Original article:

A study of role of amikacin in peritonitis model of rat

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Abstract:
Introduction: Intra-peritoneal infection is responsible for significant mortality in number of cases. Even after well-known side effects aminoglycosides are considered for prophylaxis and treatment of peritonitis. It is essential to start antibiotics as soon as infection sets in. The advantages of using amikacin are; it is broad spectrum, has increased efficacy when used singly or in combination, bactericidal and prevents emergence of resistance. The work was planned to study the role of amikacin on bacterial growth in an experimental model of peritonitis.

Materials and method: This study was done on 44 healthy Mus Norvagicus Albinus rats to see the effect of Amikacin in cases of peritonitis on bacterial count in peritoneal fluid. The rats were divided in two groups. Peritonitis was induced by instilling suspension of E.coli inside the peritoneal cavity of rats and studied for its growth.

Results: There was lesser growth of bacteria in the group in which amikacin was used. The t value tX/Y = 5.59; p < 0.05 and the p value is significant. It shows that amikacin plays a greater role in inhibiting bacterial growth and reducing bacterial counts in peritonitis.

Discussion: Antibiotics play an important role in preventing infections, when there are chances of infection due to peritonitis. There is also reduction in rates of bacterial resistance when antibiotics are given in combination of amikacin. Even in pediatric age group a single daily dose of amikacin produces same results when compared to multiple doses of amikacin, the safety of drug also increases by low dosage of drug

Conclusion: amikacin plays a greater role in inhibiting bacterial growth and reducing bacterial counts in peritonitis.

Keywords: Experimental model , Peritonitis , Bacterial growth , Amikacin

Introduction
Intra-peritoneal infection is responsible for significant mortality in number of cases. Aminoglycosides are considered as gold standard in prevention and treatment of intra-abdominal infection; it prevents abscess formation and also reduces mortality. But on the other hand it is said that activity of amikacin is reduced in anaerobic conditions. Even after well-known side effects aminoglycosides are considered for prophylaxis and treatment of peritonitis. 1,2 It is
essential to start antibiotics as soon as infection sets in. So along with surgery, antibiotics are also needed; the antibiotic should be broad spectrum covering anaerobes, gram negative bacteria and enterococci. The advantages of using amikacin are that, it is broad spectrum, has increased efficacy when used singly or in combination, bactericidal and prevents emergence of resistance. The combination of aminoglycosides with other antibiotics produces synergistic effects. As far as literature says there are benefits of single daily dose of amikacin when compared with multiple daily doses considering toxicity. The benefits of using this drug is, it is cheaper, easily available, efficacious and has less side effects. Taking into account all these we designed the study to observe the role of intramuscular amikacin in cases of experimentally induced peritonitis in rat model. The present work was planned to find out the role of amikacin on bacterial growth in experimental model of peritonitis in rats.

Materials and Method
This study was conducted in Netaji Subhash Chandra Bose Government Medical College, India from May 2002 to July 2004. The study was done on 44 healthy albino male and female rats (Mus Norvagicus Albinus), to see the effect of Amikacin in cases of peritonitis on bacterial count in peritoneal fluid. The due approval and clearance from Institutional Ethics Committee for animals was obtained. According to the guidelines of Institutional Ethics Committee the animals were treated in humanely manner. The diet and water requirement of rats was taken care. After proper labeling of rats they were kept in hygienic conditions in separate cages.

Materials used
Mus Norvagicus Albinus Rats, 1ml Syringe, 2ml Syringes, Tuberculin Syringe, Povidone Iodine Solution, Ether, Escherichia coli suspension containing 1x10^9 Escherichia coli/ml suspension derived from Microbiology department, Amikacin injection 500mg, distill water for injection

Procedure
Rats were randomly divided into two equal groups
Group X: The abdomen was cleaned and 0.5ml of Escherichia coli suspension was instilled inside the peritoneal cavity in the right iliac fossa of the rats. No antibiotics were given and pneumoperitoneum was created after 4 hours.

Group Y: The abdomen of rats was cleaned and 0.5ml of Escherichia coli suspension was instilled inside the peritoneal cavity in the right iliac fossa. After 4 hours of the procedure pneumoperitoneum was created and injection amikacin was given according to the weight of rats.

After 72 hours, laparotomy was performed after proper sedation. After exploring the abdominal cavity for frank pus, pus pockets, adhesions and inflammation. The peritoneal fluid was collected from each rat and kept in different sterile vials after diluting it to 100 times and labeling them sent to Microbiology lab for culture. There was no evidence of injury to viscera during the prior procedure. The fluid was examined and cultured for the bacterial growth and colony counts.

Results
In group X where no antibiotics were used and suspension of E.coli was instilled and after 4 hours pneumoperitoneum was produced, on laparotomy on third day no pus pockets were seen but pus was observed in few rats and when peritoneal fluid was sent for culture there was growth of E. coli.

Group Y in which E.coli was instilled inside the peritoneal cavity and after 4 hours pneumoperitoneum was created and injection of amikacin
was given intramuscularly, on third day laparotomy was performed, no pus pockets were seen, peritoneal fluid was sent for culture which also showed growth of E.coli.

TABLE 1- Showing colony counts and standard deviation in each group

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean Colony counts</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group X</td>
<td>840</td>
<td>± 681.21</td>
</tr>
<tr>
<td>Group Y</td>
<td>220</td>
<td>±209.61</td>
</tr>
</tbody>
</table>

[ Table 1: Colony counts in each group]

TABLE 2- Showing t value and p value calculated by paired t test

<table>
<thead>
<tr>
<th>Groups</th>
<th>t value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tX/Y</td>
<td>5.59</td>
<td>p&lt; 0.05 *</td>
</tr>
</tbody>
</table>

[ Table 2: Comparative t-value of colony count between groups]

The results were calculated by paired t test and significance was noted. The mean colony count in group X was 840± 681.21 and mean colony count in group Y was 220 ±209.61 (Table.1)which was significantly less as compared to group X, the t value tX/Y = 5.59; p<0.05 * (Table.2)and the p value is significant. It shows that amikacin plays a greater role in inhibiting bacterial growth and reducing bacterial counts in peritonitis.

Discussion
Antibiotics play an important role in preventing infections, when there are chances of infection due to peritonitis. The main isolated bacteria from the culture of peritoneal fluids are E.coli and Klebsiella species. These bacteria are sensitive to drugs like Ceftazidime, Amikacin and Chloramphenicol. Studies have shown that gram negative bacteria show lowest resistance to Amikacin and Imipenem followed by other drugs. The efficacy of certain drugs increase by 99 to 100% when they are used along with amikacin. So it can be stated that the risk of infection reduces when amikacin is used alone or in combination with other drugs. Combination chemotherapy is a better option for producing good results in cases of peritonitis.

Efficacy of aminoglycosides and polypeptides when used in combination can give best possible results. When amikacin is compared with Isepamicin the efficacy of both the drugs is same so it is better to use Amikacin which is comparatively a cheaper drug. There is also reduction in rates of bacterial resistance when antibiotics are given in combination of amikacin. Even in pediatric age group a single daily dose of amikacin produces same results when compared to multiple doses of amikacin, the safety of drug also increases by low dosage of drug. The single dose of amikacin daily is found to be not associated with any renal damage. Increase in beta 2 microglobulin concentration in urine is responsible for renal failure in cases of aminoglycosides administration but it can be dealt with single daily dose. This antibacterial treatment provides greater efficacy in reducing the bacterial counts. Hence it can be concluded that amikacin is safe and less toxic.
The antibiograms show higher sensitivity to amikacin and netilmicin when compared to second and third generation cephalosporins. So the selection of antibiotics should be given priority in reducing infection, so if you are prescribing amikacin it means you are doing better for the patient. Amikacin is equally efficacious as other expensive molecules available and safe. It has been observed that use of Amikacin is cheaper when compared to other drugs and it is more beneficial when used in combination.

So if bacterial peritonitis sets antibiotics for controlling the growth of bacteria in peritoneal fluids are particularly useful. It is mandatory to use antibiotics in cases of peritonitis, the combination of antibiotics plays a major role in preventing infections because they are caused by multiple bacteria; aerobe or anaerobe. Along with antibiotics surgical treatment is also needed to reduce the bacterial load in cases of peritonitis.

In our experimental peritonitis model we compared the growth of bacteria in control group and amikacin group. We found that there was a reduced growth of bacteria in amikacin group when compared with control group.

Conclusion

From our study we can conclude that in cases of peritonitis it is mandatory to use antibiotics. Amikacin is a good and less expensive drug. When used in combination with other drugs the efficacy increases manifolds. This drug is cheaper, less toxic when used cautiously. It definitely reduces the bacterial load in cases of peritonitis as there in reduction number of colony counts in experimental animals.

References


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