Prescribing patterns among paediatric inpatients in a teaching hospital in western Nepal

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ABSTRACT

Introduction: Infants and children constitute a large proportion of the population in developing countries. In Nepal, studies on drug use patterns in the paediatric age group are lacking in hospitals in the western region. The present study was carried out to obtain demographical information and information on the prescribing patterns of drugs. The antibiotic sensitivity patterns of commonly-isolated micro-organisms and the mean cost of drugs were obtained.

Methods: The study was carried out over a four-month period (December 1, 2003 to March 31, 2004) at the Manipal Teaching Hospital, a tertiary care hospital in Pokhara, western Nepal. The case records of patients discharged from the paediatrics ward during the study period were analysed. Mean number of drugs prescribed was calculated. The percentage of admissions that were prescribed antibiotics was determined.

Results: 356 patients were admitted during the study period, of which 228 were male. The median duration of hospitalisation was four days. The mean number of drugs prescribed per admission was 4.5. 789 drugs (48.9 percent) were prescribed by the parenteral route. Antibiotics were prescribed in 249 admissions (69.9 percent). *Staphylococcus aureus, Escherichia coli,* and *Acinetobacter* species were the common organisms isolated, and were resistant in some cases to the commonly-used antibiotics. The mean (+/- standard deviation) cost of drugs per admission was 5.4 (+/-1.6) US dollars.

Conclusion: Prescribing by generic name should be encouraged. Use of parenteral antibiotics was high and route conversion programmes should be instituted. Use of antibiotics for predominantly viral infections should be reduced. Treatment guidelines for common conditions should be formulated.

Keywords: antibiotics, children, drug prescription, drug utilisation, parenteral drugs

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INTRODUCTION

Medical audit oversees the observance of standards of medical treatment at all levels of the healthcare delivery system[1]. The study of prescribing patterns is a part of the medical audit and seeks to monitor, evaluate, and if necessary, suggest modifications in prescribing practices to make medical care rational and cost-effective[2]. Nepal is a developing country in South Asia, with a population of 24.6 million in 2002 and an annual population growth rate of 2.3%[3]. More than half of the total population is in the paediatric age group[4]. Infants and children are especially vulnerable to contract illnesses and to the harmful effects of drugs due to differences in pharmacodynamics and pharmacokinetics[5].

Studies have indicated that children were prescribed drugs frequently and the mean number of drugs was as high as 5.5[6,7]. Antibiotics are commonly prescribed in paediatric patients[8,9]. In developing countries like Nepal, the paediatrician faces a shortage of culture and sensitivity data to guide antibiotic usage due to various reasons. In Nepal, studies on prescribing patterns of antibiotics in the paediatric age group have been conducted in the Kathmandu valley and in eastern Nepal[10,11]. However, studies in the western development region and in Pokhara are lacking. Such studies are required to obtain baseline data about prescribing habits and to communicate to the prescribers the various lacunae observed to improve prescribing. The data will also be helpful in planning longitudinal studies on prescribing and drug use patterns.

The present study was carried out to obtain baseline data on prescribing patterns among

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paediatric inpatients. The objectives of the study were to: (1) Obtain information on the age, sex, length of stay and illness of patients admitted in the paediatrics ward during the study period. (2) Obtain information on the prescribing patterns of drugs. (3) Calculate the mean (± standard deviation [SD]) number of drugs prescribed per admission, and the percentage of drugs prescribed from the essential drug lists. (4) Enumerate the specimens sent for culture and sensitivity testing, the organisms isolated and their antibiotic sensitivity patterns. (5) Calculate the mean (± SD) cost of drugs per hospital admission and the percentage of the cost contributed by parenteral preparations and antibiotics.

METHODS

The study was carried out over a four-month period from December 1, 2003 to March 31, 2004 at the Manipal Teaching Hospital, a tertiary care hospital attached to the Manipal College of Medical Sciences, Pokhara, Nepal. The case records of patients discharged from the paediatric ward during the study period were taken up for analysis. The records were obtained from the medical records department of the hospital. The age and sex of the patients were recorded. The date of admission and of discharge was noted. For calculating the length of stay, the day of admission was included, while that of discharge was excluded. The diagnosis written in the discharge summary was noted. The name, dose, frequency, duration and route of administration of drugs prescribed during hospital stay were recorded. The mean ± SD number of drugs prescribed per admission was calculated.

The most commonly-prescribed drug classes and individual drugs were noted. The percentage of drugs prescribed from the essential drug list of Nepal [12] and the World Health Organisation (WHO) list of essential drugs[13] was derived. The percentage of the drugs prescribed by the parenteral route (intravenous, intramuscular, per rectal, suppository, nebulisation, metred dose inhaler, eye and ear drops, and skin preparations) was calculated. The percentage of admissions in which an antibiotic was prescribed was determined. Antibiotic use was classified as for prophylaxis, bacteriologically-proven infection (BPI) or non-bacteriologically-proven infection (non-BPI), and others. The use of antibiotics which did not clearly fall into prophylaxis, BPI or non-BPI was classified as others.

Details of the specimens sent for culture and sensitivity testing, the organisms isolated and their antibiotic sensitivity patterns were determined. The mean (± SD) cost of drugs per admission was calculated in Nepalese rupees and US dollars using the price list supplied by the hospital pharmacy. The percentage of the total cost contributed by parenteral preparations and antibiotics was determined. The appropriateness of drug prescribing in various conditions in relation to the diagnosis was considered.

RESULTS

356 patients were admitted to the paediatric wards of the Manipal Teaching hospital during the study period, of which 228 were male. 35 patients were less than 28 days old, 76 were between 28 days to one year old, 122 were between the ages of one to five years old, while 79 were between five to ten years old. 44 patients were above the age of ten years but below 14 years. 139 patients were from Pokhara city, while 92 were from the Kaski district in which Pokhara is situated. Among the neighbouring districts, the most number of patients was from Tanahun and Syangja.

The majority of patients (248 [69.7%]) were hospitalised for between one and four days. The median duration of hospitalisation was four days. Acute gastroenteritis (59 patients [16.6%]) was the most common reason for hospitalisation. Other common illnesses were viral fever, upper respiratory tract infections (URTI), bronchopneumonia, seizure disorder, and neurocysticercosis. Four children were HIV-positive. A total of 1,614 drugs were prescribed to the 356 patients. The mean (± SD) number of drugs prescribed was 4.5 (±3.7). 723 drugs (44.8%) were prescribed from the essential drug list of Nepal, while 738 (45.7%) were prescribed from the WHO list of essential drugs. 938 drugs (58.1%) were prescribed by generic name.

Table I shows the most commonly-prescribed classes of drugs in the paediatric ward during the study period. Antibiotics were most commonly-prescribed, followed by antipyretic and anti-inflammatory drugs and intravenous fluids. The most commonly-used individual drugs are shown in Table II. Ampicillin and paracetamol were most commonly used. 97 specimens were sent for culture and sensitivity testing. Blood (50 specimens [51.5%]), urine (17 specimens [17.5%]), stool (16 specimens [16.5%]) and cerebrospinal fluid (seven specimens [7.2%]) were the most common. No growth was reported in 58 specimens, while no salmonella, shigella or vibrio was grown in the stool specimens. Insignificant bacteriuria

was seen in six specimens, while normal flora was grown in five specimens (four throat swab specimens and one sputum specimen). The antibiotic sensitivity patterns of the isolated micro-organisms are shown in Table III.

Table I. Most commonly-prescribed drug classes in the paediatric ward.

Drug class	Number (%)
Antibiotics	371 (23)
Anti-pyretic and anti-inflammatory	177 (11)
Intravenous fluids	154 (9.5)
Anti-epileptics	106 (6.6)
Anti-asthma drugs	99 (6.1)
Anti-emetics	70 (4.3)
Anti-ulcer drugs	67 (4.1)
Diuretics	33 (2)
Corticosteroids	32 (2)
Anti-tuberculosis drugs	29 (1.8)

Table II. Most commonly-used individual drugs in paediatric inpatients.

Drug	Number (%)
Ampicillin	155 (9.6)
Paracetamol	140 (8.7)
Paediatric balanced fluid with dextrose	112 (6.9)
Domperidone	55 (3.4)
Ranitidine	49 (3)
Cefotaxime	47 (2.9)
Salbutamol	44 (2.7)
Midazolam	41 (2.5)
Cetrizine	28 (1.7)
Gentamicin	24 (1.5)

No antibiotics were used in 107 admissions (30%) while a single antibiotic was prescribed in 147 admissions (41.3%). Two, three and four antibiotics were prescribed in 80 (22.5%), 19 (5.3%) and 3 (0.8%) admissions, respectively. Antibiotics were prescribed for non-BPI in 146 cases and for BPI in 12 cases. Antibiotics were used for prophylaxis in traumatic injuries (four cases) and to prevent opportunistic infections in HIV-positive patients (two cases). In 44 patients, the antibiotics were used in viral infections while in 41 patients, they were used without a definite indication. The use of antibiotics to prevent secondary bacterial infections in a viral infection was not taken as a use for prophylaxis.

789 drugs (48.9%) were prescribed by the parenteral route, 616 drugs (38.2%) were prescribed by the intravenous route, 73 drugs (4.5%) were given by nebulisation, while 43 drugs (2.7%) were given as nasal drops. 14 drugs were applied to the skin, and 112 drugs (6.9%) were fixed-dose combinations (FDCs). The mean (± SD) cost of drugs per hospital admission was 401.6 (±120.5) Nepalese rupees (5.4 ±1.6 US dollars). Antibiotics contributed to 52.5% of the total drug cost. Injectable preparations (including intravenous fluids) were responsible for 66.4% of the total drug cost, while intravenous fluids alone were responsible for 6.5% of the drug cost. Nebulised solutions contributed to 13.4% of the cost.

The use was not appropriate for the clinical diagnosis in 93 patients (26.1%). The problems observed were use of antibiotics in viral infections and in fever under investigation. In two patients, antibiotics and antifungals were used together without arriving at a specific diagnosis while in three patients, broad-spectrum coverage using

Table III. Sensitivity patterns of commonly-isolated organisms in paediatric inpatients.

Organism	Number isolated	Clox	Genta	Eryth	Pn	Ampi	Cipro	Cefta	Ceftri	Amika	Nor	Cotri	Nitro	Vanco
Staphylococcus aureus	3	2/2 (100)	2/3 (67)	1/2 (50)	0/3 (0)	1/1 (100)	2/2 (100)	ND	ND	ND	ND	0/1 (0)	ND	1/1 (100)
Escherichia coli	3	ND	2/3 (67)	ND	ND	1/2 (50)	0/1 (0)	ND	1/1 (100)	0/2(0)	2/3 (67)	0/3 (0)	2/2 (100)	ND
Acinetobacter spp.	3	ND	3/3 (100)	ND	ND	1/2 (50)	2/2 (100)	1/1 (100)	1/1 (100)	ND	ND	ND	ND	ND
Pseudomonas spp.	1	0	1/1 (100)	ND	ND	1/1 (100)	1/1 (100)	1/1 (100)	1/1 (100)	ND	ND	ND	ND	ND
Klebsiella pneumonia	1	ND	1/1 (100)	ND	ND	ND	ND	0/1 (0)	ND	0/1 (0)	1/1 (100)	1/1 (100)	1/1 (100)	ND

Key: Clox: Cloxacillin; Genta: Gentamicin; Eryth: Erythromycin; Pn: Penicillin; Ampi: Ampicillin; Cipro: Ciprofloxacin; Cefta: Ceftazidime; Ceftri: Ceftriaxone; Amika: Amikacin; Nor: Norfloxacin; Cotri: Cotrimoxazole; Nitro: Nitrofurantoin; Vanco: Vancomycin; ND: Not done.

a combination of antibiotics was administered without considering the commonest causative organisms. H_2-blockers were used in three patients without a proper indication.

DISCUSSION

Neonatal sepsis and neonatal hyperbilirubinaemia were common conditions, necessitating admission in neonates (<28 days of age). Acute gastroenteritis and lower respiratory tract infections were common illness in the older age groups. In a study in Karachi, Pakistan, the presenting complaints were fever in 18%, cough in 9%, both fever and cough in 21%, vomiting in 20% and diarrhoea in 41% of encounters[14]. However, the Pakistani study was carried out among outpatients while our study was among paediatric inpatients.

The number of male patients was more than females and the ratio was more than that expected from the sex ratio of Nepal[4]. A similar result was observed in a previous study[11]. Further studies are required on the utilisation of health services by male and female children. The mean (± SD) number of drugs prescribed was 4.5 (±3.7). This is less than the mean number of drugs prescribed in a previous study[11]. This is a welcome trend as there is an increased risk of drug interactions and errors of prescribing with polypharmacy. Antibiotics were the most commonly-prescribed class of drugs and 70% of admissions were prescribed antibiotics.

In eastern Nepal, it was observed that 84% of patients were prescribed an antimicrobial, and antimicrobials constituted 42.8% of the total drugs[15]. The percentage is higher than that reported from a study in the Netherlands, where 36% of hospitalised children received antibiotics[16]. However, in a study in a paediatric hospital in the Kathmandu valley, 93% of patients were prescribed at least one antibiotic[11]. In a study by Marlies et al, 36% of patients were prescribed at least one antibiotic[17]. It is difficult to draw firm conclusions as the morbidity profile and the socioeconomic status of the different study populations may not be matched.

In our study, antibiotics were used for BPI in only 4.8% of cases. In a previous study, antibiotics were used for BPI in 32% of cases[18]. In a previous study in Nepal, the prescription of antibiotics was mainly based on clinical judgment without investigation[11]. For proper antimicrobial prescribing, the clinician should try to define the type of infection and the presumable causative micro-organisms. Adjustment of the initial therapy based on the results of the microbiological laboratory and the clinical course of the illness is one of the most relevant steps in antimicrobial prescribing[19]. In our study, many culture results were negative or isolated normal flora. The high cost of culture and sensitivity testing may be another factor preventing the widespread use of culture and sensitivity testing.

Staphylococcus aureus and *Escherichia coli* that were isolated were, in some cases, resistant to the commonly-used antibiotics. However, the small number of isolates makes it difficult to draw firm conclusions. Ampicillin, cefotaxime and gentamicin were the most commonly-used antibiotics and the organisms were generally sensitive to these antibiotics. In a study in eastern Nepal, gentamicin, ampicillin, crystalline penicillin and cefotaxime were most commonly prescribed[10]. In a study in a teaching hospital in Bangladesh, the most commonly-prescribed antibiotics were ampicillin, gentamicin, amoxicillin, cloxacillin and ceftriaxone[20]. Our antibiotic use patterns were broadly comparable to those reported in these studies.

48.9% of the drugs were prescribed by the parenteral route. Antibiotics, intravenous fluids, antiepileptic drugs and drugs for bronchial asthma were commonly-prescribed parenterally. As noted in a previous study,[18] the patients were usually discharged once the antibiotics were changed from the parenteral to the oral route. Previous studies in Nepal had reported that the proportion of antibiotics prescribed parenterally varied from 53.8% to 75%[11]. In our study, 61.7% of antibiotics were prescribed parenterally. The parenteral route may be necessary in paediatric patients but is more expensive in terms of nursing resources. Disposable syringes are used to administer antibiotics, thus reducing the risk of infection but adding to the cost of treatment.

The mean cost of drugs was 401.6 Nepalese rupees (5.4 US dollars). Antibiotics contributed to 52.5% of the total drug cost. The cost contributed by antibiotics is comparable to that observed in a study in Kathmandu, where the average cost incurred on antibiotics was around 250 Nepalese rupees (3.4 US dollars)[21]. Cost is an important factor influencing access to treatment in a developing country like Nepal. Injectable antibiotics, intravenous fluids and nebulised solutions were major contributors to the drug cost. In Canada, an antimicrobial route conversion programme was successful in reducing the frequency of use of parenteral antibiotics and the cost of treatment[22].

A similar programme may be tried in our institution but the patients are reluctant to stay in the hospital once parenteral antibiotics are stopped. Patient education may be helpful. The use of antibiotics for acute gastroenteritis, viral fever and fever under investigation were some of the problems observed. A study in Madagascar found irrationality in antibiotic prescribing[23], while a Canadian study found that antibiotics were commonly prescribed for predominantly viral infections[8].

Our study had many limitations. The study was carried out over a four-month period, and seasonal variations in disease pattern and drug utilisation were not considered. The study was carried out during the winter and spring/summer months. Seasonal variations should be explored further in future studies. A study of one-year duration can nullify the effect of seasonal variations. The number of organisms isolated on culture and sensitivity testing was low, and it would be difficult to extrapolate the results. Only the drug costs were considered, and other costs were not taken into account. We looked at the appropriateness of prescribing in relation to the diagnosis and observed problems, especially with the use of antibiotics. However, the number of patients in our study was low and the viability of subcategory analysis may be low.

The number of drugs prescribed by generic name was low, and efforts must be made to encourage prescribing by generic names. The use of parenteral drugs was high and route conversion programmes for antibiotics should be encouraged. Antibiotic use for BPI was low, and efforts to prescribe antibiotics on a sound bacteriological basis should be encouraged. Antibiotic use for predominantly viral infections should be reduced. Standard treatment guidelines for the treatment of common diseases should be formulated. Further studies for a longer time period and with a larger patient number should be carried out.

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REFERENCES

1. Curtis P. Medical audit in general practice. J Roy Coll Gen Pract 1974; 24:607-11.
2. Srishyla MV, Krishnamoorthy M, Naga Rani MA, et al. Prescription audit in an Indian hospital setting using the DDD (defined daily dose) concept. Indian J Pharmacol 1994; 26:23-8.
3. World Health Organization. The World Health Report 2004. Changing history. Geneva: World Health Organization, 2004:116.
4. Central Bureau of Statistics. Population Monograph of Nepal. Volume 1. Kathmandu: Central Bureau of Statistics, 2003.
5. Walson PD. Paediatric clinical pharmacology and therapeutics. In: Speight TM, Holford NHG, eds. Avery's Drug Treatment. Auckland: ADIS International, 1997: 127-223.
6. Beria JU, Victoria CG, Barros FC, et al. Epidemiology of drug consumption in children of urban centers of the Southern region of Brazil. Rev Saude Publica 1993; 27:95-104.
7. Kolar JV, Kadakova E. Prescription of antimicrobial drugs to hospitalized children. Ann Pharmacother 1993; 27:974-7.
8. Pennie RA. Prospective study of antibiotic prescribing for children. Can Fam Physician 1998; 44:1850-6.
9. Sanz EJ, Bergman U, Dahlstorm M. Paediatric drug prescribing. Eur J Clin Pharmacol 1989; 37:65-8.
10. Rauniar GP, Naga Rani MA, Das BP, et al. Prescribing pattern of antimicrobial agents in paediatric in-patients. J Nepalgunj Med Coll 2003; 3:34-7.
11. Palikhe N. Prescribing pattern of antibiotics in paediatric hospitals in Kathmandu valley. Kathmandu Univ Med J 2004; 2:6-12.
12. Department of Drug Administration. National List of Essential Drugs Nepal (3rd revision). Kathmandu: Department of Drug Administration, 2002.
13. World Health Organization. WHO Model List of Essential Medicines. 13th ed. (Revised April 2003). WHO Medicines Bookshelf 4.0. Geneva: World Health Organization, 2003.
14. Nizami SQ, Khan IA, Bhutta ZA. Paediatric prescribing in Karachi. J Pak Med Assoc 1997; 47:29-32.
15. Rehana HS, Naga Rani MA. A study on the drug prescribing pattern and use of antimicrobial agents at a tertiary care teaching hospital in eastern Nepal. Indian J Pharmacol 1998; 30:175-80.
16. van Houten MA, Luinge K, Laseur M, et al. Antibiotic utilization for hospitalized paediatric patients. Int J Antimicrob Agents 1998; 10:161-4.
17. van Houten MA, Luinge K, Laseur M, Kimpen JL. Antibiotic utilization for hospitalized paediatric patients. Int J Antimicrob Agents 1998; 10:161-4.
18. Shankar PR, Partha P, Shenoy NK, et al. Prescribing patterns of antibiotics and sensitivity patterns of common microorganisms in the Internal Medicine ward of a teaching hospital in Western Nepal: a prospective study. Ann Clin Microbiol Antimicrob 2003;2:7. Available at: www.ann-clinmicrob.com/content/2/1/7. Accessed January 25, 2005.
19. van der Meer JWM, Gyssens IC. Quality of antimicrobial drug prescription in hospital. Clin Microbiol Infect 2001; 7(6 Suppl):12-5.
20. Akter FU, Heller D, Smith A, et al. Antimicrobial use in paediatric wards of teaching hospitals in Bangladesh. Mymensingh Medical J 2004; 13:63-6.
21. Jauhari AC, Pokharel A, Palikhe N, et al. Pharmacoeconomic aspects and pattern of antibiotic prescriptions in four major hospitals in Kathmandu. J Nepal Med Assoc 2004; 43:31-5.
22. Zamin HT, Pitre MM, Conly JM. Development of an intravenous to oral route conversion program for antimicrobial therapy at a Canadian tertiary health care facility. Ann Pharmacother 1997; 31:564-70.
23. Rasamoelisoa JM, Tovone XG, Andriamady C, et al. Evaluation of the use of antibiotics in the hospital paediatric milieu. Arch Inst Pasteur Madagascar 1999; 65:124-6.