45	43	41	43	58	47
	190	-	21	25	-	32	29	-	40	44	25	46	51	51	44	45	46	63	59
	589	-	5	6	-	11	12	-	18	21	6	22	28	26	21	21	23	45	41
Haemophilus influenzae	**88**	68	58	96	-	80	80	84	98	-	68	37	-	-	98	100	100	-	-
	132	72	56	99	-	90	64	83	99	-	85	37	-	-	96	100	100	-	-
	34	55	44	97	-	85	100	78	100	-	81	32	-	-	90	-	100	-	-
Pseudomonas aeruginosa	**67**	-	-	-	82	81	-	-	81	72	70	-	90	90	-	76	76	-	-
	141	-	-	-	78	82	-	-	81	73	70	-	87	84	-	73	75	-	-
	381	-	-	-	50	55	-	-	53	43	48	-	54	54	-	50	49	-	-
Acinetobacter baumannii	**28**	-	-	0	-	14	-	17	10	14	15	48	14	19	-	14	14	-	39
	31	-	-	0	-	12	-	16	12	12	10	32	16	12	-	12	12	-	51
	430	-	-	2	-	3	-	5	2	3	2	24	5	3	-	2	2	-	38

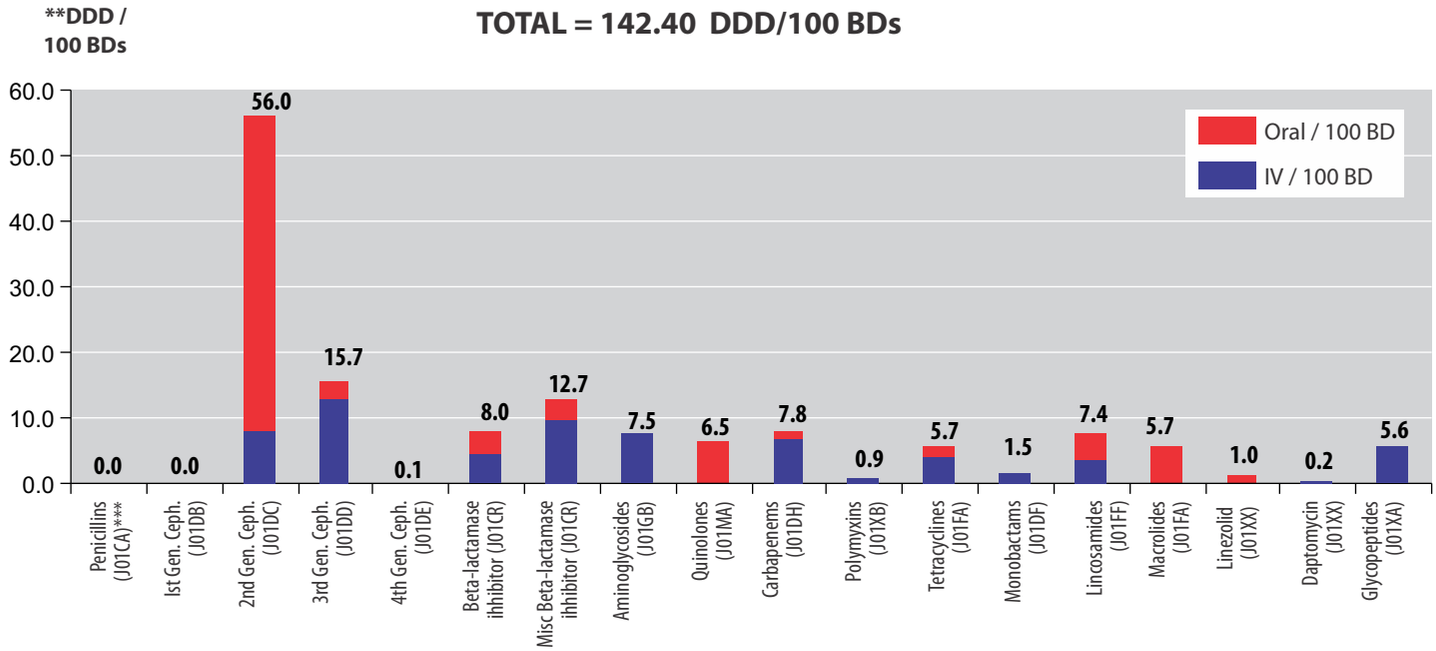
- Not done

Note: All sensitivities reported here are based on MIC testing using Vitek - 2 according to 2023 & 2024 CLSI guidelines

*PRESCRIPTION AUDITING OF ANTI-MICROBIALS

January - December 2023

TOTAL = 142.40 DDD/100 BDs



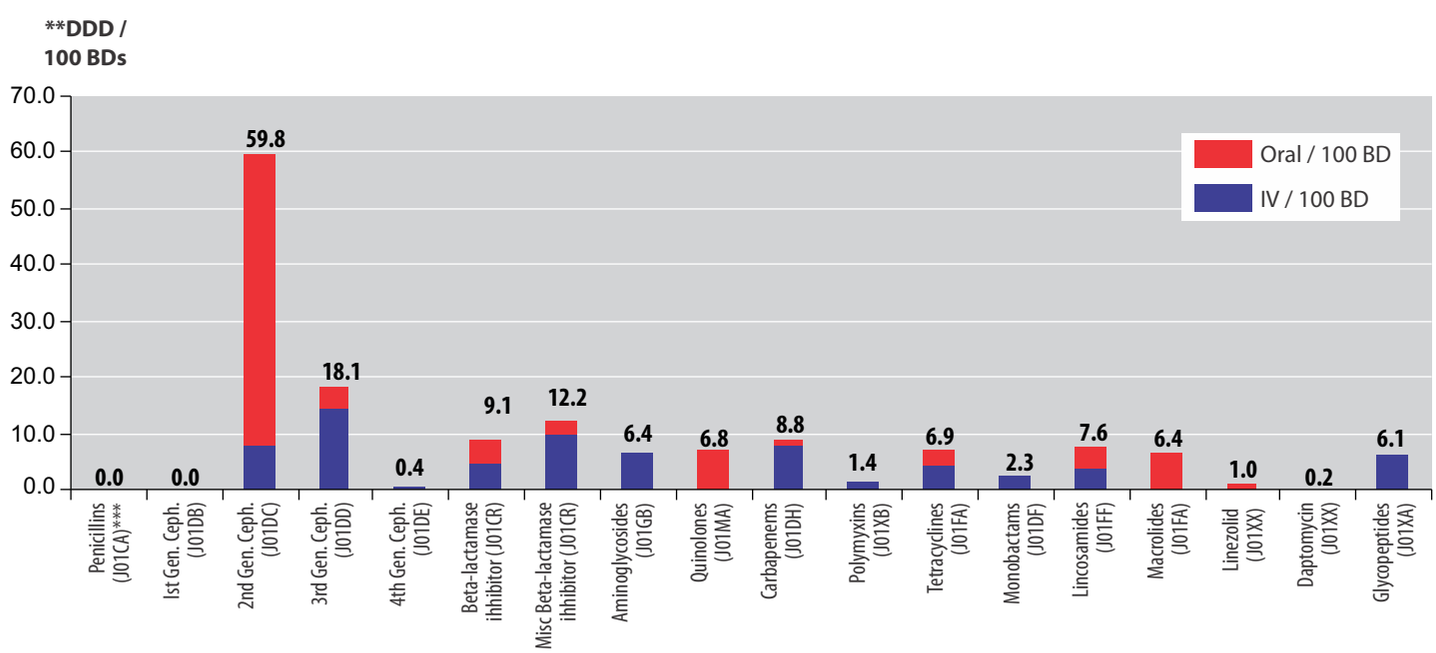
*Based on the hospital pharmacy data of the antibiotic dispensed.

**Daily Defined Doses / 100 Bed Days: Calculated as per the Anatomical Therapeutic Chemical (ATC) classification index, WHO Collaborating Centre for Drug Statistics Methodology, OSLO, Norway.

***ATC Codes.

January - December 2024

TOTAL = 153.60 DDD/100 BDs



*Based on the hospital pharmacy data of the antibiotic dispensed.

**Daily Defined Doses / 100 Bed Days: Calculated as per the Anatomical Therapeutic Chemical (ATC) classification index, WHO Collaborating Centre for Drug Statistics Methodology, OSLO, Norway.

***ATC Codes.

Beyond the Throat: Invasive Spinal .....

(contd. from page 1)

hygiene, chronic wounds, or comorbidities-can serve as a reservoir for systemic dissemination[3,5]. In particular, biovar Gravis has been frequently associated with cutaneous and invasive infections. While such colonization often goes unnoticed in immunized individuals, it remains epidemiologically significant.[4]

Invasive infections caused by *C. diphtheriae*, both toxigenic and nontoxigenic, have been documented to cause high morbidity and mortality. A cluster of endocarditis cases in South Africa revealed severe outcomes even with prompt treatment, emphasizing the need for early recognition and aggressive management.[6] In our case, diagnostic clues included non-hemolytic colonies on blood and chocolate agar, absence of growth on MacConkey agar, and club-shaped bacilli on Gram stain. These were confirmed using MALDI-TOF MS and Albert stain. Prompt organism identification and adjustment of antibiotic therapy based on susceptibility results were critical for clinical success.

Historically, penicillin has been the preferred treatment for *C. diphtheriae* infections. However, emerging resistance has been increasingly reported, particularly to beta-lactams, macrolides, and fluoroquinolones.[5,7] In our case, the isolate was resistant to ciprofloxacin, erythromycin, and clindamycin, but remained susceptible to vancomycin, teicoplanin, and doxycycline. This guided a successful treatment regimen, in line with current recommendations to perform susceptibility testing rather than rely on assumed penicillin efficacy.[1] Multidrug resistance has been observed globally. Reports from Canada and India have documented resistant strains isolated from bone and joint infections and endovascular sites, often post-surgical or device-associated.[7] These findings emphasize the need for regional surveillance and laboratory-guided therapy.

Given rising antimicrobial resistance, waning immunity in older adults, and the limitations of the current vaccine, clinicians should maintain a high index of suspicion for *C. diphtheriae* in atypical presentations of osteomyelitis. Surgical debridement and tailored antimicrobial therapy remain the cornerstone of management. With the re-emergence of *C. diphtheriae* in invasive infections, further research into its geographic spread, resistance patterns, and virulence mechanisms is essential to guide clinical and public health strategies.

PUBLICATIONS

- Mathur P, Srivastav S, Thakur AK, Wattal C- 11th author, Goel N-19th author, et al Candidaemia and Central Line-Associated Candidaemia in a Network of Indian ICUs: Impact of COVID-19 Pandemic. Mycoses. 2024 Sep;67(9):e13790. doi: 10.1111/myc.13790. PMID: 39278818.
- Wattal C, Goel N. Antimicrobial resistance. In: Dutta S, editor. Neonatal sepsis. New Delhi: Noble Vision; 2025. p. 304–333.

HIGHLIGHTS based on Blood Isolates IPD

*Two years cumilative data from Jan. 2023 to Dec. 2024.

- ACCo in S. Typhi: 2.1%
- Overall prevalence of MRSA, VRE, ESBL, and CRE was 0.45%, 0.34%, 2.7%and 1.7% respectively.
- MRSA isolation rate: 55.8 % out of 77 isolates of *S. aureus*
- VRE isolation rate: 56.3 % out of 75 isolates of *E. faecium*
- ESBL rate: 90.5% out of 645 isolates of *Enterobacteriaceae*
- CRE rate: 57.4% out of 645 isolates of *Enterobacteriaceae*
- Colistin sensitivity data not included as the sensitive category (S) of colistin in gram negative bacteria has been removed in the CLSI from year 2020 and only intermediate sensitive (IS) and resistant (R) categories are retained. As IS and R categories are clubbed together and considered as R for the purpose of antibiogram, therefore the figures would come as 100% for all the isolates

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7. .Mina NV, Burdz T, Wiebe D, Rai JS, Rahim T, Shing F, et al. Canada's first case of a multidrug-resistant Corynebacterium diphtheriae strain, isolated from a skin abscess. J Clin Microbiol. 2011 Nov;49(11):4003-5.

*Volume 30 (1) & 31 (1) are being combined to improve denominators.