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Antibiotic susceptibility of multi drug resistant bacteria in pressure ulcers of long term care facility elderly residents

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Abstract:

Pressure ulcer (PU) is a significant, common, and costly medical problem in long-term care facility residents. Worldwide, antibacterial resistance has increased dramatically over the past few years Livermore DM.2009 [4] and is currently recognised as a major medical challenge in most healthcare settings. The objective of this descriptive study is to detect the commonest multidrug resistant bacteria and its antibiotic sensitivity in pressure ulcers of elderly residents at long term care facility. 28 long term care facility elderly residents bedridden having pressure sores with drug resistant organisms. Demographic data collected and comorbidities established. Culture and sensitivity was done for pus samples from their pressure sores and documented multidrug resistant organisms with antibiotic susceptibility to a range of different antibiotic groups. All samples were processed as per standard techniques and bacteria identified by standard biochemical tests. IBM SPSS statistics (version 24, IBM corp., USA, 2016) was used for data analysis. The age ranges from 68 to 91 years with mean 80.5 +/- 6.257 years. 53.6% of residents in the age group 60-80 y while 46.4% of residents are in the age group 81-91 y. Males are 42.9% while females are 57.1%. 57.1% of those drug resistant organisms are proteus, 14.3% are pseudomonas, 14.3% are mix of klebsiela and pseudomonas, and 14.3% are MRSA. proteus is statistically significant sensitive to cefepime (CPM), meronam (MEM), and imipenam (IMP). and statistically significant resistant to colistin (CT), gentamycin(GM), and tobramycin (tob.). proteus is significantly

present in patients with comorbidities of diabetes mellitus (DM)+renal impairment (RENAL IMP.)+ Dementia.

Further studies are recommended on larger numbers of elderly patients to confirm or not confirm significant findings in this study, try to explain these findings, and make use of it in clinical practice.

Key words: Antibiotic susceptibility, multi drug resistant bacteria, pressure ulcers, long term care facility, elderly residents

INTRODUCTION

Pressure ulcer (PU) is a significant, common, and costly medical problem in long-term care facility residents. Residents with PUs have decreased quality of life and increased morbidity and mortality rates Garcia AD, Thomas DR, 2006.[1] As the population ages, a greater number of individuals will be at high risk for developing pressure ulcers. Reported PU prevalence rates range from 2.3% to 28%, and reported PU incidence rates range from 2.2% to 23.9% in long-term care facilities *Cuddigan J, Ayello EA, et.al.2001*[2] .

In Canada, The prevalence of pressure ulcers in two long-term care facilities was 36.8% and 53.2%, respectively. The incidence of pressure ulcers in these two long-term care facilities was 11.7% and 11.6%, respectively. The pressure ulcer prevalence is higher than published figures for the long-term care setting Davis CM and Caseby NG, 2001[3].

Ulcers of skin are risk for contamination and infections with bacteria. Infected pressure ulcer is a big problem, becomes deeper and needs longer medical, nursing, and sometimes surgical interventions. Infected ulcer carries more patient sufferings and risk for sepsis and septic shock with increased morbidity and mortality.

According to Center for disease detection and control (CDC); antibiotic / antimicrobial resistance is the ability of

microbes to resist the effects of drugs – that is, the germs are not killed, and their growth is not stopped. Also according to CDC; infections with resistant organisms are difficult to treat, requiring costly and sometimes toxic alternatives.

For epidemiologic purposes, Multiple drug resistant organisms (MDRO) are defined as microorganisms, predominantly bacteria, that are resistant to one or more classes of antimicrobial agents.[4] According to CDC, although the names of certain MDROs describe resistance to only one agent (e.g., MRSA, VRE), these pathogens are frequently resistant to most available antimicrobial agents. Worldwide, antibacterial resistance has increased dramatically over the past few years Livermore DM.2009 [5] and is currently recognised as a major medical challenge in most healthcare settings. Mortality attributed to resistance is considerable and thus adds to the infectious diseases burden De Kracker MEA, et.al 2011[6]. Resistance is not a new phenomenon; resistance genes are ubiquitously found in nature and interact with a complex ecosystem Davies J, Davies D .2010 [7,] Rolain JM, et.al 2012[8]

Antimicrobial resistance problem is growing and need further synchronized confrontation weapons.

The clinical relevance of a given multidrug resistant (MDR) pathogen depends on the therapeutic choices available, the severity of the infection and its consequences for the individual patient, as well as the potential impact on and cost to society Eckpergasse, 2013. [9]

Aim of the study: The objective of this study is to detect the commonest multidrug resistant bacteria and its antibiotic sensitivity in pressure ulcers of elderly residents at long term care facility.

Subjects and method: A descriptive study for 28 long term care facility elderly residents bedridden having pressure sores with drug resistant organisms. Demographic data collected and comorbidities established. Culture and sensitivity was done for pus samples from their pressure sores and documented multidrug resistant organisms with ant*ibiotic susceptibility* to a range of different antibiotic groups. All samples were processed as per standard techniques and bacteria identified by standard biochemical tests.

Statistical method: IBM SPSS statistics (version 24, IBM corp., USA, 2016) was used for data analysis. Data were expressed as Mean ± SD for quantitative parametric measures in addition to both number and percentage for categorized data. Chi – square test was used to study the association between each 2 variables or comparison between 2 independent groups as regards the categorized data. The probability of error at 0.05 was considered significant, while at 0.01 and 0.001 are highly significant.

RESULTS

A sample of 28 elderly bedridden long term care facility (LTCF) residents with multi drug resistant bacteria in their pressure ulcers. The age ranges from 68 to 91 years with mean 80.5 +/- 6.257 years. 53.6% of residents in the age group 60-80 y while 46.4% of residents are in the age group 81-91 y.

Males are 42.9% while females are 57.1%.

57.1% of those drug resistant organisms are proteus, 14.3% are pseudomonas, 14.3% are mix of klebsiela and pseudomonas, and 14.3% are MRSA.

50% of proteus organisms are in males, 50% in female ,87.5% of proteus are in the younger age group while 12.5% are

in the older one.50% of proteus are with the comorbidities of diabetes mellitus (DM) + renal impairment + dementia.

Correlation between age and different resistant organisms revealed that proteus is statistically significant present in pressure sores of younger age group 60-80 y on the otherhand psedomonas, MRSA and mix of psedomonas and klebsiela are significantly present in older age group 81-90y.

Table (1): Correlation between age and resistant organisms in pressure ulcers of bedridden long term care facility elderly.

Crosstab

			Organism				
			PROTEUS	PSEUDOMONAS	MRSA	Kleb+Pseud	Total
Age	60-80	Count	14	0	1	0	15
		%	87.5%	0.0%	25.0%	0.0%	53.6%
	81-91	Count	2	4	3	4	13
		%	12.5%	100.0%	75.0%	100.0%	46.4%
Total		Count	16	4	4	4	28
		%	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	P
Pearson Chi-Square	17.949[a]	.000

Correlation between sex and different resistant organisms revealed that pseudomonas is significantly present in pressure sores of males on the other hand MRSA and mix of pseudomonas and klebsiela are significantly Present in females.

Table (2): Correlation between sex and resistant organisms in pressure ulcers of bedridden long term care facility elderly.

Crosstab

			Organism				
			PROTEUS	PSEUDOMONAS	MRSA	Kleb+Pseud	Total
Sex	Male	Count	8	4	0	0	12
		%	50.0%	100.0%	0.0%	0.0%	42.9%
	Female	Count	8	0	4	4	16
		%	50.0%	0.0%	100.0%	100.0%	57.1%
Total		Count	16	4	4	4	28
		%	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	P
Pearson Chi-Square	11.667[a]	.009

Correlation between comorbidity (diagnosis) and different resistant organisms revealed that proteus is significantly present in patients with diabetes mellitus (DM)+renal impairment (RENAL IMP.)+ Dementia on the otherhand MRSA is significantly present in patients with DM+dementia, while mix of pseudomonas and klebsiela is significantly Present in DM+hypertension(HTN) +stroke and pseudomonas is significantly present in patients with HTN+ road traffic accident (RTA) .

Table (3): Correlation between comorbidities (diagnosis) and resistant organisms in pressure ulcers of bedridden long term care facility elderly.

Crosstab

			Organism				
			PROTEUS	**PSEUDOMONAS**	**MRSA**	**Kleb+Pseud**	**Total**
Diagno-sis	**DM+HTN+Stroke**	**Count**	0	0	0	4	4
		%	0.0%	0.0%	0.0%	100.0%	14.3%
	DM+Post.Card.Arr.+Anoxic Brain D.	**Count**	4	0	0	0	4
		%	25.0%	0.0%	0.0%	0.0%	14.3%
	DM+Dementia	**Count**	0	0	4	0	4
		%	0.0%	0.0%	100.0%	0.0%	14.3%
	DM+Renal+Dementia	**Count**	8	0	0	0	8
		%	50.0%	0.0%	0.0%	0.0%	28.6%
	HTN+RTA	**Count**	0	4	0	0	4
		%	0.0%	100.0%	0.0%	0.0%	14.3%
	Anoxic Br.D.	**Count**	4	0	0	0	4
		%	25.0%	0.0%	0.0%	0.0%	14.3%
Total		**Count**	16	4	4	4	28
		%	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	P
Pearson Chi-Square	84.000[a]	.000

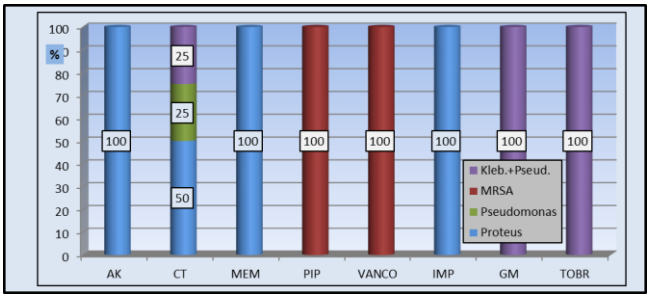

Fig. (1): Frequency of all studied antibiotics as regards their sensitivities

Proteus account for 100% of sensitive elderly in the study sample to Amikin, meronam, imipinam, and 50% of their sensitivity to colistin whereas mix of klebseila and pseudomonas for 100% of sensitivity to gentamycin and tobramycin. MRSA account for 100% of sensitivity to pipracillin and vancomycin and 25% of sensitivity to colistin. The least sensitive organism is pseudomonas which account for only 25% of sensitivity to colistin.

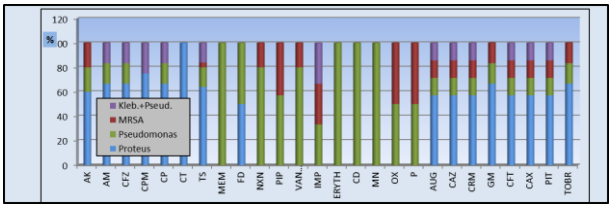

Fig. (2): Frequency of all studied antibiotics as regards their resistance.

The study revealed that proteus is statistically significant sensitive to cefepime (CPM), meronam (MEM), and imipenam (IMP) and statistically significant resistant to colistin (CT), gentamycin (GM), and tobramycin (tob.) Whereas pseudomonas is statistically significant sensitive to CT, and resistant to MEM and vancomycin (vanco.) MRSA is statistically significant sensitive to vancomycin while the mix of pseudomonas and klebsiela is statistically significant sensitive to GM and tobra.

The study revealed younger age group is highly statistically significant sensitive to MEM, pipracillin (pip.), IMP whereas older age group is statistically significant sensitive to GM and Tobra.

Males were statistically significant sensitive to Amikin (AK), CT, and Vanco and highly statistically significant resistant to CPM. While females were highly statistically significant resistant to CT, highly statistically significant sensitive to CPM.

Patients with comorbidities of DM + post cardic arrest (post C. A) + anoxic brain damage are highly statistically significant sensitive to AK, MEM and tobra. While comorbidities of DM +RI + Dementia are highly statistically significant resistant to AK, GM, tobra. and CT And sensitive to CPM, IMP. Comorbidities of HTN and RTA are highly statistically significant resistant to MEM and also statistically significant resistant to vanco. Comorbidities of dementia + DM is statistically significant sensitive to vancomycin while comorbidities of DM + HTN + stroke are highly statistically significant sensitive to GM.

DISCUSSION:

Elderly population is growing worldwide and researches concerning elderly problems still lagging. This study is a chance to describe a precious sample of elderly with resistant bacteria to more than two antibiotic groups or MRSA.

For many worldwide regions, our knowledge regarding the scope of the resistance problem is imprecise and unreliable. Surveillance of resistance is an integral part of combating resistance Eckpergasse, 2013.[9]

This study is done to find commonest multi drug resistant bacteria in bed sores of bedridden LTCF residents and what still statistically significant sensitive to which antibiotics.

Study revealed stat. significant relation between age and different organisms detected. 57.1% of those drug resistant organisms are proteus, 14.3% are pseudomonas, 14.3% are mix of klebsiela and pseudomonas, and 14.3% are MRSA. This finding is comparable to a study about drug – resistant bacteria common for nursing home residents with dementia coli (E. coli) and Proteus mirabilis (P. mirabilis) were the most common bacteria found among the study subjects with nearly 90 percent of the bacteria found were resistant to three types of antibiotics, most notably ciprofloxacin, gentamicin and extended-spectrum penicillins ScienceDaily, 2015[10]. The same is in the current study the most prevalent organism (proteus) is resistant to gentamycin.

Another study about multi drug resistant gram negative bacterial (MDRGN) infections among LTCF residents found that rates of MDRGN exceeded those of MRSA and vancomycin resistant enterococci (VRE) and increased throughout the study period Erin O'Fallon et.al 2009.[11] This finding is similar to current study finding as RGN rates exceeds that of MRSA.

Proteus is found to be statistically significantly present in pressure sores of younger age group while pseudomonas, MRSA, and mix of pseudomonas and klebsiela are statistically significant present in pressure ulcers of older age group. The younger age group under the study has stat. significant sensitivity to MEM, PIP, and IMP this significant sensitivity to MEM and IMP may be explained by significant correlation between younger age group and proteus which is statistically significant sensitive to MEM and IMP. The older group has stat. significant sensitivity to GM and Tobra. This may be explained by significant correlation between older age group and the mix of pseudomonas and klebsiela. These results may direct opinion during antibiotic choice by considering age.

Male sex has stat. significant sensitivity to AK, and CT and this significant sensitivity to CT may be explained by

statistically significant correlation between male sex and pseudomonas which is statistically significant sensitive to CT in the sample under the study.

Female sex has stat. significant sensitivity to CPM, and Vanco. This statistically sensitivity of females to vancomycin may be explained by statistically significant correlation of female sex with MRSA which is statistically significant to vancomycin.

These results may direct opinion during antibiotic choice by considering sex.

Comorbidity of DM, PCA, and anoxic brain damage has stat. significant sensitivity to AK, and MEM While comorbidity of D.M, renal imp. ,and dementia has stat. significant sensitivity to CPM, CT, and IMP this significant sensitivity to CPM and IMP may be explained by statistically significant correlation between this comorbidity and proteus which is statistically significant to CPM and IMP.

Comorbidity of D.M, HTN, and stroke has stat. significant sensitivity to GM, and Tobra. This significant sensitivity to Tobra may be explained by statistically significant correlation between this comorbidity and mix of pseudomonas and klebsiela which is statistically significant to Tobra.

Comorbidity of D.M and dementia has stat. significant sensitivity to Vanco.

This significant sensitivity to Vancomycin may be explained by statistically significant correlation between this comorbidity and MRSA which is statistically significant sensitive to Vancomycin.

Pseudomonas is statistically significant correlated to comorbidity of HTN and RTA (Road traffic accidents) in contrast to another study which demonstrated a significant correlation between Pseudomonas and Pseudomonas/S. aureus coinfections within DM wounds Urvish Trivedi et al, 2014.[12]

RECOMMENDATIONS:

Further studies are recommended on larger numbers of elderly patients to confirm or not confirm significant findings in this study, try to explain these findings and make use of it in clinical practice.

According to this study significant results maybe we can recommend that LTCF patients with pressure ulcers suspected to have resistant bacteria we can predict that it can be proteus most propably especially if age is below 80 years with comorbidity of DM+RI+D, pseudomonas if age more than 80 years male with comorbidity of HTN+RTA, MRSA if age more than 80 years, Female with comorbidity of DM+D, and mix of pseudomonas and klebsiela if more than 80years female with DM+HTN+stroke.

If antibiotics are indicated for treatment of these pressure ulcers it can be as follow:

Proteus: consider giving CPM, MEM, and IMP. Avoid CT, GM, and tob.

Pseudomonas: consider giving CT and avoid MEM and vancomycin.

MRSA: consider vancomycin.

Mix : consider giving GM, and tobramycin.

Comorbidities of DM + post C.A +anoxic brain damage: consider AK, MEM, and tobramycin .

Comorbidities of DM+RI+ Dementia: consider giving CPM , IMP and avoid AK, GM, tobramycin and colistin.

Comorbidities of HTN and RTA: consider avoid MEM and vancomycin.

Comorbidities of dementia+DM: consider giving vancomycin

Comorbidities of DM+ HTN+ stroke: consider giving gentamycin.

Male: consider AK, and CT.

Female: consider CPM, and Vancomycin.

It is worth to mention that prevention is better than treatment or non availability of effective treatment, so prevention of pressure ulcers will prevent eventually its consequences like infection with organisms difficult to manage. Also finding non toxic alternatives for managing pressure ulcers and its infections.

This study confirmed the need for novel antibiotics as emphasized in previous studies Theuretzbacher U.,2012 Carlet J,et.al 2012 , Cars O, et al.2011, David N et.al., 2010 [13,14,15,16].

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