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RESEARCH ARTICLE

BACTERIOLOGICAL PROFILE OF BURN WOUND INFECTION FOLLOWING BLAST INJURY IN A TERTIARY CARE CENTRE

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ABSTRACT

Burn trauma is as old as the discovery of fire in the history of mankind.. Injuries secondary to severe burns rank among the most serious forms of trauma resulting in anatomic, physiologic, endocrinology and immunologic stresses especially when burns involve >20% of total body surface area. Significant thermal injuries induce a state of immuno suppression that predisposes burn patients to infectious complications. The organisms responsible for infections in patients who suffer severe burns may be endogeneous or exogeneous which include bacteria, fungi and viruses which can change over time in the individual patient. A total no. of 22 patients with age group ranging from 16 years to 70 years with 10% to 70% burns were brought to the casualty of the Govt. Medical College, Trivandrum, following an accidental blast injury which occurred in a temple premises at Puttingal, a village at Kollam District in Kerala on 10/04/2016. A total no of 56 samples ofexudates, 10samples of blood for culture and sensitivity were received within 24 hours central microbiology Laboratory at Govt. Medical College Hospital Trivandrum from the third day of admission onwards. The most common bacteria isolated from the exudates was Pseudomonas aeruginosa (39.58%) followed by Acinetobacter species (27.08%) Klebsiella pneumoniae (20.83%) MRSA (8.33%) and Staphylococcus aureus (2.08%) and Enterococcus faecalis (2.08%). Blood culture was positive in 30% samples. Multi Drug Resistant strains of pseudomonas aeruginosa, Ecoli and Acinobacterbaumanii were isolated from blood samples. Centralline tip from one patient and tracheal aspirate from two patientsyielded Acinobacterbaumanii. The patients were treated with appropriate antibiotics according to the antibiotic sensitivity pattern of the isolates obtained from clinical specimens and surgical interventions done wherever needed. The mortality rate was 9.07% in this study. This is significantly less when compared to many other studies, the reasons being strict and efficient Infection Control Practices in our institution.

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INTRODUCTION

An intact skin surface is vital to the preservation of body fluid, homeostasis, thermoregulation, host is protection against infection etc. Thermal injury creates a breach in the surface of the skin. Although burn wound surfaces are sterile, immediately following thermal injury, these wounds eventually become colonized with skin pathogens after 48 hours that typically reside in sweat glands and hair follicles. Micro organisms colonizing the burn wound originate from the patient's endogenous skin flora, respiratory flora and gastro intestinal flora. Bacteria may also be transferred to a patient's skin surface via contact with contaminated external environment surfaces, water, fomites, air and the soiled hands of health care workers.

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Aim of the study

1. To isolate, identify and study the aerobic bacteriological spectrum of burn wound infection following blast injury.
2. To study the antibiotic sensitivity pattern of clinical isolates from burn wound infections.
3. To detect multidrug resistant strains in burn wound infection.

MATERIALS AND METHODS

Study design : Descriptive Study
Study group : Patients admitted with burns on 10.4.2016 following blast
Injury with age 16-70 years.
Study period : On the day of admission to discharge (Average 2weeks to 6 weeks) (10.4.2016 to 31.5.2016)

Study setting : Dept of Microbiology, surgery, Orthopaedics, Dermatology. Govt Medical College, Trivandrum.

Collection of Samples

Exudates from the burn wound site was collected using sterile swabs on the third day after admission in the hospital after cleaning the site with sterile normal saline. Two swabs were collected from the same site. One swab was used for gram stain to observe the number of pus cells morphology and gram reaction of bacteria. Second swab was collected in Amies transport medium and transported to the 24 hours Central Microbiology Laboratory at Govt. Medical College Hospital, Trivandrum.

MATERIALS AND METHODS

Gram staining: Done immediately after receiving the sample in the laboratory with the material collected in one of the sterile swab.

Culture: With the other swab**,** the samples were inoculated into Blood agar, Mac Conkey agar and Mannitol Salt agar and incubated at 37^0C. Next day, the plates were observed for the appearance of colonies. Smear was prepared from a single colony and gram staining was done. The bacteria were identified by their morphology and conventional biochemical reactions.

Antibiotic Sensitivity Testing

ABST was done on Mueller Hinton agar by Kirby-Bauer disk diffusion method for all the gram negative and gram positive isolates.

Detection of MRSA

Cefoxitin disc diffusion method was used as per CLSI guidelines. The isolates with zone of inhibition less than or equal to 22 mm were reported as MRSA. (Methicillin Resistant Staphylococcus Aureus)

Detection of ESBL

ESBL detection was done for all gram negative isolates which are found to be resistant to 3rd generation cephalosporins. The test organism was inoculated on to the Mueller –Hinton agar to give a semi confluent growth. Ceftazidime (30µg), Cefotaxime (30µg), Aztreonam (30 µg) and ceftriaxone (30 µg) discs were placed on the agar plate with an Amoxycillin – clavulanic acid (20/10mg) disc at the centre. The distance between the Amoxycillin-Clavulanic and cephalosporins were maintained at 25-30 mm. Following overnight incubation at 37^0C, ESBL production was detected when the Zone of inhibition around the cephalosporins or Aztreonam was expanded by the clavulanate. An ESBL producer could be defined as having zone diameter of greater than or equal to 5mm according to CLSI guidelines.

Double disc method

The test organism was inoculated on Mueller- Hinton Agar to give a semi confluent growth. Cefotaxime (30µg) and Cefotaxime- Clavulanic acid disc were placed on the agar plate with a distance of 22mm. After overnight incubation at 37^0C, ESBL production is detected by the inference than the zone of inhibition around the Cefotaxine Clavulanic acid was enhanced than the cefotaxime disc alone. An ESBL producer will have a zone of diameter more than or equal to 5mm.

Detection of Carbapenemase producing organisms

(metallo β –lactamase (MBL) production

Screening for metallo β lactamase production was performed in Imipenem resistant isolates of Pseudomonas acruginosa, Acinetobacter baumanii, Klebsiella pneumonia and E.Coli by Imipenem EDTA combined disc test as described by Young *et al*. Test organism was inoculated on to Mueller Hinton Agar as recommended by CLSI guidelines. Two discs of Imipenem (10mg) were placed on the plate and about 10µl of 0.5M EDTA solution was added to one of them. The zone of inhibition around Imipenem and Imipenem –EDTA disc were compared after overnight incubation at 37^0C. An increase in zone size of at least 7mm around the Imipenem EDTA disc as compared to Imipenem disc alone was recorded as positive result.

Modified Hodge Test

Prepare 0.5 MacFarland dilution of the E.Coli ATCC 25922 (indicator organism) in broth or saline and dilute 1:10 in saline or broth./ Inoculate on MHA plate as for routine disk diffusion procedure. Allow the plate to dry. Place a 10µg Ertapenem susceptibility disc in the centre of the test area. After that in a straight line, streak the test organism from the edge of the plate. Repeat the same with QC strain in another direction (positive control) and negative control. Incubate overnight at 35^0C± 2^0C in 24 hours.

Interpretation

Positive: After 24 hours of incubation, examine the plate for clover –leaf- type indentation at the intersection of the test organism and the E.Coli 25922, within the zone of inhibition of the Carbapenem susceptibility disc.

Negative: Has no growth of E.Coli 25922 along the test organism growth streak within the disc diffusion zone.

Identification of bacteria

Gram positive isolates such as Staphylococcus are identified by gram staining, colony morphology on Blood agar, MA, Mannitol Salt agar etc, catalse test coagulase test and the antibiotic susceptibility pattern. Enterococci are identified by gram staining colony morphology on BA and MA> Heat resistance at 60^0C for 30 minutes. Gram negative bacilli are identified by gram staining, colony morphology on BA and MA, oxidase test, catalase test and other relevant biochemical reactions. For the identification of Pseudomonas aeruginosa, Hugh Leifson's oxidative fermentative Test and Arginine dihydrolase test. Acinetobacter baumanii was identified by producing oxidative reaction on O/F media and pink colonies on 10% lactose medium.

RESULTS

Following the blast injury, a total no. of 22 patients were admitted in surgical wards, orthopedic wards, Dermatology

wards, and Intensive care units on 10.4.2016. Clinical specimens were collected from the patients from the third day of admission onwards. A total number of 78 samples were collected under sterile precautions and sent to the 24 hours Central Microbiology Laboratory at Govt. Medical College Hospital, Thiruvananthapuram.

Clinical Specimens Vs Culture positives

S.No.	Specimen	Total No. of samples	Culture positives No. and percentage
1	Exudate	56	44 (78.57%)
2	Blood	10	3 (30%)
3	Tracheal aspirate	3	2 (66.66%)
4	Sputum	3	1(33.33%)
5	Urine	3	1 (33.33%)
6	Central line tip	1	1 (33.33%)
7	Bone tissue	1	0 (0%)
8	BAL Fluid	1	0 (0%)
	Total	78	52 (66.66%)

Distribution of cases according to gender

Gender	No. & Percentage
Male	19 (86.36%)
Female	3 (13.64%)
Total	22 (100%)

Distribution of cases according to age

Age group	No. and percentage
11-20	2 (9.09%)
21-30	4 (18.18%)
31-40	5 (22.73%)
41-50	7 (31.82%)
51-60	3 (13.64%)
61-70	1 (4.55%)
Total	22 (100%)

Distribution of cases according to extent of burns

Extent	No and percentage
1-10%	1 (4.55%)
11-20%	3 (13.64%)
21-30%	2 (9.09%)
31-40%	3 (13.64%)
41-50%	6 (27.27%
51-60%	5 (22.73%)
70-80%	2 (9.09%)
Total	22 (100%)

Analysis of Exudates

Samples collected	Culture positive	Culture negative
56	44 (78.57%)	12(21.43%)

Distribution of isolates according to microbial flora

Total No. of isolates	Mono microbial	Poly microbial
44	40 Nos. (90.90%)	9.09%

Among the total isolates, 90.90% were monomicrobial and 9.09% were polymicrobial Organisms isolated in Monomicrobial infections.

S.No	Organism	No. & percentage
1	Pseudomonas acryginosa	16 (40%)
2	Acinetobacter baumanii	11 (27.5%)
3	Klebsiella pneumoniae	10 (25%)
4	MRSA	1 (2.5%)
5	Staphylococcus aureus	1 (2.5%)
6	Enterococci	1 (2.5%)

Polymicrobial isolates

S.No	Organisms	No. & Percentage	Total Organisms
1	Pseudomonas aeruginosa +MRSA	2 (50%)	Pseudomonas -3
2	Acinetobacter baumanii +MRSA	1 (25%)	MRSA 3
3	Acinebacterbaumanii +Psuedomonas aeruginosa	1 (25%)	Acinetobacter-2 baumannii
	Total	4 (100%)	8

Blood Culture Analysis

Samples collected	Culture positive	Culture Negative
10	3 (30%)	7 (70%)

Isolates obtained from blood culture

S.No.	Organism	No. & Percentage
1	E.coli	1 33.3%)
2	Psuedomonasacruginosa	1 (33.3%)
3	Acinetobacter baumanii	1 (33.33%)
	Total	3 (100%)

Analysis of other clinical specimens

S.No.	Nature of sample received	Total No. of samples	Culture positive	Organism isolated
1	Central line tip	1	1 (100%)	Acinetobacter baumanii
2	Tracheal aspirate	3	2 (66.66%)	Acinetobacter baumanii
3	Sputum	3	1 (33.33%)	Klebsiellapneumoniac
4	Urine	3	1 (33.33%)	E.Coli

Antibiotic Sensitivity pattern of gram negative isolates

S.No.	Antibiotic tested	Pseudomonasacruginosa 21		Acinetobacter baumanii 17		Klebsiellapneumoriae 11		E .Coli 2	
		Sensitive No.	Resistant No.	Sensitive	Resistant	Sensitive	Resistant	Sensitive	Resistant
1	Ampicillin	NT	NT		17 (100%)	NT	NT		2 (100%)
2	Gentamicin	0	21 9100%)		17 (100%)	2 (18.18%)	9 (81.82%)	2 (100%)	
3	First generation cephalosporin	NT	NT	NT	NT	NT	NT	0	2 (100%)
4	Ceprofloxacin	0	21 (100%)	0	17 (100%)	2 (18.18%)	9 (81.82)	0	2 (100%)
5	3rd generation caphalosporins	10 (47.62%)	152.38%)	2 (11.76%)	15 (88.23%)	4 (36.36%)	7 *(63.63%)	12 (100%)	0%
6	Amikacin	10 (47.62%)	11 (52.38%)	10 (58.82%)	7 (41.18%)	4 (36.36%)	7 (63.63%)	2 (100%)	0%
7	Cefoperazoresulbactum	16 (76.19)	5 (23.89%)	10 (58.84%)	7 (41.18%)	6 (54.54%)	5 (45.45%)	2 (100%)	0%
8	Piperacillin tazobactum	14 (76.19%)	5 (23.81%)	NT	NT	NT	NT	NT	NT
9	Imepenem	14 (66/66%)	7 (38.33%)	17	0	11 (100%)	0	2 (100%)	2
10	Meropenem	14 (66.66%)	7 (33.33%)	17	0	11 (100%)	0	2 (100%)	0
11	Tigecyeline	1 (57.14%)	9 (42.86%)	10 (58.84%)	41.82%)	NT	NT	2 (100%)	
12	Cohistin	21 (100%)	0 (0%)	17 (100%)	0 (0%)	11 (100%)	0	2 (100%)	
13	Polymyxin B	21 (100%)	0 (0%)	17 (100%)	0 (0%)	11 (100%)	0	2 (100%)	

Among the 3rd generation cephalosporins, ceftazidime was used for testing pseudomonas aeruginosa and ceftriaxone was used for testing Acinetobacter baumanii, Klebsiella pneumoniae and E.Coli.

Hearing loss : 1 (4.55%)
Amputation: 1 (4.55%)
Patellar Injury: 1 (4.55%)

Antibiotic Sensitivity pattern of gram positive isolates

S.No.	Antibiotic tested	Staphylococcus auresus (1)		MRSA (4)		Enterococci (1)	
1	Penicillin	0	1 (100%)	0 (0%)	4 (100%)	0 (0%)	1 (100%)
2	Ampicillin	1 (100%)	0%	0 (0%)	4 (100%)	1 (100%)	0%
3	Erythromycin	1 (100%)	0%	0 (0%)	4 (100%)	NT	NT
4	Cefoxitin	1 (100%)	0%	0 (0%)	4 (100%)	NT	NT
5	Gentamicin	1 (100%)	0%	0 (0%)	4 9100%)	0 (0%)	100%
6	Amikacin	1 (100%)	0%	1 (0%)	3 (75%)	0 (0%)	100%
7	Clindamycin	1 9100%)	0%	0	4(100%)	NT	-NT
8	Rifampicin	1 (100%)	0%	4 (100%)	0 (0%)	NT	NT
9	Vancomycin	1 (100%)	0%	4 (100%)	0 (0%)	1 (100%)	0%
10	Linezolid	1 (100%)	0%	4 (100%)	0 (0%)	1 (100%)	0%

NT- Not tested

Distribution of Mechanism of drug resistance among gram negative isolates

Resistance mechanism	Pseudomonas aeruginosa (21)	Acinetobacter baumanii (17)	Klebiella pneumoniae (11)	E.Coli (2)
ESBL	8 (38.09%)	4 (23.53%)	2 (18.18%)	0
MBL(carbapenamase)	6 (28.57%)	12 (70.59%)	6 (54.54%)	1 (50%)

Specimen wise analysis of isolates

S. No.	Organism isolated	Exudate	Blood	Tracheal aspirate	Central Venous tip	Sputum	urea	Total
1	Pseudomonas acryugenosa	19	1	-	-	1	-	21
2	Acinetobacter baumanii	13		2	1	-	-	17
3	Klebsiella pneumoniae	10	0	-	-	1	-	11
4	E.Coli	-	1	-	-	-	1	2
5	MRSA	4	0	-	-	-	-	4
6	Staphylococcus aureus	1	-	-	-	-	-	1
7	Enterococci	1	-	-	-	-	-	1
		48	3	2	1	2	1	57

Surgical procedures done in patients admitted following blast injury

S.No.	Surgical procedure	No. of patient
1	Emergency Tracheostomy	1
2	Total patellectomy	1
3	BK amputation	1
4	Exploratory surgery (left eye & lower lid Reconstruction)	1
5	Scrotal exploration & Left orchidectomy	1
6	Right Frontotemporal craniectomy EDH Removal	2
7	Open Reduction Right elbow	1
8	Open ILN tibia	1
9	ILF Right Femur	1
10	Zygomatic facial fixation	1
11	ORIF	2
12	Wound Exploration Foreign body removal	2
13	Skin grafting	2
14	Knee sparing Left leg exfixation	1
15	Elbow sparing Exfixation	1

Outcome of cases admitted with burn wound infections

Patients admitted	No. of patients survived	No. of patients expired
22	20 (90.90%)	2 (9.09%)

Morbidity

Burn wound Infection: 20 (90.90%)
Wound Infection + Fracture: 12 (54.54%)
Wound infection + sepsis: 3 (13.64%)
Scrotal injury: 1 (4.55%)
Soft tissue injury: 4 (18.18%)
Head injury: 3 (13.64%)

Infection Central programme at Govt. Medical College Hospital Trivandrum

An effective ICP was initiated by an efficient IC team with the active participation of microbiologist who visited the wards and ICUS daily morning and have given guidance to the health care workers who were involved in the patient care sterility testing was done in the orthopaedics ICU and burns ICU on

12/4/2016. Swabs were collected from handrails of 4 beds. Culture yielded gram negative bacilli and hence through cleaning of all the beds with the disinfectant was insisted on 13/4/2016. Repeat swabs collected incubation. Fumigation of the burns ICU was done on 14/4/2016. Swabs were collected from the washbasin from the dermatology ward (ward 9) which yielded Acinetobacter species. Hence thorough cleaning thrice daily with hypochlorite solution was instructed. Sterility testing done on 15/4/2016 after fumigation of burns ICU, Repeat swabs collected from handrails of bed and wash basin were sterile.

DISCUSSION

The present study was conducted in the Dept. of Microbiology to know the bacteriological agents causing burn wound infection following accidental burns due to blast injury on 10.4.2016. A total no. of 22 patients were admitted at the Medical College Hospital, Trivandrum in the surgical wards, orthopaedics wards, dermatology wards, burns ICU and Neurosurgery ICU etc. clinical specimen were collected from the patients from the patients from the third day of admission onwards. The study was also focused to determine the antibiotic sensitivity pattern of the isolates obtained in the culture. The results are compared and correlated with the study conducted by other researchers in such instances. A total no. of 78 samples were received which includes 56 samples of exudates 10 samples of blood, 3 samples of tracheal aspirates. 3 samples of sputum, 3 samples of urine, one sample each of central line tip, bone tissue and Bronchi alveolar lavage fluids etc. Out of the 78 samples received, 52 samples were culture positive (66.66%). Culture positivity of the exudates was 78.57% and culture positivity of the blood sample was 30%.

Distribution of cases according to microbial flora

Among the isolates obtained from culture of the exudates, 90.90%, were monomicrobial and 9.09% were polymicrobial. This finding correlates with the studies by Rajput *et al* (2008), Jefferson *et al* (2005) Sanjay Dhar *et al* (2007). Culture positivity of the exudates was 78.57%. Culture was sterile in 21.43% of cases. This may be due to prior intake of antibiotics by the patients and local application of antiseptics. Sometimes the patient may be having anaerobic infection.

Distribution of cases according to monomicrobial isolates.

Pseudomonas aeruginosa was the most common organism isolated (40%). The use of broad spectrum antibiotics effective against staphylococcus led to the emergence of Pseudomonas aeruginosa as the predominant organism causing burn wound infection. Our finding correlates which studies of Saxena *et al* (2013) Manjula Mehta *et al* (2007) and Estahbanati *et al* (2002). SanjayDhar *et al* reported 18.18% of Pseudomonas aeruginosa isolates in their study. The next common organism isolated was Acinetobacter baumanii (27.5%) followed by Klebsiellapreumoniae (25%). Their findings are consistent with the studies by Shareen George *et al* (2015). Studies by Kehinde *et al* (2004), and Shanker Srinivasan *et al* (2009) reported prevalence of Klebsiella pneumoniae isolates, being 34.4% and 33.9% respectively. In our study, 8.33% of the isolates were MRSA (Methicillin Resistant Staphylocaoccusaureus). According to the study by Rodeltetal in 1989, MRSA strains have become increasingly prevalent as nosocomial pathogens causing burn wound infections. The increase in incidence of MRSA correlates with the studies conducted by John M Boyce *et al* and Altoparlak U *et al* (2004) and (1983) SamyAShehab *et al* (2003).

Distribution of cases according to polymicrobial isolates

In the present study, only 4 samples yielded polymicrobial isolates (9.09%). Among the polymicrobial isolates, combination of Pseudomonas aeruginosa and MRSA constitutes 50% of the isolates. This finding correlates with the study by Appelgren *et al* (2002) and Ozumba *et al* (2000). The other polymicrobial isolates in this study are combination of Acinetobacter baumanii and MRSA (25%) and Acinetobacter Baumanii and Pseudomonas aeruginosa (25%). Among the polymicrobial infections, combination of pseudomonas aeruginosa and staphylococcus aureus are the predominant organism reported by BS Nagoba *et al* (1989).

Mixed bacterial growth

In our study, 5 cultures of the exudates yielded heavy mixed bacterial growth (9.43%). The growth was confluent and the organisms could not be isolated in pure culture. Studies by Rajput *et al* and Singh *et al* (2008) showed that multiple isolates were obtained in 37.5% of cases and 40% cases respectively. Because of the improved culture techniques and proper collection of samples the prevalence has been significantly reduced in this study.

Antibiotic Sensitivity pattern of gram negative isolates

Pseudomonas aeruginosa-In the present study, 16 (76.19%) isolates of pseudomonas aeruginosa were sensitive to cefaperazone-sulbactum and piperacillin–tazobactum Imipenem and Meropenem. All isolates were sensitive to colistin and polymyxin B. Studies by Ludwisk K Branski *et al* (2009) and Agnikotri N*et al* reported 90% of cases sensitive to these antibiotics. In our study[10], 47.62% of the isolates were sensitive to Ceftazidime. Higher Sensitivity rated 70% reported by Rajput *et al* (2008). In a study of Jeffersen *et al* (2005) 51.1% of isolates sere sensitive to Ceftazidime, 53.3% sensitive to piperacillin – tazobactum, 60% to Imipenem. Revathy *et al* reported 83% of strains susceptible to Ceftazidime. In the present study, 47.62% strains were sensitive to Amikacin. This finding is consistent with the study by Ludwik K. Branskietal and Mehedi Hasan *et al* who have reported 53.3% sensitivity rate. The increasing resistance to various anti Psuedomonal agents has been reported worldwide and this poses serious problem in the therapeutic management.

E.Col. and Klebsiella pneumonia

In our study 34.7% E coli were sensitives to cepro, 3rd gen ceph, Amikacin, Cefaperazone Sulbactum, piperacithintazobactum, Meropenem and Imipenem. Three isolates (42.86%) K. pneumonia sensitive to Amikacin, Ciprofloxamin, Cefasulbactum, piperacithin-Imipenem all the isolates of E. coli and Klebsiel; la pneumonia were sensitive to Colistin. In correlation to our study, SankerSreenivasan *et al* (2009), only 72.4% Kleb are sensitive to Imipenem 82.8%, Sensitive to Cefapexazonesulbactum 66.9% to sensitivity to Amikacin 63.6% E coli sensitive to Imipenem 42.7% Amikacin 9.1% to cefaperazonesulbactum. In contrast to our study, Imran *et al* (2009) the most effective antibiotic against E Coli and Klebsiella being cefaperizonesulbactum and

imipenem. In a study by Merlin Gugget Lin *et al* (2009), Imipenem is reliable reserve antibiotic for the fermenting enterobacteriac (E Coli & Klebisellapneble) with susceptibilities of or near 100%. More than 90% of E.Coli and K. pneumoniae were sensitive to Imipenem in a study of Jefferson *et al* (2005).

Acinetobacterbaumanii

30% isolates of A. baumanii Sensitive Amikacin, CefapexagoneSulbacit-Pipt, Smith to Amuli, Cefsulbapiptazobach, M000 All we sensitive colistin Lisa L Maragakis *et al* (2008), reported resistant A. baumanii which showed sensitively Colistin only. A study conducted by Jefferson *et al* (2005) also showed a high sensitivity to Imiprnrm. A study by Avneer *et al* (2015) showed 4.16% isolates were sensitive to Ampicillin, 6.5% Sensitive to gentamicin, 48% Amikacin 21% Cefotaxime 39% to Imipenem 58% to polymycin

ABST pattern of gram positive isolates

MRSA -In the present study, MRSA isolates were sensitive to Amikacin, Vancomycin Rifampicin and Linezolid. This finding correlated with the studies by SmithaSarma *et al*, Rajput *et al* Bhat *et al* and Vasaikar. All the isolates were sensitive to Vancomycin and Linezolid which correlates with the study by SamyAShehab *et al* and Revathy G etal (1998). None of the isolates of MRSA were sensitive to Clindamycin. High frequency of inducible resistance was reported by Ajanta *et al* (2008). A study by Enright (2003) reported that eventhough vancomycin is used in treating MRSA injection, recently resistance has developed to this agents also. A study by Geraldo A Oliverira *et al* (2001) reported isolation of VRSA in Brazil and the first report of isolation of multiple VRSA strains from one facility over a relatively short period of time. This alerts us to the possibility that VRSA may be capable of nasocomical transfer if adequate hospital injection control measures are not taken.

Enterococci

Only one isolate of enterococci isolated in this study was sensitive to Vancomycin and Linezolid. A study by Shareen George *et al* (2015) correlates with our study

E.Col. and Klebsiella pneumonia

In our study 34.7% E coli were sensitives to cepro, 3rd gen ceph, Amikacin, Cefaperazone Sulbactum, piperacithintazobactum, Meropenem and Imipenem. Three isolates (42.86%) K. pneumonia sensitive to Amikacin, Ciprofloxamin, Cefasulbactum, piperacithin------Imipenem all the isolates of E. coli and Klebsiel;la pneumonia were sensitive to Colistin. In correlation to our study, SankerSreenivasan *et al* (2009), only 72.4% Kleb are sensitive to Imipenem 82.8%, Sensitive to Cefapexazonesulbactum 66.9% to sensitivity to Amikacin 63.6% E coli sensitive to Imipenem 42.7% Amikacin 9.1% to cefaperazonesulbactum. In contrast to our study, Imran *et al* (2009) the most effective antibiotic against E Coli and Klebsiella being cefaperizonesulbactum and imipenem. In a study by Merlin Gugget Lin *et al*. (2009), Imipenem is reliable reserve antibiotic for the fermenting enterobacteriac (E Coli & Klebisellapneble) with susceptibilities of or near 100%. More than 90% of E.Coli and K. pneumoniae were sensitive to Imipenem in a study of Jefferson *et al* (2005).

Drug resistance of gram negative organism

Among the isolates, 38.89% cases of pseudomonas aeruginosa, 14.28%of klebsiella pneumoniae, 20% of Acinetobacter baumanii are found to be ESBL producers. A study by Mathangi *et al* during a period of 6 years showed that the ESBL produces were 37%. In accordance with our present study, studies conducted by Clark *et al* (2003) and SmithaSarma *et al* (2011) reported that increased prevalence of ESBL has contributed to the emergence of MDR among bacteria such as Klebsiellaand E coli. 29.63% isolates of Pseudomonas aeruginosa,70% Acinetobacter baumanii, 57.14% klebsiella pneumoniae, 25% E Coli were Carbapenemase MBL producers. A study conducted by Navneet Kaur *et al* (2015) showed 61% of Acinetobacter baumanii were Carbapenemase producers. Study conducted by Nahia *et al* (2015) has reported 66.6% of MBL Producing isolates were Acinetobacter, 89.6% pseudomonas and 70% Klesiella species. A high percentage of multidrug resistant isolates is probably due to empirical use of broad spectrum antibiotics and nonadherence to hospital antibiotic policy. Once MDR strains become established in the hospital environment they can persist for months. Therefore careful microbiological surveillance and in vitro testing before the start of antibiotic therapy and restrictive antibiotic policy may be of great help in prevention and treatment of MDR isolates in burns units and thus reduction of overall infections related morbidity and mortality. The overcrowding in burns ward is an important cause of cross infection and must be avoided in order to control hospital acquired infection.

Outcome

Of the 22 cases admitted, 20 survived (90.01%) and 2 died (9.09%). Both patients who died had 70% of burns. A study by Marc G Jeschke *et al* (2015) concluded that the extent of the burn is related to morbidity and mortality. Adults with >40% and children with >60% are at high risk. In studies by Soares de Macedo *et al* (2006) and Chalise *et al* (2008), the mortality rate was 5% and 14% respectively. However, Mac Manus *et al* (1981) reported 90.72% mortality. These findings were in contrast to our study.

Bacteriological Examination of burn unit

The present study showed inadequate levels of disinfection in burn unit. The nursing supervisors informed about the inadequacy in disinfection process. With the help of nursing and cleaning staff, adequate measures were taken to ensure proper disinfection in consultation with senior faculty members in the dept. Importance of no touch technique and hand washing in between examination of patients were stressed. Following these measures a repeat bacteriological examination was done. It showed that disinfection of burn unit was inadequate. Surveillance of burn wound infection with feedback of appropriate data to surgeons has been shown to be important component of strategies to reduce burn wound infections. To keep a check on burn wound infections, it is important for every hospital to have a data on prevalent organisms and their susceptibility pattern to antibiotics. This should be done frequently to know the changing pattern of

organisms and their susceptibility patterns. Based on this, the hospital should formulate an effective antibiotic policy.

Conclusion

The present study was conducted in the Govt. Medical college Hospital, TVM for 2 months (April and May 2016) following the blast injury took place at Puttingal on 10.4.2016. A total No. of 22 patients from whom 78 samples were collected. The patients were admitted in Surgical wards Burns ICU and Fever ICU etc. The samples collected are exudates from burn wound collected using sterile swabs, Blood samples for blood culture, Tracheal aspirates, sputum samples and urine samples etc. First samples of exudates from burn wound were collected on the third day after admission. Repeat swabs were collected whenever required. 4-5 samples were collected from patients who had burn wound infection. The aim of the study was to find out the bacteriological profile of burn wound infections following blast injury and the antibiotic susceptibility pattern of the clinical isolates obtained during the study.

The bacteriological profile shows that the most common bacterial pathogen causing burn wound infection in this study was Pseudomonas aeruginosa (39.58%). Next common organism was Acinetobacterbaumanii (27.08%) followed by Klebsiella pneumoniae (20.83%), MRSA (8.33%), Staphylococcusaureus (2.08%) and Enterococcusfaecalis (2.08%) Culture positivity was 78.57% in this study. Among the isolates obtained, 90.90% were monomicrobial and 9.09% polymicrobial. Among the monimicrobial isolates the most frequent pathogen isolated was Pseudomonas aeruginosa (40%). The most common polymicrobial infection was due to Pseudomonas aeruginosa and MRSA (50%). All the MRSA strains were sensitive to Vancomycin, Linezolid and Rifampicin. All the isolates were resistant toclindamycin. All the gram negative isolates were sensitive to colistin.19% of the isolates of Pseudomonas aeruginosa strains were sensitive to piperacillin – tazobactum and Imipenem ESBL production was noticed in 38.89% of pseudomonas aeruginosa, 20% cases of Acinetobacter baumanii and 14.28% of Klebsiella pneumoniae. Carbapenemase production was noticed in 28.57% Pseudomonas aeruginosa, 70.59% cases of Acinetobacter baumanii, 54.54% of Klebsiella pneumonia and 50% isolates of E.coli. Only one isolate of staphylococcus aureus in our study was sensitive to, gentamicin, Amikacin, Cloxacillin, Cephalosporin, 1st generation and resistant to penicillin. MRSA infections were treated with Linezolid and life threatening injection were treated with combination of Vancomycin and Amikacin. Infection with ESBL producing gram negative bacterial isolates were treated with piperacillin or cefoperazone-sulbactum. The mortality rate in our study was 9.09% and this is mainly due to strict and effective infection control measures taken from the day of admission to the day of discharge. Barrier nursing techniques were strictly followed. Appropriate antibiotics were administered according to ABST pattern. Most of the gram negative bacterial isolates were multi drug resistant. The prevalence of MDR organisms is to be considered as a warning sign for the emerging spread of antibiotic resistance and the need for urgent implementation of strict antibiotic policy and infection control measures. For the implementation of antibiotic policy there must be a good communication between the surgeon and the microbiologist who is giving the relevant culture reports with clinical interpretation. Timely change of antibiotic according to the ABST pattern as advised by the Microbiologist should be followed. It helps in good healing of the burn wound. For infection control, the activities of the Infection Control Committee in the hospital are necessary. This study shows that a significant reduction in wound infections is attainable if clinicians embrace the principle of practice of Infection Control measures in daily patient care.

The guidelines for the management of burn wound infection followed in our hospital were collection of appropriate specimens for culture before starting antibiotics, starting empirical antibiotic treatment immediately after collecting the specimens, formulation of treatment protocols and change of antibiotic according to ABST pattern. Implementation of strict hygienic measures and barrier nursing Regular follow up and repeat cultures whenever necessary and administration of appropriate antibiotics. The predominant age group was between 41-50yrs (31.82%). Majority of the patients were males (86.36%). Most of them were admitted with 50% burns in this study (27.27%). The mortality rate in this study was significantly reduced (9.09%)due to strict infection control practices.

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