



Microbiology Newsletter

Sir Ganga Ram Hospital

Volume 10, No. 1

March 2005

ESBL- An Emerging Threat to Antimicrobial therapy

ESBL or Extended Spectrum Beta Lactamases are plasmid mediated enzymes capable of hydrolysing & inactivating a wide variety of beta lactams, including penicillins, third generation cephalosporins & aztreonam. These enzymes are commonly found in *Enterobacteriaceae* family especially *E.coli* & *Klebsiella spp.* Due to extensive use of ceftazidime, cefotaxime, ceftriaxone, aztreonam, cefuroxime which are known to be ESBL inducers, there has been a clonal dissemination of such resistant strains in patients with risk factors for colonisation or infection with ESBL producing organisms, such as long term antibiotic exposure, prolonged ICU stay, nursing home residency, severe illness, residence in an institution with high rates of ceftazidime & other 3rd generation cephalosporin use, instrumentation & catheterisation. Thus judicious use of third generation cephalosporins & formulation of antibiotic policy are essential.

ESBL detection

Methods for laboratory detection of ESBLs are based on recommendations from the Clinical Laboratory Standard Institute (CLSI) formerly called National Committee for Clinical Laboratory Standards (NCCLS) & Canadian External Quality Assessment Advisory Group for antibiotic resistance.

ESBL Screening Methods

1. Standard disc diffusion method

In vitro sensitivity testing using established CLSI procedure is carried out using aztreonam, cefotaxime, ceftazidime, cefpodoxime, ceftriaxone discs. Any zone diameter within the "grey zone" is a probable ESBL producing strain requiring phenotypic confirmatory testing.



IAMM Delhi Chapter meet, Silver Oak IHC, New Delhi. Left to Right - Dr. Mridula Bose (Secretary), Dr. Madalsa Mathur (President), Dr. K.C. Mahajan (Guest of Honor, Chairman - Dept. of Academics, SGRH), Prof. K.B. Sharma (Chief Guest) and Dr. C. Wattal (Chairman Organising Committee - SGRH)

2. Double disc synergy / Disc approximation method

In this test discs of aztreonam, cefotaxime, ceftazidime, cefpodoxime, ceftriaxone discs are placed 15-20mm (edge to edge) from amoxicillin-clavulanic acid disc. Plates are incubated overnight at 35°C. Enhancement of zone of inhibition is indicative of presence of an ESBL. It is vital to place discs at precise distance as recommended. Proper storage of antibiotic discs, bringing discs to room temperature together with regular performance of quality control (QC) on the antibiotic disc are critical to the sensitivity of disc approximation test.

Phenotypic Confirmatory Methods

3. Disc diffusion method

Ceftazidime vs ceftazidime/clavulanic and cefotaxime vs cefotaxime/clavulanic acid are placed onto a Mueller-Hinton agar plate lawned with the test organism & incubated as described above. Regardless of the zone diameters, a greater than or equal to 5mm increase in a zone diameter for an antimicrobial agent tested in combination with clavulanic acid vs. its zone size when tested alone, indicates probable ESBL production

4. MIC method :

- **ESBL E-test strips** - Two E test combination strips e.g. ceftazidime/ceftazidime - clavulanic acid or cefotaxime/cefotaxime - clavulante are employed to perform the phenotypic confirmatory testing. These strips are inoculated on the surface of the agar plate & incubated overnight. An 8 fold reduction in the MIC of cephalosporin in the presence of clavulanic acid indicates production of ESBL
- **VITEK** - MIC of isolates for different antibiotics & ESBL detection are determined by GNS-651 card (VITEK SYSTEM, bioMérieux)

contd. on page 8

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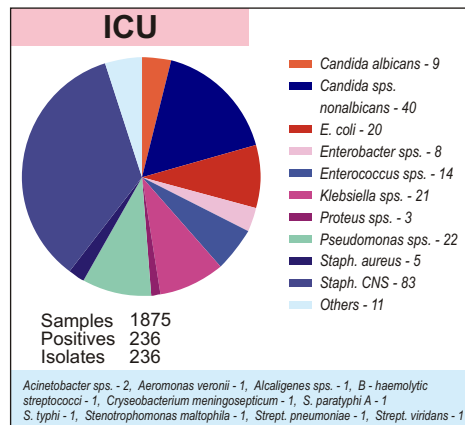
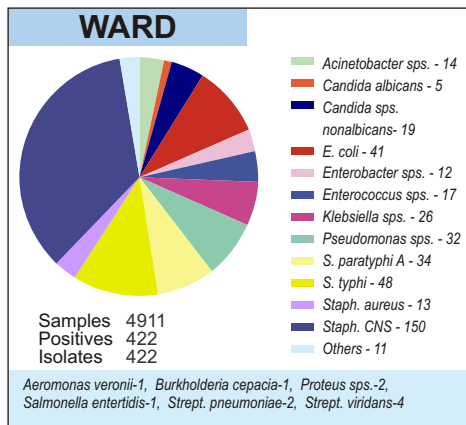
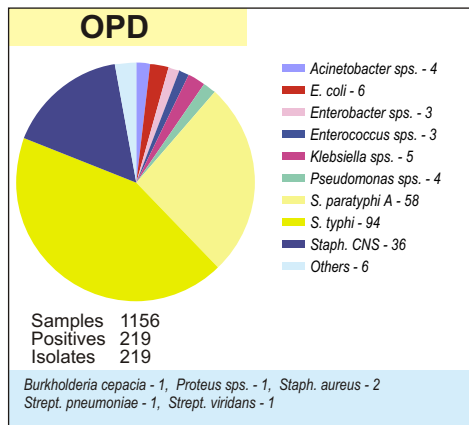
DEPARTMENT OF CLINICAL MICROBIOLOGY

Correspondence: chandwattal@sgrh.com

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BLOOD

July - December 2004



PERCENTAGE RESISTANCE

Organism	No. of Isolates	Resistance (%)						
		Penicillin	Oxacillin**	Ampicillin	Clindamycin	Gentamicin	Vancomycin**	HLAR* Gentamicin
Staph aureus	2	--	--	--	--	--	--	--
	13	100	62	--	15	50	0	--
	5	100	40	--	20	25	0	--
Staph CNS	36	70	47	--	8	23	0	--
	150	84	71	--	35	60	0	--
	83	99	89	--	62	77	0	--
Enterococcus spp.	3	--	--	--	--	--	--	--
	17	62	--	92	--	--	0	50
	14	89	--	67	--	--	0	83
Strept. viridans	1	--	--	--	--	--	--	--
	4	0	--	--	0	0	0	0
	1	--	--	--	--	--	--	--

OPD
WARD
ICU

* HLAR: High Level Aminoglycoside Resistance.

** Oxacillin sensitivity can be extrapolated for all -lactams and -lactam-inhibitor combinations; and Vancomycin sensitivity for Teicoplanin.

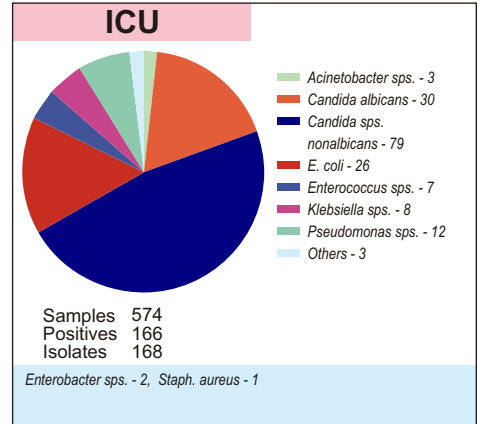
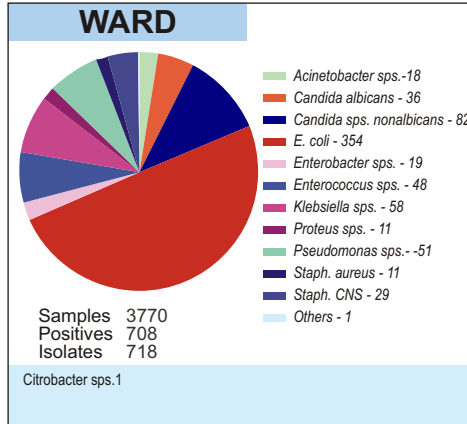
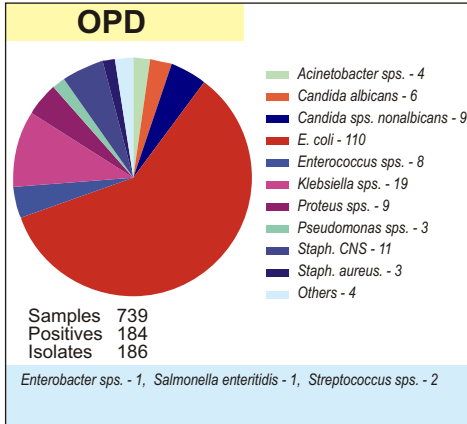
Organism	No. of Isolates	Resistance (%)												
		Ampicillin	Cefuroxime	Cefotaxime	Ceftriaxome	Ceftazidime	Piperacillin	Gentamicin	Amikacin	Ciprofloxacin	Ofloxacin	Piperacillin + Tazobactam*	Cefoperazone + Sulbactam*	Meropenem*
S. typhi	94	15	--	0	0	--	--	--	--	43**	55**	--	--	--
	48	15	--	0	0	--	--	--	--	36**	62**	--	--	--
	1	--	--	--	--	--	--	--	--	--	--	--	--	--
S. paratyphi A	58	0	--	0	0	--	--	--	--	48**	69**	--	--	--
	34	0	--	0	0	--	--	--	--	36**	73**	--	--	--
	1	--	--	--	--	--	--	--	--	--	--	--	--	--
E. coli	6	83	50	50	40	--	--	40	0	67	60	40	50	0
	41	100	85	79	85	--	--	65	35	82	88	28	63	4
	20	95	90	100	86	--	--	79	35	89	81	65	69	0
Klebsiella spp.	5	--	60	33	67	--	--	62	33	75	50	40	67	0
	26	--	92	62	75	--	--	67	48	73	88	41	58	0
	21	--	94	86	94	--	--	94	58	90	86	58	75	0
Pseudomonas spp.	4	--	--	--	--	--	--	--	--	--	--	--	--	--
	32	--	--	50	--	56	50	63	45	54	57	31	54	27
	22	--	--	61	--	55	47	79	54	70	57	41	46	39
Acinetobacter spp.	4	--	--	--	--	--	--	--	--	--	--	--	--	--
	14	61	43	60	31	--	--	40	25	15	33	0	0	11
	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Enterobacter spp.	3	--	--	--	--	--	--	--	--	--	--	--	--	--
	12	100	100	100	75	--	--	58	50	77	60	69	100	0
	8	100	100	100	100	--	--	33	57	100	75	28	100	0

*Percentage Resistance may indirectly appear higher than actual, because 2nd line drugs are tested only in multi-drug resistant isolates.

** Moderately susceptible (Kirby Bauer disc diffusion); resistant to Nalidixic acid; Refer to highlights on Pg. 8 for ACCO data for Salmonella.

URINE

July - December 2004



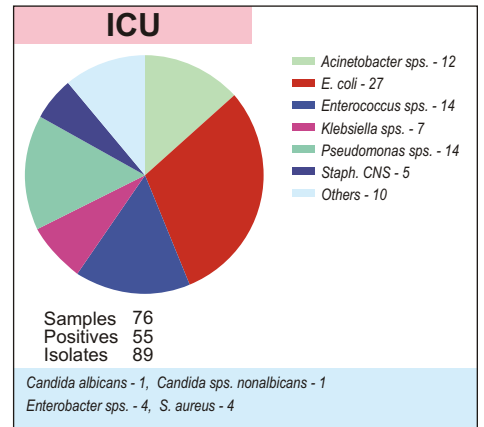
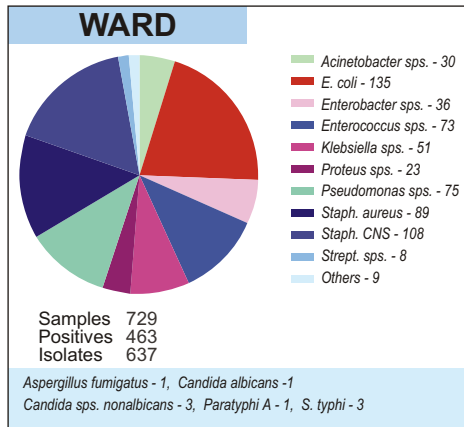
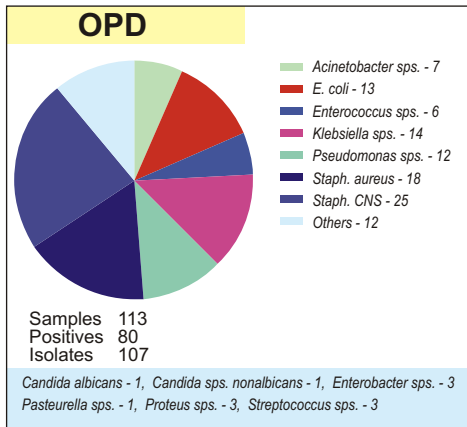
PERCENTAGE RESISTANCE

GPC	No. of Isolates												OPD	
		Penicillin	Oxacillin*	Clindamycin	Nitrofurantoin	Gentamicin	Norfloxacin	Ofloxacin	Ciprofloxacin	Tetracycline	Vancomycin*	HLAR** Gentamicin	WARD	ICU
Enterococcus spp.	8	50	--	--	0	--	100	80	67	100	0	57		
	48	66	--	--	17	--	95	95	80	84	0	56		
	7	100	--	--	25	--	100	100	75	100	14***	100		
Staph CNS	11	82	27	20	0	73	80	63	67	50	0	--		
	29	100	62	43	7	69	97	58	75	50	0	--		
	0	--	--	--	--	--	--	--	--	--	--	--		
Staph aureus	3	--	--	--	--	--	--	--	--	--	--	--		
	11	64	33	30	0	60	70	50	0	50	0	--		
	1	--	--	--	--	--	--	--	--	--	--	--		

* Oxacillin sensitivity can be extrapolated for all -lactams and -lactam-inhibitor combinations; and Vancomycin sensitivity for Teicoplanin.
 ** HLAR: High Level Aminoglycoside Resistance.
 *** One isolate of VRE.

GNB	No. of Isolates															
		Ampicillin	Co-trimoxazole	Cefturoxime	Cefotaxime	Ceftazidime	Co-amoxycylav	Amikacin	Gentamicin	Nitrofurantoin	Nalidixic acid	Norfloxacin	Ciprofloxacin	Cefoperazone + Sulbactam*	Piperacillin + Tazobactam*	Meropenem*
E. coli	110	86	76	54	53	--	94	15	45	44	88	71	72	35	13	0
	354	92	79	73	70	--	84	34	64	46	96	75	93	45	29	0
	26	96	85	85	82	--	100	48	77	43	96	96	100	65	35	0
Klebsiella spp.	19	100	39	63	53	--	100	15	44	94	67	67	33	38	29	0
	58	100	84	79	74	--	100	56	80	71	92	91	91	67	45	0
	8	100	71	75	63	--	100	50	71	50	88	75	63	60	29	0
Proteus spp.	9	70	100	22	20	--	--	0	25	90	100	67	100	0	0	0
	11	67	91	60	64	--	80	78	80	100	91	82	67	11	0	0
	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pseudomonas spp.	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	51	--	--	--	90	79	--	87	88	--	--	--	90	84	63	60
	12	--	--	--	92	92	--	92	87	--	--	--	61	80	67	91
Enterobacter spp.	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	19	90	71	84	84	--	83	69	71	72	82	76	60	67	63	0
	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acinetobacter spp.	4	100	100	100	75	--	100	75	50	100	100	100	--	50	25	0
	18	100	83	94	69	--	100	89	100	94	94	94	80	82	61	24
	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

*Percentage Resistance may indirectly appear higher than actual, because 2nd line drugs are tested only in multi-drug resistant isolates.



PERCENTAGE RESISTANCE

GPC	No. of Isolates	Penicillin	Oxacillin*	Clindamycin	Erythromycin	Gentamicin	Ciprofloxacin	Tetracycline	Co-trimoxazole	Vancomycin*	HLAR**	
											HLAR**	Gentamicin
Staph aureus	18	83	22	12	32	26	33	33	67	0	--	--
	89	92	33	21	46	32	49	36	85	0	--	--
	4	--	--	--	--	--	--	--	--	--	--	--
Staph CNS	25	79	63	27	70	48	52	44	72	0	--	--
	108	86	71	38	71	53	59	34	70	0	--	--
	5	100	80	40	100	75	80	60	50	0	--	--
Enterococcus spp.	6	50	--	--	--	--	67	67	--	0	60	60
	73	40	--	--	--	--	81	60	--	0	60	60
	14	69	--	--	--	--	85	75	--	7***	46	46
Strept. spp.	3	--	--	--	--	--	--	--	--	--	--	--
	8	0	0	0	0	0	0	0	--	0	--	--
	--	--	--	--	--	--	--	--	--	--	--	--

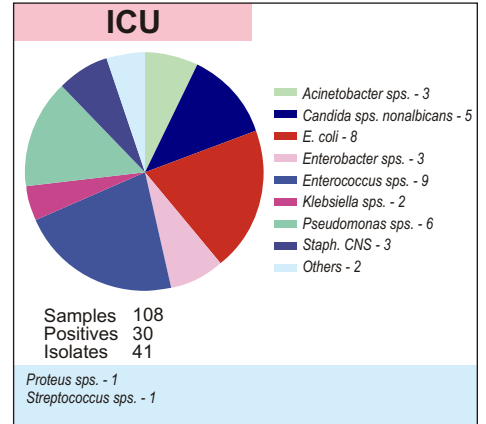
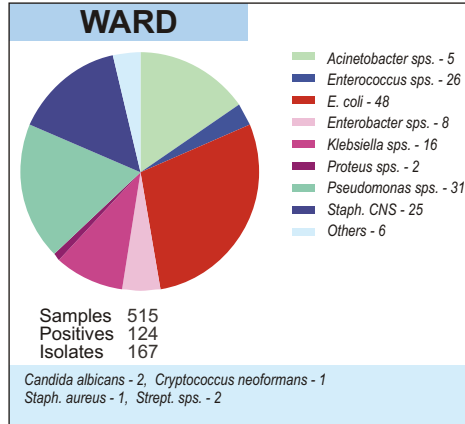
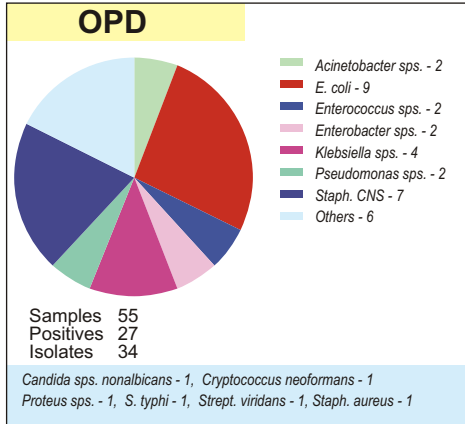
* Oxacillin sensitivity can be extrapolated for all -lactams and -lactam-inhibitor combinations; and Vancomycin sensitivity for Teicoplanin.
** HLAR: High Level Aminoglycoside Resistance.
*** One isolate of VRE.

GNB	No. of Isolates	Ampicillin	Cefotaxime	Ceftriaxone	Ceftazidime	Piperacillin	Aztreonam	Gentamicin	Amikacin	Ciprofloxacin	Co-amoxycylav	Co-trimoxazole	Piperacillin + Tazobactam*	Cefoperazone + Sulbactam*	Meropenem*
	135	94	82	81	--	--	--	70	35	85	91	75	29	57	0
	27	97	79	78	--	--	--	82	52	86	96	75	48	66	0
<i>Pseudomonas</i> spp.	12	--	69	--	14	44	15	54	44	63	--	--	6	39	0
	75	--	68	--	65	48	78	66	63	68	--	--	39	55	49
	14	--	67	--	75	67	75	63	75	67	--	--	58	72	66
<i>Klebsiella</i> spp.	14	--	36	33	--	--	--	30	0	43	92	62	9	33	0
	51	--	78	75	--	--	--	75	34	82	100	73	18	49	0
	7	--	86	66	--	--	--	83	75	100	100	86	29	57	0
<i>Enterobacter</i> spp.	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	36	97	73	71	--	--	--	68	77	78	94	75	32	50	0
	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
<i>Acinetobacter</i> spp.	7	57	38	--	25	--	--	28	22	29	57	86	0	0	0
	30	93	90	--	81	--	--	56	74	86	90	86	50	61	34
	12	100	100	80	--	--	--	78	50	--	100	82	67	55	33
<i>Proteus</i> spp.	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	23	59	30	25	--	--	--	33	25	43	43	50	5	6	0
	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

*Percentage Resistance may indirectly appear higher than actual, because 2nd line drugs are tested only in multi-drug resistant isolates.

BODY FLUIDS

July - December 2004



PERCENTAGE RESISTANCE

GPC	No. of Isolates	Penicillin	Oxacillin**	Clindamycin	Erythromycin	Gentamicin	Ciprofloxacin	Tetracycline	Vancomycin**	HLAR* Gentamicin
										HLAR* Gentamicin
<i>Enterococcus</i> spp.	2	--	--	--	--	--	--	--	--	--
	26	32	--	--	--	--	67	56	0	45
	9	62	--	--	--	--	87	71	22***	75
Staph CNS	7	57	43	0	33	17	17	17	0	--
	25	76	64	20	73	32	54	30	0	--
	3	--	--	--	--	--	--	--	--	--

OPD
WARD
ICU

* HLAR: High Level Aminoglycoside Resistance.

** Oxacillin sensitivity can be extrapolated for all -lactams and -lactam-inhibitor combinations; and Vancomycin sensitivity for Teicoplanin.

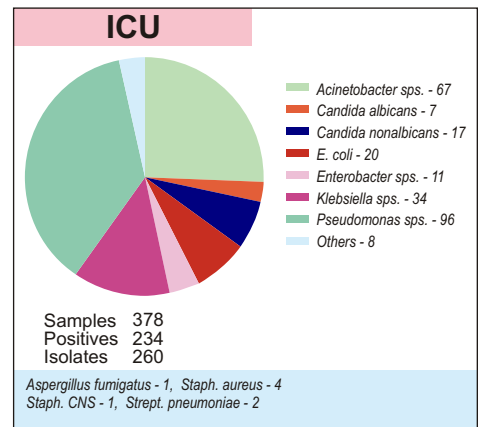
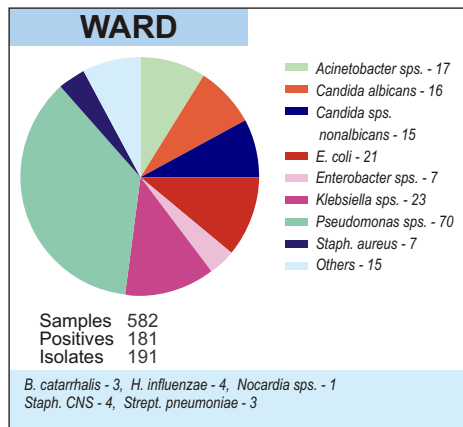
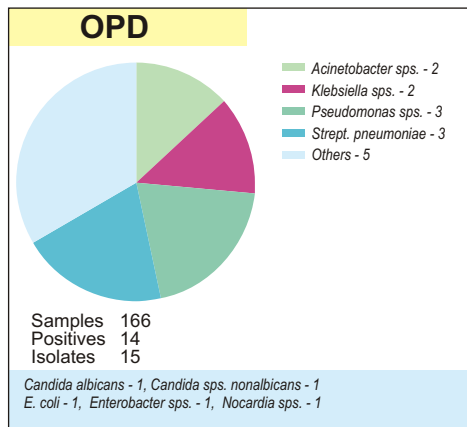
*** Two isolates of VRE.

GNB	No. of Isolates	Ampicillin	Cefuroxime	Ceftriaxone	Ceftazidime	Piperacillin	Gentamicin	Amikacin	Ciprofloxacin	Co-amoxiclav	Co-trimoxazole	Piperacillin + Tazobactam*	Cefoperazone + Sulbactam*	Meropenem*
												Piperacillin + Tazobactam*	Cefoperazone + Sulbactam*	Meropenem*
<i>E. coli</i>	9	100	100	85	--	--	78	27	100	100	100	50	71	0
	48	96	83	79	--	--	61	37	83	93	71	36	66	0
	8	100	100	100	--	--	71	33	100	100	100	37	80	0
<i>Pseudomonas</i> spp.	2	--	--	--	--	--	--	--	--	--	--	--	--	--
	31	--	--	--	65	89	57	32	69	--	--	29	73	45
	6	--	--	--	100	100	100	100	100	--	--	67	100	67
<i>Klebsiella</i> spp.	4	100	100	100	--	--	75	100	100	100	67	75	75	0
	16	100	80	85	--	--	60	55	94	100	93	37	85	0
	2	--	--	--	--	--	--	--	--	--	--	--	--	--
<i>Enterobacter</i> spp.	2	--	--	--	--	--	--	--	--	--	--	--	--	--
	8	100	87	83	--	--	100	50	87	100	60	75	87	0
	3	--	--	--	--	--	--	--	--	--	--	--	--	--
<i>Acinetobacter</i> spp.	2	--	--	--	--	--	--	--	--	--	--	--	--	--
	5	100	80	50	--	--	80	40	60	80	80	80	40	60
	3	--	--	--	--	--	--	--	--	--	--	--	--	--

*Percentage Resistance may indirectly appear higher than actual, because 2nd line drugs are tested only in multi-drug resistant isolates.

RESPIRATORY ISOLATES

July - December 2004



PERCENTAGE RESISTANCE

GPC	No. of Isolates	Penicillin	Oxacillin*	Clindamycin	Erythromycin	Gentamicin	Ciprofloxacin	Tetracycline	Co-trimoxazole	Vancomycin*
<i>Staph. aureus</i>	--	--	--	--	--	--	--	--	--	-
	7	86	14	0	14	33	42	14	50	0
	4	100	75	25	25	0	50	50	100	0
<i>Strept. pneumoniae</i>	3	--	--	--	--	--	--	--	--	--
	3	--	--	--	--	--	--	--	--	--
	2	--	--	--	--	--	--	--	--	--

* Oxacillin sensitivity can be extrapolated for all -lactams and -lactam-inhibitor combinations; and Vancomycin sensitivity for Teicoplanin.

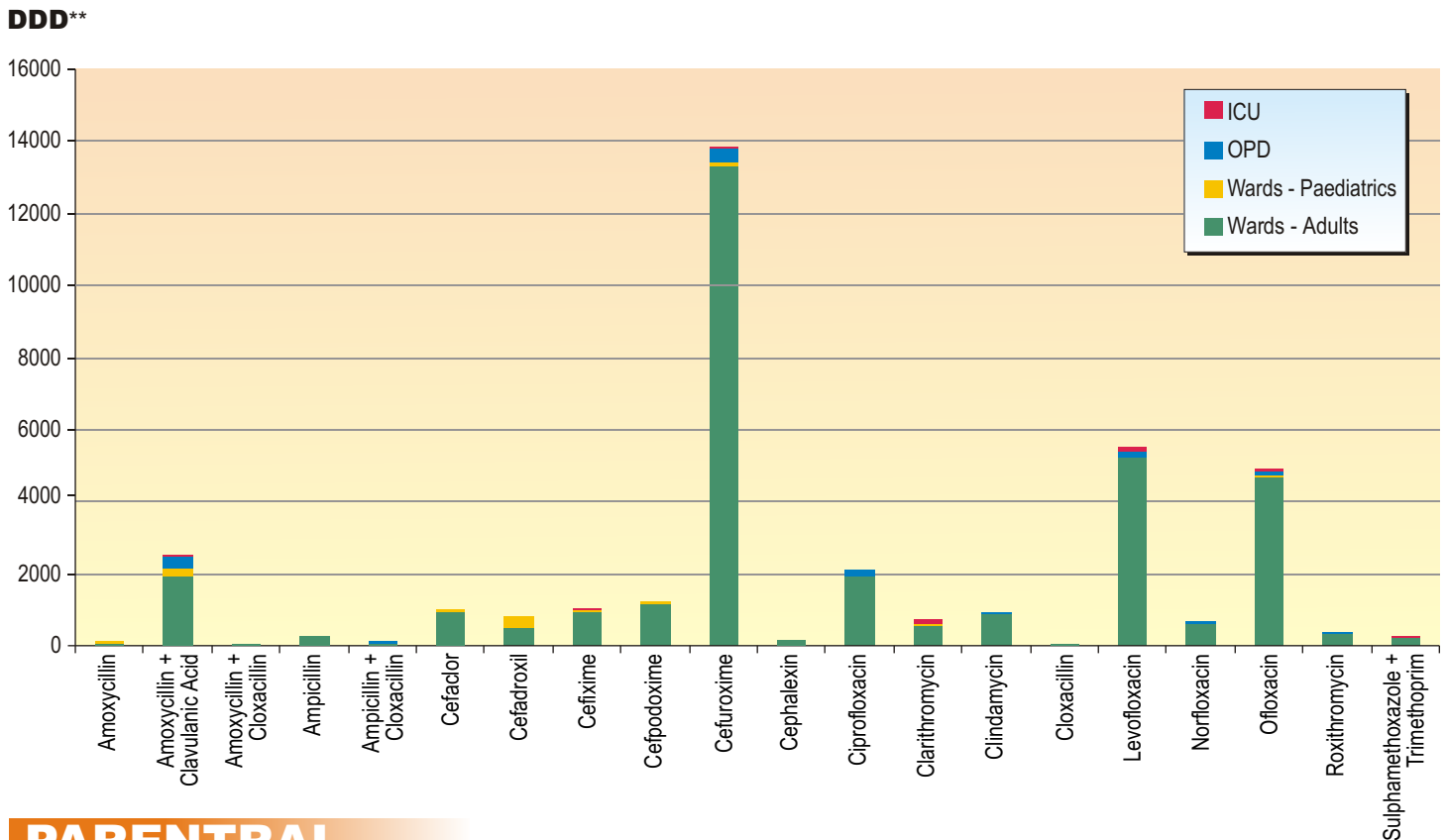
GNB	No. of Isolates	Ampicillin	Cefuroxime	Cefoperazone	Ceftazidime	Ciprofloxacin	Co-trimoxazole	Gentamicin	Amikacin	Netilmicin	Cefoperazone + Subbactam*	Piperacillin + Tazobactam*	Meropenem*
<i>E. coli</i>	1	--	--	--	--	--	--	--	--	--	--	--	--
	21	100	91	90	--	100	95	55	20	50	29	10	0
	20	95	95	95	--	95	90	78	40	81	75	95	0
<i>Pseudomonas</i> spp.	3	--	--	--	--	--	--	--	--	--	--	--	--
	70	--	--	72	69	75	--	84	72	--	66	55	61
	96	--	--	87	90	88	--	89	88	--	90	83	86
<i>Klebsiella</i> spp.	2	--	--	--	--	--	--	--	--	--	--	--	--
	23	100	61	74	--	61	61	52	45	47	41	29	0
	34	100	97	97	--	94	93	81	76	82	81	55	0
<i>Enterobacter</i> spp.	1	--	--	--	--	--	--	--	--	--	--	--	--
	7	100	100	100	--	100	86	67	63	72	84	43	0
	11	100	100	91	--	73	91	78	72	67	80	60	0
<i>Acinetobacter</i> spp.	2	--	--	--	--	--	--	--	--	--	--	--	--
	17	95	88	100	--	71	93	79	75	57	20	53	45
	67	100	98	98	--	92	72	60	89	52	71	84	72

*Percentage Resistance may indirectly appear higher than actual, because 2nd line drugs are tested only in multi-drug resistant isolates.

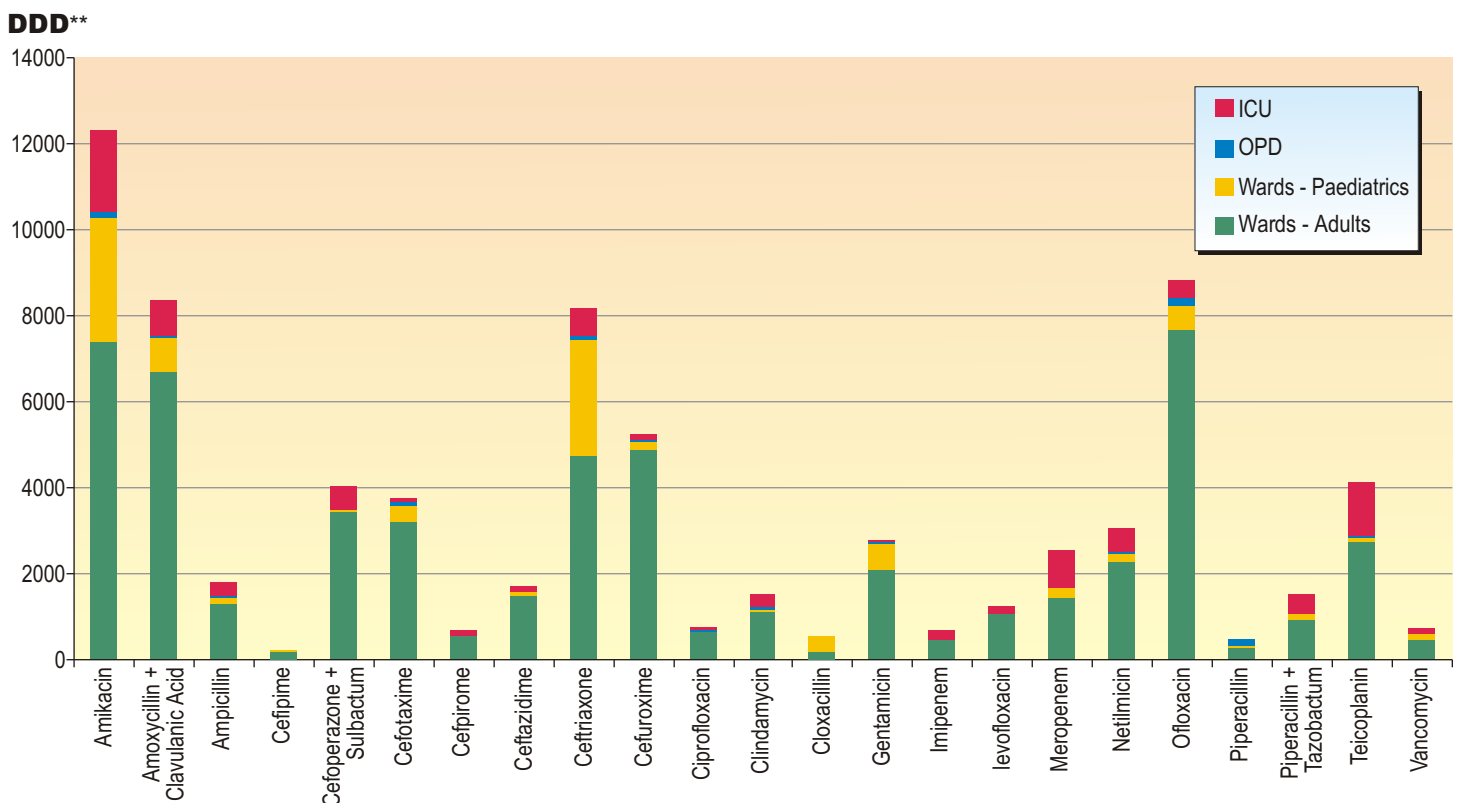
PRESCRIPTION AUDITING

July - December 2004*

ORAL



PARENTERAL



* Based on the Hospital pharmacy data of the antibiotics dispensed.

** DDD - Daily Defined Doses have been calculated as per Anatomical Therapeutic Chemical (CTC) classification index with Defined Daily Doses (DDD). Oslo (Norway). WHO Collaborating centre for Drug Statistics Methodology; 2002 and in paediatric group of patients the "Guide to antimicrobial therapy" by Sanford et al, USA (2000) presuming 10 kg as the average body weight.

HIGHLIGHTS

- The ACCo resistance in *S.typhi* is around 15%, Nalidixic acid resistance in *S.typhi* and *S.paratyphi* is approximately 90% and 97% respectively.
- Isolation of MRS A in pus varied between 22-33%.
- Cefuoxime continues to be the most commonly used oral antimicrobial, followed by levofloxacin, ofloxacin and co-amoxycylav.
- Among injectable antimicrobials, amikacin is most widely used, followed by ofloxacin, coamoxycylav and ceftriaxone.

DEPARTMENT NEWS

The Department of Clinical Microbiology organized a quarterly meeting of the Indian Association of Medical Microbiologists, Delhi Chapter, at Silver Oak, India Habitat Centre, Lodhi Road, New Delhi on 18th September, 2004 under the Chairmanship of Dr. C. Wattal. The conference was dedicated to antibiotics and automation in bacteriology. Dr. Dilip Mathai, Professor and Head, CMC, Vellore delivered a guest lecture on "**Rational Usage of antibiotics & antibiotic Policy**". The deliberations were widely appreciated.

Dr. Pankaj Aggarwal and Dr. Anuj Sharma participated as faculty and delivered lecture on "**Antibiotic Policy as practiced at SGRH**" and "**Rapid Bacteriology & Molecular Assays**". The chief Guest, Prof. K. B. Sharma, inaugurated the meeting. Dr. K.C. Mahajan, Chairman Dept. of Academics, SGRH was the guest of honour. Dr. Madalsa Mathur (then President, IAMM-DC) and Dr. Mridula Bose (then Secretary IAMM-DC) also graced the dias. Dr. K.P. Jain, Prof. K.B. Sharma, Dr. Ashok Rattan and Dr. V.K. Sharma chaired various sessions. Two poster competitions were also organised on the occasion, where 13 entries were received.

A Pre-conference workshop was also held by the Department at SGRH on 17th September 2004 on various automated techniques in bacteriology such as VITEK, BacTAlert 3D including automation in tubercular culture and sensitivity, and molecular assays such as AccuProbe, NASBA and TMA. It was attended by 22 participants from all over India. Some of the reflections are mentioned below.

Pre-Conference Workshop - 17th Sept. 2004 (Reflections)

Dr. B. K. RAO (Hony. Secy. BOM, Sir Ganga Ram Hospital)
Excellent, educative, practical hands on training, really enjoyed it.

Dr. SONAR NARULA (Consultant Microbiologist, Jaslok Hospital & Research Centre, Mumbai)
Excellent workshop with lot of attention paid to details and explanation given with regard to the plus & negative points of each methodology also a very friendly atmosphere.

Dr. ANAND DESHMUKH (Microbiologist, Breach Candy Hospital, Mumbai)
Very useful workshop.

Dr. JOHN KENNETH -(Consultant, Sagar Apollo Hospital, Bangalore)
Well organized workshop

Dr. M. A. THIRUNARAYAN (HOD Microbiology Department, Apollo Hospital, Chennai)
Exhaustive, well organized, useful and informative, good technical support.

Dr. SANDHYA KABRA (Specialist Microbiology, Lok Nayak Hospital, New Delhi)
Very well marked and organized, learning experience, lot of effort from all the organizers.

Due to space constraint all reflections could not be included.

Faculty:

Dr. C. Wattal MD Sr. Consultant & Head	Dr. T.D. Chugh MD, MRC Path Sr. Consultant	Dr. Anuj Sharma MD Consultant	Dr. J.K. Oberoi MD Clinical Assistant	Dr. K.J. Prasad Ph.D Sr. Research Officer	Dr. S. Datta MD Sr. Resident	Dr. R. Raveendram MD Sr. Resident	DNB Students: Dr. Priyanka Dr. L. Mahindra
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Case Report

(Contd. from page 1)

In the department of Clinical Microbiology at Sir Ganga Ram Hospital a study was conducted from 1st May-10th October 2004. Samples cultured were blood, pus, sputum, drain fluid, ascitic fluid, high vaginal swab, tissue, bronchoalveolar lavage, intravascular catheter tips, bone marrow aspirates, bile, peritoneal fluids, urine etc. Endotracheal aspirates were excluded in this study as we were not sure that the organisms isolated were actual pathogens or colonisers. Total samples received during this period were 1116, of which 435 showed positive culture results & rest were negative. 435 culture isolates included *Pseudomonas* spp. (117), *E.coli* (61), *Klebsiella* (48), *Staphylococcus* spp. (74), *Acinetobacter* spp. (33), *C. tropicalis* (17), *C. albicans* (16), *Enterococcus* spp. (15), *Enterobacter* spp. (14), *C. parapsilosis* (15), mixtures (30) & others (4). Isolates of *E. coli* & *Klebsiella* spp. were screened for ESBLs.

Sample	Total	ESBL Positive
Blood	500	28
Pus	24	10
Sputum	41	12
Drain	34	8
Pleural fluid	33	4
Intravascular devices	47	3
Wound Swab	15	5
Bile	6	3
HVS	8	2
Aspirates	8	3
BAL	40	4
PD fluid	26	4
Tissue	5	1
Ascitic fluid	59	7
Bone marrow aspirate	2	1
Urine	190	5

ESBL Results

Out of 61 *E.coli* isolated 56 were found to be ESBL positive by the above mentioned methods and for *Klebsiella* spp., 44 were ESBL positive & 4 were ESBL negative. The overall percentage of ESBL positives was 91.7% . All ESBL positive strains were sensitive to carbapenems.

Factors predisposing to ESBL production were

- Device association (IV lines, Urinary catheters- 100%)
- 3rd generation cephalosporins (92%)
- Ventilators (39%)
- Diabetes (11%)
- Previous ICU stay (9%)
- History of Surgery (4%)

References :

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3. Patricia A. Bradford. Extended- Spectrum Beta- Lactamases in the 21st Century: Characterisation, Epidemiology, and Detection of This Important Resistance Threat. Clinical Microbiology Reviews, Oct 2001; 933-951
4. Dilip Mathai, Paul R Rhomberg. Evaluation of the invitro activity of six broad spectrum Beta- lactam antimicrobial agents tested against recent clinical isolates from India: a survey of ten medical centre laboratories. Diagnostic Microbiology & Infectious Disease 2002;44:367-377

Addendum to previous issue.

The reference be kindly read as Volume 10, No. 1, September 2004.