Original Research Article

Antibiotic usage rates in bacterial versus nonbacterial diseases: a new way to monitor hospital-acquired infections in children: a retrospective case analysis

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ABSTRACT

Background: While treating children, the selection of antibiotics, when indicated, should be from the point of its effectiveness, safety, suitability, and cost. However, this flow of action does not take place in all cases. Aim of the study was to assess the antibiotic usage in admitted children and mortality.
Methods: The case records between January to July 2012 in children wards was evaluated for the use of antibiotics. Patients were grouped into; group A- 'must use' antibiotic in all, and group B- where antibiotics are not indicated.
Results: There were 1852 admissions, including 719 Thalassemia cases. Antibiotic usage was 63% in 1133 cases after excluding thalassemia. Out of 1133 cases, 423 were in group A and 710 cases were in group B. In group B the antibiotic usage was 41%. The mortality was 6.6% and 4.8% in group A and B. Inside group B, mortality was 5.9% versus 4.0% in those administered versus not administered, antibiotics.
Conclusions: There was no increase in mortality in patients in whom antibiotics were not prescribed, and no added benefit of prescribing antibiotics was observed in nonbacterial group B disease patients. The mortality was similar in both the groups. In nonbacterial group B, the antibiotics did not offer any advantage in the reduction of mortality, but increased the cost of the treatment, and possibly the chance of development of drug resistance and adverse events. When analysing the hospital antibiotic usage, only the nonbacterial diseases should be considered to get a true picture of the inappropriate prescription of antibiotics.

Keywords: Antibiotic resistance, Bacterial, Children, Hospital-acquired infections, Inappropriate antibiotic prescribing, Nonbacterial

INTRODUCTION

Antibiotics are among the most important discoveries of the past century. World Health Organization has defined the use of rational medication as "providing medication to individuals easily, at the lowest prices and for the most suitable dosages and periods according to clinical findings and personal characteristics of individuals".

The effective medication groups must be listed and among these medications, the most suitable antibiotic must be selected from the point of its effectiveness, safety, suitability and cost effectiveness. However, this flow of action does not work in all cases. Antibiotics are in the list of most frequently used medications in most countries.

A significant part of the antibiotic application is empirical. Most of the acute respiratory tract infections are of viral origin, where the antibiotics neither affect the duration, symptoms, and intensity of the illness nor avoid the development of secondary infections.[1] Antibacterial

resistance has increased in the last 20 years as a global issue.[2] Incorrect prescription of antibiotics to a significant portion of the patients leads to increase in health-care costs, sickness, and death.

Aim

The aim of this study was to assess retrospectively, the prevalence of antibiotic use in admitted children, and outcome.

METHODS

Study type, place and duration

This study was a retrospective analysis of case records from January to July- 2012 at children wards, Sir TG Hospital, Bhavnagar to evaluate the use of antibiotics.

All the cases records of admitted patients during that period were studied. Neonates were not included in study. A list of 32 main diseases was prepared and the use of antibiotics in each disease was evaluated. Type and number of antibiotics and duration of treatment was not taken into account. After excluding thalassemia cases, they were grouped into two disease groups. Group A or antibiotic group, wherein antibiotics have to be used and were used in all cases, e.g. pyogenic meningitis, tetanus, diphtheria, tuberculosis, pneumonia- a 'must use' bacterial disease group. Group B or nonbacterial/no antibiotic disease group including acute diarrhoea, where antibiotics are not to be used in all cases, e.g. infective hepatitis, acute flaccid paralysis, malnutrition, measles, asthma etc.

The data was reviewed to determine: (1) whether antibiotics were prescribed or not and (2) outcome of patients.

Statistical analysis

Chi-square test of 2×2 tables at 0.05 level of significance to calculate the p value.

RESULTS

There were total 1852 admissions, of which 719 were Thalassemia cases. Out of remaining 1133 cases in the study, 423 were from group A bacterial disease list and 710 were from group B nonbacterial, no antibiotic diseases (Table 1). Other results are as shown in Tables 2 and 3.

As seen in Table 1, out of 1133 cases (excluding 719 thalassemia out of total 1852), 712 (62.84%) received antibiotics and 421 (37.16%) did not, this indicates significant use of antibiotics. If thalassemia cases are included, then total 38.44% (712/1852) received antibiotics; while 20.22% (289/ 710+719), from group B had received antibiotics. All (423) patients from group A

received antibiotics. Out of 710 patients from group B, 289 (41%) received antibiotics and 421 (59%) were treated without antibiotics.

Table 1: Flowchart antibiotic use and mortality excluding neonates.

Type of cases	Number (%)	Expiry (%)
Total cases	1852	62 (3.35)
Total studied (excluding 719 thalassemia)	1133 (100)	62 (5.47)
Group A (antibiotics in all)	423 (37.3)	28 (6.62)*
Group B	710 (62.7)	34 (4.79)*
Antibiotic given (Gr B)	289 (40.7)	17 (5.88)^
Antibiotics not given (Gr B)	421 (59.3)	17(4.04)**^
Antibiotic given (Gr A + Gr B)	712 (62.8)	45 (6.32)**

Gr A- bacterial, Gr B- nonbacterial/no antibiotic diseases.
*p=0.216 showing similar mortality in both groups, ^p=0.28, **p=0.12

Table 2: Types of disease and mortality in bacterial disease group A.

Disease	No. of cases	expiry
Pyogenic meningitis	32	06
Tetanus	17	03
Diphtheria	06	02
Tuberculosis	23	00
Pneumonia	165	06
Streptococcal tonsillopharyngitis	14	00
Enteric fever	97	00
Pertusis	10	00
Septicemia	18	10
Cholera	05	00
Severe malnutrition	36	01
Total	423	28 (6.62%)

As can be seen from Tables 1 to 3, the p values for the deaths in antibiotic and no antibiotic groups were similar with non-significant p values. In group B diseases where antibiotics were not indicated, there was no advantage of using or not using the antibiotics in terms of deaths.

DISCUSSION

We decided to do this study retrospectively because blinding is not possible in case of a prospective study, as once a treating physician knows that the study is going on, he may change his pattern of prescribing antibiotics during that particular study period. We decided to study as two groups, because prevalence of bacterial disease in a country and during different seasons in that country affects the antibiotic usage.

Table 3: Types of disease and mortality in nonbacterial group B.

Diseases	Total	Antibiotics (expiry)	No antibiotics (expiry)
Infective hepatitis	32	01 (0)	31 (0)
Acute flaccid paralysis	11	03 (2)	08 (2)
Mild malnutrition	03	00 (0)	03 (0)
Cardiac disease	44	28 (8)	16 (5)
Asthma	31	01 (0)	30 (0)
Dengue fever	01	00 (0)	01 (0)
Diarrhoea	132	34 (0)	98 (0)
Epilepsy	86	03 (0)	83 (2)
Snake bite	04	02 (0)	02 (0)
Bronchiolitis	51	03 (0)	48 (0)
Organophospharous poisoning	01	00 (0)	01 (1)
Kerosene poisoning	18	01 (1)	17 (1)
Anaemia	42	00 (0)	42 (2)
Nephrotic syndrome	35	26 (0)	09 (0)
Renal failure	05	03 (2)	02 (2)
Encephalitis	06	04 (3)	02 (2)
Malaria	19	04 (0)	15 (0)
Measles/post measles	26	14 (0)	08 (0)
Scorpion sting	05	01 (0)	04 (0)
Sickle cell disease	14	12 (1)	02 (0)
Tonsillopharyngitis	149	149 (0)	00 (0)
Total	710	289 (17) (5.88%)*	421 (17) (4.04%)*

*Chi sq.=1.1579; p=0.28 - not significant

In this study, 63% patients received antibiotics. This is more as compared to study in India by Sriram et al in December 2008 (52.2%) and Pradeepkumar et al (50.5%), and comparable with the study by Mora et al, at 65%.[1-3] Antibiotic usage was similar to the study by Gerber et al, at 60%.[4]

In group A diseases, we cannot avoid use of antibiotics because all these are bacterial infections; but in group B disease, we can avoid the antibiotic usage. All group B diseases can be treated without antibiotics and there are no added benefits of using antibiotic in these cases.

Mortality was 28 (6.62%) from group A and 34 (4.79%) from group B (p=NS). There was no significant difference in mortality in group B patients in whom antibiotics were used (5.88%) as compared to those in whom antibiotics were not used (4.04%) (p=0.28).

Akande et al reported that from 370 proven respiratory syncytial virus (RSV) infection children <2 years, 30% (110) were started on iv antibiotics; 75% (82) empirically who had hospital stay of >3 days (p=0.04); and in 83% (91) it was continued even after reports documented RSV.[5] Continued antibiotic usage, which was started empirically based on fever on admission and ordering sepsis workup, was associated with an increased hospital stay LOS, (R=0.15, p=0.0082). Ergül et al from Turkey reported that the one-third children received inappropriate or unnecessary antibiotics.[6] Kimura et al from Japan reported antibiotic use of 31.65% in non-bacterial acute respiratory infections in all age groups and has advocated to promote antimicrobial stewardship program.[7] Yoshida et al from Japan reported in children that inappropriate prescriptions for non-bacterial upper respiratory infections was 66%.[8]

Thus above results and discussion suggests that empiric antibiotic use is widespread, though there is no role of empirical antibiotics, when it is not indicated in nonbacterial diseases; and also in terminal stages of nonbacterial diseases wherein, antibiotics are neither effective nor recommended.

CONCLUSION

Antibiotic use, prevalence and outcome are affected by prevalence of bacterial disease in a particular region/ country and season. In this study, out of 1133 patients, in 712 patients antibiotics was used, and in 421 patients it was not used. However, there was no difference in mortality or morbidity in both the groups. No added benefit of prescribing antibiotics was observed in the nonbacterial group B disease patients. The mortality was similar in group A and group B. In group B, the antibiotics did not offer any advantage in reduction of mortality, but unnecessarily increased the cost of the treatment. Inappropriate use of antibiotics may increase the chances of development of drug resistance.

This paper looks at a new way to reduce hospital-acquired infections, by monitoring antibiotic usage and not by merely monitoring the hospital-acquired infection rates.

In our facility there is scope of cutting down of antibiotic use in diarrhoea and cardiac diseases. WHO does not recommend antibiotics for acute diarrhoea even when caused by a bacteria.

Recommendations

When monitoring hospital antibiotic use policy, it should be monitored in group A and B diseases separately. Thus, the changing prevalence of bacterial illnesses in different regions or seasons will not modify the antibiotic use pattern in group B conditions where it is not indicated. Education and awareness of physicians in antimicrobial stewardship program (ASP) is needed.

Monitoring of hospital-acquired infections must include antibiotic use rate (in group A and B diseases separately)

and not only hospital acquired sepsis rate (any facility may show near to zero hospital-acquired infection rate for some months if they use higher level than recommended or highest category antibiotics in all the patients, stating 'why take a chance?').

Rational use of antibiotics should be embraced as the principal strategy to control the increase in drug resistance, to reduce the cost, and to prolong the usefulness of antibiotics.

The departments should conduct internal audits in their units/wards regarding use of antibiotics in group B disease with aim to cut down unnecessary or indiscriminate use of antibiotics.

This paper looks at a new way to reduce hospital-acquired infections, by monitoring antibiotic usage and not by merely monitoring the hospital-acquired infection rates.

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