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Microbial Spectrum of Intra-Abdominal Pathology of Patients Requiring Surgical Intervention in a Rural Teaching Hospital

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Abstract:

Background: *Intra abdominal pathologies requiring surgical intervention include appendicitis , malignancies, trauma ,perforation peritonitis etc. The most common organism isolated at the time of surgery was E. coli.We studied the spectrum of microbes at the time of laparotomy/laparoscopy to help us to know the emerging trends in microbiological spectrum and the sensitivity pattern in this medical college hospital.*

Objective: *To study the microbial spectrum and sensitivity pattern in patients with intra abdominal pathology requiring surgical interventions.*

Methodology: *After ethical committee approval was obtained, data for this retrospective study, with a sample size of 93 cases were collected from theGeneral Surgery Records and analysed.*

Result: *Of the 93 cases studied, E. coli dominated in 75% cases of acute appendicitis and Enterococcus was found in 16.2%. In cases of hollow viscous perforation 50% were E.coli and 15.3% were K.pneumoniae. In acute appendicitis with peritonitis 64.25% were E.coli, K.pneumoniae and Enterococcus were 21.4% each.In case of colonic malignancy 28.5% of patients were infected by E. coli followed by enterococcus with 21.4%. E.coli and K. pneumoniae were more sensitive to carbapenems, colistin and fluroquinolones, while Enterococcus was more sensitive to Linezolid.*

Conclusion: *E. coli is the organism that predominates in intra abdominal pathology requiringsurgical intervention and the common organisms are mostly sensitive to the carbapenems, linezolid , Colistin and fluroquinolones.*

Keywords: *Microbial spectrum, microbial sensitivity, E. coli, Meropenem,*

I. Introduction

Intra-abdominal pathologies are many and varied, ranging from appendicitis, malignancies, trauma, perforation peritonitis etc. They are generally the result of invasion and multiplication of enteric bacteria in the wall of a hollow viscous or beyond. *Escherichia coli* is the most common organism isolated from the patients who have intra-abdominal pathology[1].

Carbapenems retained the highest susceptibility rates against hospital and community acquired *E.coli* and *K.pneumoniae* pathologies[2].

The microbiology of intra-abdominal pathologies is significantly altered in patients who have been exposed to the health care setting. This alteration may be due to the acquisition of nosocomial pathogens or may reflect prior antimicrobial therapy that has selected for resistant organisms. In a study by K. Krobot et al.(2004)[3] it was found that appendicular pathology was the most common intra-abdominal pathology with 38%, colonic pathologies accounted with 26%, duodenal pathologies with 23% and biliary pathologies for which cholecystectomy was done accounted to about 6%.

In a study by D.H Wittmann et al. (1991)[4] ,it was found that out of 900 isolates from intra abdominal pathologies, *E.coli* was the most common aerobe isloated. It was isloated from about 450 patients with intra abdominal pathologies. *K. pneumoniae* was isloated from about 110 patients.Both *Enterobacter* spp. and Pseudomonas spp. accounted in less than 100 cases of intra abdominal pathology. In anaerobic organisms *Bacteroides* was isolated in about more than 600 cases.

In a study by M. Guembe et al. (2003-2007) [5],a total of 572 aerobic and facultative gram-negative bacilli were isolated from intra-abdominal infections in 510 patients. *E.coli* (52%) was the most common isolated species, followed by *Klebsiella* spp. (16%), *Proteus mirabilis* (6.3%) and *Enterobacter* spp. (6.3%). Among the non-fermenters, *P. aeruginosa* was the most common isolated species (6.8%).

There has been similar studiesin the past like D.H Wittmann et al.(1991)[4],who showed that cefotaxime, cefoperazone and moxalactam were sensitive in 100% of cases for *E.coli*. this was followed by cefotetan with

99% and imipenem with 98%. Ceftazidime was sensitive in 100% of cases which were followed by cefotaxime and cefotetan with 99% sensitivity for *K.pneumoniae*.

In a rural tertiary care centre there has not been much record of literature about the microbial spectrum and sensitivity pattern of intra-abdominal pathologies which led us to selecting this topic.

This project is aimed at studying the spectrum of microbes, at the time of laparotomy/laparoscopy and their sensitivity pattern. This would help us know the microbiological spectrum and the sensitivity pattern and would help us to know the emerging trends in sensitivity and resistance and also in anticipating the antimicrobial therapy.

II. Methodology

The study was a retrospective review carried out in the department of General Surgery of MOSC Medical College, Kolenchery during 1st June 2014 to 31st July 2014. **Study Population**: 93 patients above 12 years of age who underwent laparotomy/laparoscopy and had peritoneal swab or peritoneal pus which has been sent for culture sensitivity intra-operatively during the period April 2009 to April 2014 were studied. The patients were stratified into different pathological groups based on the microbe present and the anti-microbial sensitivity.

Data collection: All data, including microbial culture sensitivity report were collected from patient records and entered into case study sheet. The initial antibiotic used was recorded and the changes in the antimicrobial therapy based on the culture sensitivity pattern were noted. The various post-operative morbidities were also studied.

Ethical Issues: Waiver of informed consent was requested as patients were not going to be interviewed and observations were made only from the hospital records for which permission was obtained from the medical superintendent.The study was approved by the ethics committee on 15.01.2014. All records were maintained anonymously and kept strictly confidential by the investigator.

III. Results

Intra-abdominal pathology

Acute appendicitis :

A total of 44 cases of acute appendicitis were studied. *E.coli* was the most common organism isolated from acute appendicitis with 52.3%(p=0.0008), followed by *Enterococcus* spp. and *K. pneumoniae* with 6.8%. In combination *Enterococcus* spp. and *E.coli* with 9%.

Hollow viscous perforation peritonitis :

A total of 16 cases of hollow viscous perforation peritonitis were studied. *E.coli* was the most common organism isolated from hollow viscous perforation peritonitis with 31.25%(p=0.4142), followed by *K. pneumonia* with 18.75%. In combination, *K. pneumonia* and E. coli, and *Enterobacter* spp. and E.coli with 6.2%.

Acute appendicitis with peritonitis :

A total of 14 cases of acute appendicitis with peritonitis were studied. *E.coli* was the most common organism isolated from acute appendicitis with peritonitis with 42.8% (p=0.0943), followed by P.aeruginosa with 14.4%. In combination, *K.peumoniae* and *E.coli*, *Enterococcus* spp. and *E.coli*, and *Enterococcus* spp. and *K. pneumoniae* with 7.1%.

Colorectal surgery:

A total of 12 colorectal cases were studied. *E.coli* was the most common organism isolated from colorectal surgery with 25%(p=0.4895), followed by *Enterococcus* species with 16.6%. In combination *Enterococcus* spp.and *K. peumoniae* accounted to 16.6%.

Cholilithiasis, choledocolithiasis:

A total of 4 cases of cholilithiasis, choledocolithiasis were studied. *Enterobacter* spp. was the most common organism isolated from cholilithiasis and choledocolithiasis with 50%(p=0.4652), followed by *E.coli* with 25%. In combination, *K.pneumoniae* and *Streptococci* spp. with 25%.

Carcinoma stomach :

A total of 2 cases of carcinoma stomach were studied. *Acinetobacter* spp. was the most common organism isolated from carcinoma stomach with 50%. In combination *Enterobacter* spp. and *Streptococci* with 50%.

Intussusception : There was 1 case of intussusception. In intussusception *E.coli* was isolated with 100% presence.

Sensitivity pattern of organisms in intra abdominal pathology

***Acinetobacter* spp. :**

Tigecycline was sensitive in 14.2% of cases of *Acinetobacter* spp infections. In combination, colistin and tigecycline were sensitive in 28.5%, colistin and tobramycin, ciprlfloxacin and cephalexin, and colistin and

meropenem in 14.2% of cases..

***Enterobacter* spp.** :

In combination linezolid and vancomycin were sensitive in 50% of cases and gentamicin and ciprofloxacin in 33.3% of cases of *Enterobacter* spp. Infections.

***Enterococcus* spp. :**

Vancomycin was sensitive in 6.2% of cases of *Enterococcus* spp. infections. In combination linezolid and vancomycin sensitive in 50%, ampicillin and cephalexin in 12.5%, and linezolid and erythromycin in 6.2%.

***K.pneumoniae*:**

Colistin was sensitive in 11.8% to *K.pneumoniae*. In combination doripenem and imipenemwas sensitive in 17.6%, and imipenem and meropenem in 11.8%.

***E.coli* :**

In combination doripenem and imipenem were sensitive in 19.3%, colistin and meropenem in 17.5%, imipenem and meropenem in 10.5%, meropenem and tigecycline in 14%, and ciprofloxacin and meropenem in 8.8% to *E.coli*.

***Streptococci* :**

Tigecycline and gentamicin were both sensitive in 25.5% of cases of *Streptococci* infections . In combination, linezolid vancomycin erythromycin in 25% and linezolid vancomycin cephalexin in 25%.

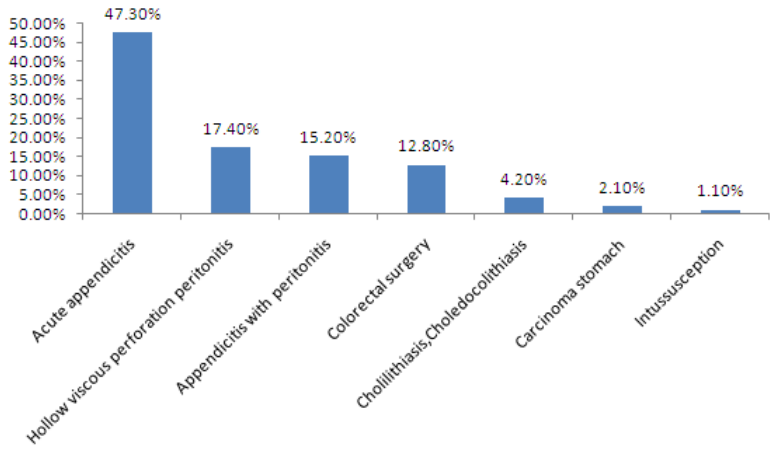
***Staphylococci* :**

In combination gentamicin and cefuroxime were sensitive in 25%, and rifampacin and clindamycin in 25% towards *Staphylococci*.

***P.aeruginosa* :**

Meropenem was sensitive in 12.5% cases *P.aeruginosa*. In combination doripenem and levofloxacin, ciprofloxacin and nitilmicin, colistin and meropenem, imipenem and ciprofloxacin, colistin and ciprofloxacin, levofloxacin and ciprofloxacin , and ciprofloxacin meropenem, tricycline are in 12.5% of cases.

Figure 1. Incidence of various intra abdominal pathology in the study group

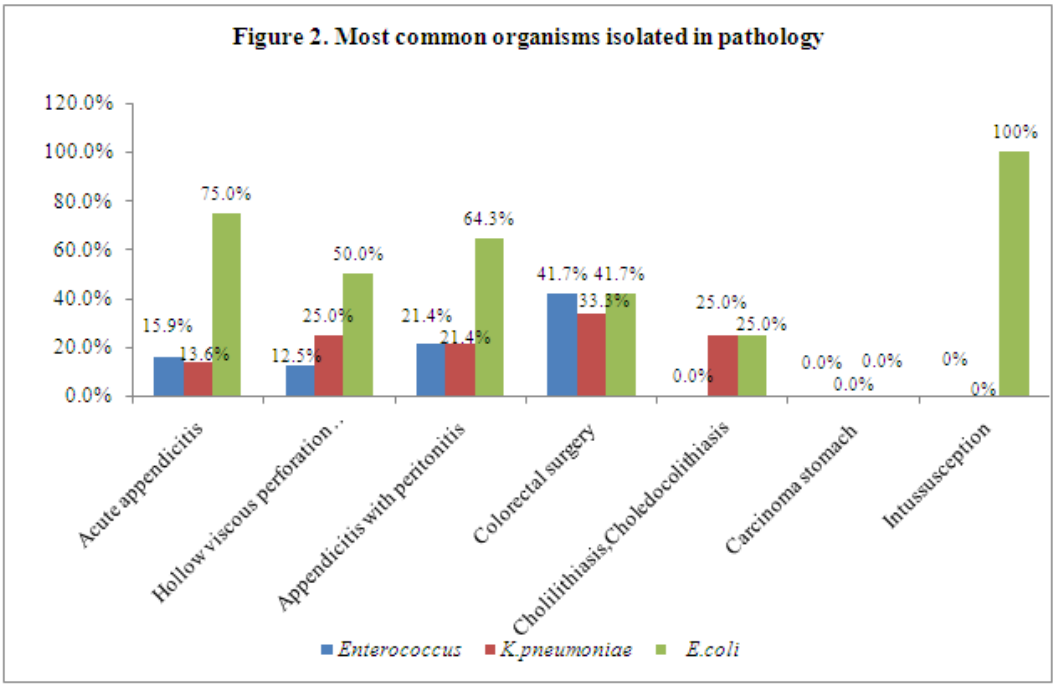


Acute appendicitis were seen in 47.3% . Hollow viscous Perforation peritonitis in 17.4% , appendicitis with peritonitis in 15.2% , Colorectal surgery in 12.8% , Cholilithiasis, Choledocolithiasis in 4.2%, Carcinoma stomach in 2.1% and
Intussusception in 1.1%.

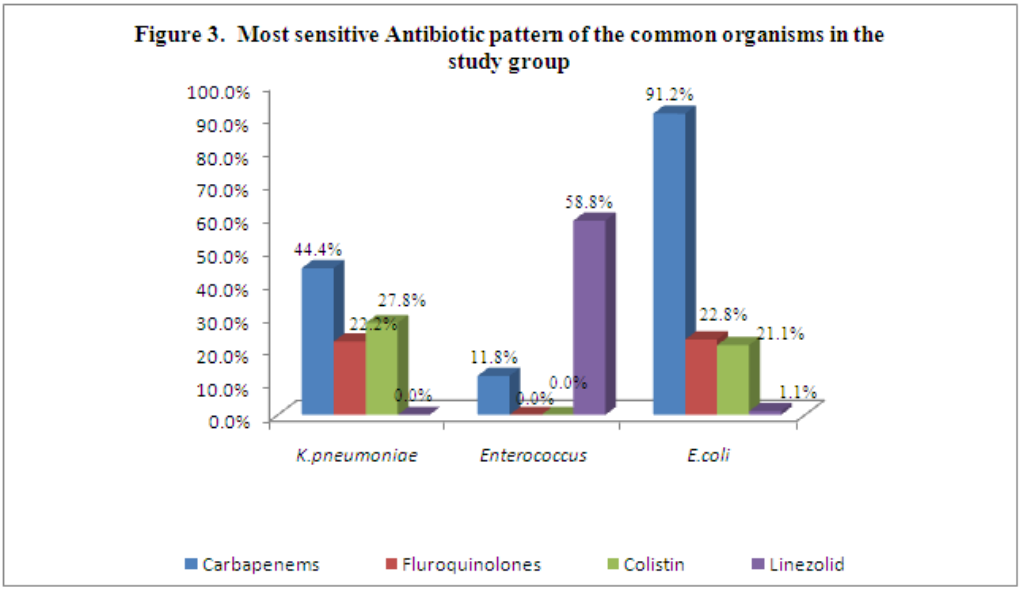
Table No.1. Organisms isolated in pathology of study group

Organisms	**Acute appendicitis**	**Hollow viscous perforation peritonitis**	**Appendicitis with peritonitis**	**Colorectal Surgery**	**Cholilithiasis, Choledocolithiasis**	**Carcinoma stomach**	**Intussception**	**Total**	**Percentage**
E.coli	33	8	9	5	1	0	1	57	61.3
K.pneumoniae	6	4	3	4	1	0	0	18	19.2
Enterococcus	7	2	3	5	0	0	0	17	18.3
P.aeruginosa	3	2	3	0	0	0	0	8	8.6
Acinetobacter	3	3	0	1	0	1	0	7	7.5
Enterobacter	0	2	0	0	2	1	0	5	5.4
Streptococci	2	0	0	0	1	1	0	4	4.3
Staphylococci	0	0	1	1	0	0	0	2	2.2

The commonest bacteria isolated was *E.coli* with 61.3%,followed by *K.pneumoniae* with 19.2% and *Enterococcus* with 18.5%. *Enterococcus* spp. were isolated with 18.3% which is followed by *P.aeruginosa* (8.6%), *Acinetobacter* spp. (7.5%), *Enterobacter* spp. (5.4%), *Streptococci* (4.3%) and *Staphylococci* (2.2%).



In 47.3% of cases of acute appendicitis. *E.coli* dominated with 75%. Followed by *Enterococcus* spp. with 15.9%.In 17.4% of cases of hollow viscous perforation peritonitis, *E.coli* dominated with 50%. Followed by *K.pneumoniae* with 25%. In 15.2% of cases of acute appendicitis with peritonitis, *E.coli* dominated with 64.3%. Followed by *K.peumoniae* and *Enterococcus* with 21.4%. In 12.8% of cases of colorectal surgery, *E.coli* and Enterococcus spp. were seen in 41.7% of cases. Followed by *K. pneumoniae* with 33.3%.



E.coli was sensitive to carbapenems in 91.2% of cases, 22.8% to fluroquinolones and 21.1% to colistin. *K.pneumoniae* was sensitive to carbapenems in 44.4% of cases, 27.8% to colistin and 22.2% to fluroquinolones. *Enterococcus* spp. was sensitive to linezolid in 58.8% of cases and 11.8% to carbapenems.

IV. Discussion

The treatment of patients with intra-abdominal infections must be approached with calculated strategy because mortality rates for these patients can approach a high percentage. Intra abdominal infections are typically managed using surgical intervention in conjunction with antibiotic therapy, but selecting appropriate initial empiric therapy is crucial.

The most common source of infection in community acquired intra-abdominal infections is the appendix, followed by the colon, and then the stomach.

Intra abdominal pathology

In this study, the most common pathology was acute appendicitis which accounted for 47.3% for which the frequent surgery done was laparoscopic appendicectomy. Hollow viscous perforation peritonitis accounted to about 17.4% followed by appendicitis with peritonitis with 15.2% and Colorectal surgery with 12.8%. Cholilithiasis, Choledocolithiasis were present in 4.2% of cases and carcinoma stomach in 2.1% of cases. Intussusception accounted to about 1.1%.

In a study by K. Krobot et al.(2004) [3] , it was found that appendicular pathology was the most common intra-abdominal pathology with 38%, colonic pathologies accounted with 26%, duodenal pathologies with 23% and biliary pathologies for which cholecystectomy was done accounted to about 6%.

In a different study by Sartelli et al. (2012)[6] it was shown that the most common intra-abdominal infections were appendicitis. It accounted to about 38.4% of cases for which appendicectomy was done. Cholecystitis was see in 14.4% of cases for which cholecystectomy surgry was done. Gastroduodenal suturing was done for gastroduodenal perforation which accounted for 8.1%. Other common pathologies accounted in 4.9% of cases.

These articles are in concordance with the results obtained from the present study.

Organisms isolated from intra abdominal pathology

In the present study, the commonest bacteria isolated was *E.coli* with 61.3%,followed by *K.pneumoniae* with 19.2% and *Enterococcus* with 18.5%. *Enterococcus* spp. were isolated with 18.3% which is followed by *P.aeruginosa* (8.6%), *Acinetobacter* spp.(7.5%), *Enterobacter* spp. (5.4%),*Streptococci* (4.3%) and *Staphylococci* (2.2%).

In a study by, D.H Wittmann et al. (1991)[4]; Out of 900 isolates from intra abdominal pathologies,*E.coli* was the most common aerobe isloated. It was isloated from about 50% patients with intra abdominal pathologies. *K. pneumoniae* was isloated from about 12.2% patients.Both *Enterobacter* spp. and *Pseudomonas* spp. accounted in less than 11.1% cases of intra abdominal pathology.In anaerobic organisms *Bacteroide*s was isolated in about more than 66.6% cases.

In a similar study by K. Krobot et al. (2004)[3], *E.coli* was the most common organism isolated which accounted to about 47% of cases and was followed by *K.pneumoniae* with 7%. Both *Enterobacter* spp. and *P.aeruginosa* accounted for about 4% of cases

In another study by Sartelli et al. (2012)[6]; aerobic gram negative bacteria accounted to about 70.6%, which mainly was *E.coli* in about 45% of cases. *E.coli* resistant to third generation cephalosporins accounted to about 5%. *K.pneumoniae* were isolated in 7.9% of cases. *K.pneumoniae* resistant to third generation cephalosporins accounted to 2.7% of cases. *Enterobacter* spp. with 4%, *Pseudomonas* with 4.6% *Proteus* with 2% and others with 7% were also isolated. In case of aerobic gram positive bacteria *Staphylococci* accounted to about 3.1% and *Streptococci* with 6.9%.

In another study by Neetu Shree et al. (2014)[7], *Escherichia coli* (43.5%) emerged as the most predominant pathogen followed by *Klebsiella* spp. (25.4%), while *Bacteroides fragilis* emerged as the predominant anaerobe. *Acinetobacter* spp.(7.4%), *P. aeruginosa* (5.5%), *Enterobacter* spp(1.8%), *Citrobacter* spp.(0.9%) and *Proteus vulgaris* (0.9%) were also isolated.

These studies, which were done during different decades, still states that E.coli is the most common organism to be isolated from intra abdominal pathology.

In this study, in 47.3% of cases of acute appendicitis, *E.coli* dominated with 75%. Followed by *Enterococcus* spp. with 15.9%.In 17.4% of cases of hollow viscous perforation peritonitis, *E.coli* dominated with 50%. Followed by *K.pneumoniae* with 25%.In 15.2% of cases of acute appendicitis with peritonitis, *E.coli* dominated with 64.3%. Followed by *K.peumoniae* and *Enterococcus* spp. with 21.4%.In 12.8% of cases of colorectal surgery, *E.coli* and *Enterococcus* were seen in 41.7% of cases. Followed by *K. pneumoniae* with 33.3%.In a study by M. Guembe et al[5]. (2003-2007), total of 572 aerobic and facultative gram-negative bacilli were isolated from intra-abdominal infections in 510 patients. E.coli (52%) was the most common isolated species, followed *by Klebsiella* spp. (16%), *Proteus mirabilis* (6.3%) and *Enterobacter* spp. (6.3%). Among the non-fermenters, *P. aeruginosa* was the most common isolated species (6.8%).

In a different study by Neetu Shree et al. (2014)[7], a total of 108 strains of aerobic bacteria and 22 strains of anaerobic bacteria were isolated during the present study. Three *Candida* spp. were also isolated. The 92 aerobic Gram negative bacilli (GNB) isolates comprised of 47 (43.5%) *E. coli*, *Klebsiella* spp. 27 (25.4%), *Acinetobacter* spp. 08 (7.4%), *P.aeruginosa* 06 (5.5%), *Enterobacter* spp. 02 (1.8%), *Citrobacter* spp. 01 (0.9%) and *Proteus vulgaris* 01(0.9%).

These studies also show that acute appendicitis, the most common intra abdominal pathology, *E.coli* was the most common organism isolated from intra abdominal pathology.

Most sensitive antibiotic pattern

In the present study, *E.coli* was sensitive to carbapenems in 91.2% of cases, 22.8% to fluroquinolones and 21.1% to colistin. *K. pneumoniae* was sensitive to carbapenems in 44.4% of cases, 27.8% to colistin and 22.2% to fluroquinolones. *Enterococcus* spp. was sensitive to linezolid in 58.8% of cases and 11.8% to carbapenems.

In a study by D.H Wittmann et al. (1991)[4], Cefotaxime, cefoperazone and moxalactam were sensitive in 100% of cases for *E.coli*. this was followed by cefotetan with 99% and imipenem with 98%.Ceftazidime was sensitive in 100% of cases which were followed by cefotaxime and cefotetan with 99% sensitivity for *K.pneumoniae*.

In a different study by Santosh Saini et al. (2004)[8], it was found that, from the study ceftizoxime was sensitive to *E.coli* in about 77.7% of cases followed by cefotaxime with 66.6% and ciprofloxacin with 51.8%.Both ceftizoxime and cefotaxime were sensitive to *K.pneumoniae* in about 83.3% of cases followed by amikacin with 55.5% of sensitivity. Ceftizoxime, amikacin and ciprofloxacin were sensitive in 35.2% of cases for *P.aeruginosa* followed by cefotaxime with 23.5% sensitivity.

In three different studies by Villages et al. (2011)[9], Hauser et al.(2007), Chaudhuriet al.(2009)[10], Imipenem, tigecycline, and colistin appeared as the most active drugs against E. coli and *Klebsiella* spp. (100% susceptible).

These different studies show that, the sensitivity pattern of the most common organisms like *E.coli*, *K. pneumonia* and *Enterococcus* have changed from cephalosporins to carbapenems. Our study also shows that carbapenems are the most sensitive drug.

From the present study group, *E.coli* was most sensitive to carbapenems with 91.2% and 22.8% to cephalosporins.*K.pneumoniae* have maximum sensitivity to carbapenems and 27.8% to colistin and 22.2% to fluroquinolones.*Enterococcus* spp. had maximum sensitivity to linezolid with 58.8%.

Taking into account of all these, it appears that carbapenems, linezolid, colistin and fluroquinolones should be considered as the 1st line calculated empirical therapy in treating surgical cases of intra abdominal pathology.

V. Conclusion

The study emphasizes need for antimicrobial susceptibility testing of clinically significant isolates not only as a routine procedure but also on periodic basis, specially when no definitive resistance or susceptibility patterns are available in a given geographic location.

A calculated empiric therapy would reduce the chances of microorganisms in developing resistance to anti microbial therapy.

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