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Antibiotic Resistance and MAR indexing of E.coli

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Abstract:-

In the present study 663 samples of gastrointestinal disorder were collected out of them 335 samples were positive for E.coli . The samples were screened for antibiotic susceptibility test. While out of positive samples 264 were resistance and 23 were sensitive and remaining were intermediate**.** In the present study Imipenum was the most susceptible antibiotic while Cephalexin were the most resistant antibiotic found.
Key Words:- E.coli, antibiotic resistance, MAR indexing.

Introduction

Escherichia coli is an emerging bacterial pathogen of global significance. Pal M *et al* 2016. *E. coli* commonly reside in the intestines of warm-blooded animals, it is subjected to frequent encounters with antimicrobials and provides it with high selection pressure leading to a high likelihood of resistance against multiple antimicrobials consumed by its host. Adebowale, O. *et al* 2022 As the discovery of first antibiotic was the new weapon against pathogens and it was useful for the patients suffering from various diseases. Saga and Yamaguchi., 2009. But after some time, the over use and misuse of antibiotics in developing countries leads to the antibiotic resistance in the organisms (Roy, 1997; Yoneyama and Katsumata, 2006). Antimicrobial resistance (AMR) is a major global health threat as multidrug-resistant (MDR) organisms are increasing mortality and economic burden in humans.

Material and Method

Stool samples were collected from the hospitalized patients with enteric disease. Samples were collected in a sterilized container and immediately proceed for further isolation processes.(Sharma RM *et al*,1969, Ruiz J *et al* 1996). On the basis of morphological, cultural and biochemical characterization, the microorganisms were screened. The selected isolates then further screened for their antimicrobial activity as per the CLSI (2014) guidelines. The *E.coli* were isolated by standard method and the organism were characterized on the basis of morphological, cultural and biochemical methods. The antibiotic susceptibility were done by Kirby Bauer disk diffusion method as per the guideline of CLSI.

Result and Discussion:-

E.*coli* is well known for its capacity to cause a variety of infections. In addition to gastrointestinal illness typically manifested as diarrhea, *E. coli* also causes a variety of diseases outside the intestinal tracts of humans and animals, (Ali *et al.*, 2014)

Sr. No	Antibiotics	Symbol and concentration	Total susceptibility		Total isolates	MAR indexing
			Sensitive	Resistant		
1.	Ampicillin	AMP ^{10}	01	19	20	0.035
2.	Amoxyclav	AMC^{30}	02	18	20	0.033
3.	Cefoperazone/sulbactum	CFS$^{75/30}$	04	16	20	0.029
4.	Cephalexin	CN^{30}	00	20	20	0.037
5.	Cephalothine	CEP^{30}	02	18	20	0.033
6.	Cephaloridine	CR^{30}	03	17	20	0.031
7.	Cefpodoxime	CPD^{10}	05	15	20	0.027
8.	Cefuroxime	CXM^{30}	04	16	20	0.029
9.	Cefdinir	CDR^{5}	06	14	20	0.025
10.	Cefixime	CFM^{5}	05	15	20	0.027
11.	Cefotaxime	CTX^{30}	04	16	20	0.029
12.	Ceftazidime	CAZ^{30}	03	17	20	0.031
13.	Ceftizoxime	CZX^{30}	05	15	20	0.027
14.	Ceftriaxone	CTR^{30}	04	16	20	0.029
15.	Cefepime	CPM^{30}	02	18	20	0.033
16.	Cefpirome	CFP^{30}	03	17	20	0.031
17.	Imipenem	IPM^{10}	19	01	20	0.001
18.	Aztreonam	AZ^{30}	17	03	20	0.005
19.	Amikacin	AK^{30}	08	12	20	0.022
20.	Gentamicin	GEN^{10}	08	12	20	0.022
21.	Streptomycin	S^{10}	09	11	20	0.020
22.	Tobramycin	TOB^{30}	13	07	20	0.012
23.	Co-trimoxazole	COT^{25}	12	08	20	0.014
24.	Chloramphenicol	C^{30}	16	04	20	0.007

25.	Ciprofloxacin	CIP[5]	05	15	20	0.027
26.	Norfloxacin	NX[10]	08	12	20	0.022
27.	Tetracycline	TE[30]	07	14	20	0.025

Table 10 :- MAR index Of antibiotics for E.coli

The gastrointestinal disorder and the diarrhea associated with *E.coli* which is the world wide common problem. The increased rate of infection results in to the severe conditions. The antibiotic therapy given for this infections increases the cost of treatment and also increases the MDR problem. In our study the isolates from the gastrointestinal disorder like *E.coli, Klebsiella pneumonia, Salmonella typhi, Shigella flexneri* and *proteus vulgaris* their antimicrobial sensitivity and Multiple Antibiotic Resistance index (MAR) for antibiotic was calculated.

In the antibiotic therapy the antibiotic from the β-lactum group was Ampicillin, in this study there was 95% resistance rate was observed which is very much higher than that of the study carried out by Sarshar *et al*., (2014) according to them the 36.11% resistance was reported. The lower resistance rate was reported by Rigobelo *et al*., (2006) that is 41.0%, followed by 55.6% by Akingbade *et al.,* (2014), 75% by Zakiria *et al*., (2015), while 84% resistance rate reported by two studies in 2014 and in 2016 by Ali *et al*., (2014) and Kipkorir *et al*., (2016). The Alikhani *et al*., (2013) reported 87.5% while 90.7% Manikandan and Asmath ., (2013). Our results somewhat correlates with the Tawfick *et al.,* (2016) it becomes 93.1%**.** The higher resistance rate than that of our findings was reported by Moini *et al.,* (2015) by 97%.

The MAR indexing for each antibiotic used was calculated by the formula given by Tambekar *et al* 2006. Multiple antibiotic resistance (MAR) indexing has been shown to be a cost effective and valid method of bacteria source tracking. Multiple antibiotic resistance index is calculated as the ratio of number of antibiotics to which organism is resistant to total number of antibiotics to which organism is exposed. Sandhu *et al.,* (2016), Krumperman , (1983); Osundiya *et al,* (2013); Apun *et al,* (2008).

The MAR indexing for ampicillin in this study was 0.035 which is higher than that of Devi and Rajkumat (2013) which is 0.027 and lower than that of Tambekar *et al.,* (2006) they are reported and 0.037 MAR respectively.

The resistance rate Amoxyclav in this study was 90% which is higher than that of 55.3% Tawfick *et al.,* (2016), but exactly similar to the study of Deshmukh and Ukesh (2014) study reported 90.56% resistance rate, similarly the resistance rate of Cefoperazone/sulbactum was 80% in our findings while, Dshmukh and Ukesh (2014) reported less resistance than that of present finding which is 13.20%. The MAR indexing is 0.029 which was just similar to that of Devi and Rajkumat (2013).

In the enteric pathogens Cephalosporin group of antibiotics was the primary choice of drug in medical practitioners. In this study the number of generation of this group was studied. The antibiotic resistance for

Cephalexin was founded 100% while 94% resistance was found to Ali *et al.,* (2014), similarly for Cephalothine 90% resistance rate was found, while for Cephaloridine 85% resistant was identified the lower resistance rate was reported by Rigobelo *et al.,* (2006) which is 46.1%. The MAR indexing for the above antibiotics was 0.037, 0.033 and 0.031 respectively.

The resistance rate of 51.6% for Cefpodoxime was reported by Tawfick *et al.,* (2016) which is lower than that of our findings 75%. Similerly for Cefuroxime 80% resistance was founded while higher that is 100% resistance rate was reported by Egbule *et al.,* (2016) followed by lower rate that is 38.3% by Akingbade *et al.,* (2014).

The antibiotic resistance for Cefixime was 75% in our study while Egbule *et al.,* (2016) reported higher resistance than that of our findings that is 100% while lower resistance reported by Ali *et al.,* (2014) that is 54% followed by 40.7% by Akingbade *et al.,* (2014) 37.5% by Alikhani *et al.,* (2013). 30.56% and 14% resistance rate reported by Sarshar *et al.,* (2014) and Manikandan and Asmath., (2013) respectively. The MAR indexing for this antibiotic was 0.027 higher than that of 0.023 reported by Devi and Rajkumat., (2013) and lower than that Tambekar *et al.,* (2006). Who reported 0.039 MAR index.

The MAR Indexing for Cefdinir was 0.025 which is much lower than that of Tambekar *et al.,* (2006) reported 0.041. The resistance rate of Cefotaxime was 80%in this finding while 75% resistance was reported by Alikhani *et al* 2013 followed by 44.1% resistane in Tawfick *et al.,* (2016) study 14% in Manikandan and Asmath., (2013) study respectively.

The resistance rate of Ceftazidime in this finding was 85% which is lower than that of Egbule *et al.,* (2016) reported 100% resistance rate. While lower resistance 28.4% by Akingbade *et al.,* (2014), 16.67% by Sarshar *et al.,* (2014), 35.5% by Tawfick *et al.,* (2016) and 55.2% by Moini *et al.,* (2015) respectively. The MAR indexing for this antibiotic was 0.031 which was higher than that of 0.022 reported by Devi and Rajkumat (2013). In the present study for Ceftizoxime 75% resistance rate was observed and the MAR indexing for it 0.027.

The resistance rate of Ceftriaxone was 80% which is higher than other studies 33.3% by Akingbade *et al.,* (2014), 16.67% by Sarshar *et al.,* (2014), 17.5% by Alikhani *et al.,* (2013) and 38.8% by Moini *et al.,* (2015) respectively. Similarly for Cefepime 90% resistance rate was studies in this study which is higher than the findings of Deshmukh and Ukesh (2014) study they reported 20.75% resistance rate, followed by 85% resistance for Cefpirome.

The Imipenem was most effective drug found in this study with only 5% resistance rate which is much lower than that of 29% reported by Zakiria *et al.,* (2015) and correlates with 5.56% reported by Sarshar *et al.,* (2014)**.** The MAR indexing for this antibiotic was 0.001 reported in this study as well as

correlates with Devi and Rajkumat (2013). Similarly for Aztreonam 15% resistance rate and 0.005 MAR indexing was recorded.

Amikacin resistance rate in this study was 60% which is higher than that of other findings 5.56% by Sarshar *et al.,* (2014), 37.3% by Tawfick *et al.,* (2016), 44.8% by Moini *et al.,* (2015). The MAR indexing for this antibiotic was 0.022 which was higher than that of 0.005 reported by Devi and Rajkumat (2013) and 0.009 reported by Tambekar *et al* (2006).

100% resistance rate was reported by Egbule *et al.,* (2016) followed by 68.8%**,** by Moini *et al.,* (2015) for the antibiotic Gentamycin. In this study 60% resistance rate was calculated which is lower than previous studies and higher than that of 42% by Zakiria *et al* (2015), 21.4 by Rigobelo *et al.,* (2006), 32.1% by Akingbade *et al.,* (2014), 8.33% by Sarshar *et al.,* (2014), 46.1% by Tawfick *et al.,* (2016), 9.3% by Manikandan and Asmath (2013) and 27.5% by Alikhani *et al.,* (2013). The MAR indexing for this antibiotic was 0.022 higher than that of 0.018 reported by Devi and Rajkumat (2013).

The antibiotic resistance rate of Streptomycin in present work was 55% which is somewhat higher than that 40.7% reported by Akingbade *et al.,* (2014), 32.4% by Rigobelo *et al.,* (2006) and 9% in Kipkorir *et al*., (2016). For Tobramycin 35**%** resistance rate was recorded. The MAR indexing for this antibiotic was 0.012 lower than that of 0.022 reported by Devi and Rajkumat (2013).

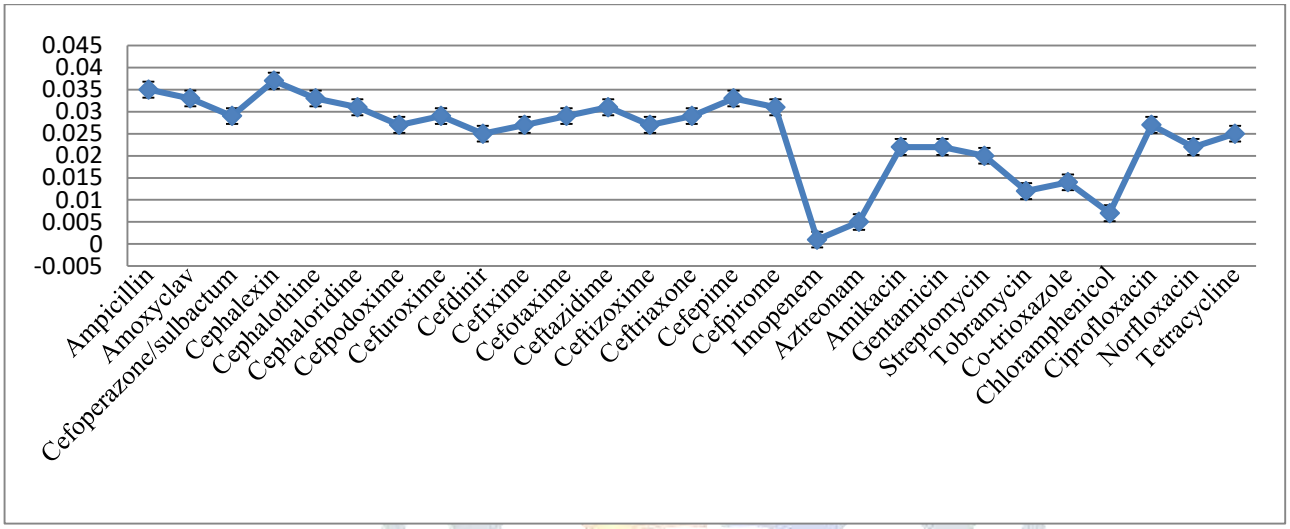
For the Co-trimoxazole 40% resistance rate was recorded which is much lower than that of others findings. 72.5% resistance rate was reported by Alikhani *et al.,* (2013) while 61.7% resistance by Akingbade *et al.,* (2014) The MAR indexing for this antibiotic was 0.014 lower than that of 0.043 reported by Tambekar *et al*., (2006).

The antibiotic resistance rate of Chloramphenicol in present work was 20% which is somewhat higher than that of 13.89% resistance rate reported Sarshar *et al.,* (2014) while much lower than that of the findings of Tawfick *et al.,* (2016) reported 61.8% resistance rate followed by 35% by Alikhani *et al.,* (2013), 27% by in Kipkorir *et al.,* (2016) study and 23.3% by Manikandan and Asmath (2013)**.** The MAR indexing for this antibiotic was 0.007 higher than that of 0.003 reported by Devi and Rajkumat (2013).

For Ciprofloxacin 75% resistance rate was reported in this study which is correlates with the 74% in Ali *et al.,* (2014). Followed by 67% resistance rate reported by Egbule *et al* (2016), 55.1% by Zakiria *et al.,* (2015) 38.8% by Moini *et al.,* (2015) 24% by Tawfick *et al.,* (2016), 14% by Manikandan and Asmath (2013) and 8.33% by Sarshar *et al* (2014). The MAR indexing for Ciprofloxacin in this study was 0.027 which is higher than that of Devi and Rajkumat (2013) and higher than that of Tambekar *et al.,* (2006) they are reported 0.023 and 0.014 MAR respectively.

The resistance rate for Norfloxacin was 60% which is lower than that of Alikhani *et al.*, (2013) reported 5%. The MAR indexing for this antibiotic was 0.022 higher than that of 0.014 reported by Tambekar *et al.*, (2006).

The antibiotic resistance pattern of Tetracycline recorded which is 70% in the present Work. It is lower than that of Alikhani *et al.*, (2013) reported 75% resistance and higher than 64% in Ali *et al.*, (2014), 54.3% by Akingbade *et al.*, (2014), 50% by Zakiria *et al*., (2015), 45.7% by Rigobelo *et al.*, (2006), 41.67% by Sarshar *et al.*, (2014) 16% in Kipkorir *et al.*, (2016). The MAR indexing for this antibiotic was 0.025 which was lower than that of 0.043 reported by Devi and Rajkumat (2013).



MAR indexing of antibiotics for E.coli

Conclusion:-

From this study none of the isolates was clearly susceptible to antibiotic selected for the infection. Which is the emerging challenge for everyone. E.coli is resistant to tetracycline, ampicillin this could be due to exhaustive use of the first group of antimicrobials drug, while the other group is newly introduced in the medical field, but resistance also developed for them also. Worldwide the resistance to E.coli increases dramatically and the new alternative medical line of treatment still not developed. It's time to utilize the present data, for molecular resistance gene isolation in different areas and by using systemic and proper guideline to cure the problem. It is the need of the day to improve our immunity to combat with these powerful pathogens.

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