

Original Article

ANTIBIOTICS UTILIZATION PATTERNS AND DIRECT COST IN AN EMERGENCY TREATMENT UNIT IN SRI LANKA

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ABSTRACT

Objective: Anecdotal evidence suggested that antibiotics are frequently used in the Emergency Treatment Units in Sri Lanka, mostly for the respiratory tract, soft tissue or urinary tract infections. This study aimed to describe the utilization patterns of antibiotics in terms of most common type, indication and associated direct cost in ETU at the Teaching Hospital Karapitiya, Sri Lanka.

Methods: In this study, utilization patterns and the direct cost of antibiotics in an emergency treatment unit was evaluated by checking the bed-head tickets of all patients admitted to the unit from 1/5/16 to 15/5/16. Out of the 414 bed-head tickets checked 156 patients were receiving antibiotic treatment. Socio-demographic characteristics were analyzed. The prices of antibiotics in SriLankan government hospitals were taken from the hospital medical supply division price list. Data were analyzed by Microsoft Excel™.

Results: In this study, 45.5% (out of 156 patients) were aged between 61-80years. The most used antibiotic was amoxicillin/clavulanic acid (18.1%) and clarithromycin (15.5%). Generic antibiotics were used for most patients (95.58%). Fixed-dose combinations were used in 18.5% of cases, including amoxicillin/clavulanic acid and piperacillin/tazobactam. The common indications for prescribing antibiotics were respiratory tract infections (31.2%) and soft tissues injuries (12.1%).

Conclusion: This study revealed that there is apparent overuse of antibiotics and reveals that antibiotic stewardship programme could reduce antibiotic use, antibiotic resistance, and cost. Improved understanding of the rationale for antibiotic use would contribute optimising their use. Further studies are needed to establish the extent of sub-optimal prescribing of antibiotics in Sri Lankan hospitals.

Keywords: Antibiotic cost, Sri Lanka, Antibiotic resistance, Antibiotics utilization, Emergency department

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INTRODUCTION

Emergency Treatment Unit (ETU) is the term used to refer to the emergency department in Sri Lankan hospitals. The ETUs use adult modified triage scale [1] to triage patients who require immediate attention due to life-threatening conditions, traumatic injuries, poisoning, and snake bites and usually patients are categorised into four groups in this unit [2]. The ETUs in tertiary care hospitals in developing countries face heavy patient loads with many of those seen require antibiotics treatment [3]. If antibiotics are prescribed only empirically, suboptimal or appropriately and complicated with poor patient adherence; they can lead to antibiotic resistance (ABR). The ABR is of growing clinical and economic significance and the greatest burden occurs in low and middle-income countries (LMICs) [4, 5].

Inappropriate prescribing of antibiotics has been noted in many developing countries [6]. Despite most of the URTIs are viral infections there appears to be a high prevalence of antibiotics prescribed for viral URTIs in developing and transitional countries, ranging from about 40% to 75% [2, 6]. A recent country-specific analysis reported a high rate of antibiotic use for viral URTIs in public primary care facilities including in Sri Lanka (70%) [7].

The impact of ABR is greatest in low-income countries, facing the double burden of fewer antibiotic choices and higher rate of infectious disease [8]. To develop effective strategies for rational prescribing of antibiotics a better understanding of the factors influencing local prescribing decisions is essential [9]. Therefore, medicine utilization studies are vital to understanding prescribing pattern specific to that institution or a country specifically with antibiotic where inappropriate use of antibiotics are associated with ABR [10, 11].

The World Health Organisation (WHO) defined drug utilisation as; the marketing, distribution, prescribing, dispensing and administration of medication, with consideration of its use economic

burden [12]. The purpose of drug utilisation studies is to optimise medication use by identifying, documenting, and analysing problems in drug utilisation, including comparing patterns of use of specific drugs between prescribers and institutions [13-15].

WHO introduced a set of core drug-use indicators that include the average number of medications per prescription, percentage of antibiotics, percentage of generics and brands, percentage of injections and percentage of drugs prescribed from an essential medicine list [12, 16]. Cheekavolu *et al.* (2011) found the majority of medications were prescribed by trade name, antibiotics were prescribed for 21.78% of all patients on admission, due to overestimation of the severity of illness or as prophylaxis, increasing the cost of medications used in the ETU [17].

A retrospective cohort study on antibiotic utilisation for acute respiratory tract infections in a United States ETU, reviewed 126 ETU patients' visit records. Antibiotics were prescribed in 61% of all patients with the lowest prescribing rate in patients aged between five and 19 y and the highest in patients aged between 20 and 64 y [18]. Routine prophylactic antibiotic use in the management of snakebite in Zimbabwe has observed 69 patients received antibiotics and over 40% of the antibiotics were given parentally with estimated cost of US\$ 522.98 per patient [19].

In South Africa, a retrospective chart review on antibiotic prescribing patterns in the paediatric emergency department at Georgetown public hospital corporation examined 811 patient encounters; an average of 2.5 medications was prescribed per encounter (the WHO standard is 2.0). One or more antibiotics were prescribed among 36.9% patients (the WHO standard is 30%) where 90.83% of antibiotics were prescribed from the essential or formulary list and 30% of prescriptions included the generic names and 75% of them were broad-spectrum antibiotics [8, 12].

Studies evaluating antibiotic utilisation patterns and the associated costs in Sri Lankan hospitals are lacking but antibiotic prescribing in the primary care settings and inappropriate dispensing for minor infections is reportedly alarmingly high in the outpatient settings [9, 17] Therefore, this study aimed to understand antibiotic utilisation patterns and associated direct costs in an ETU setting in Sri Lanka.

MATERIALS AND METHODS

Methods

The objective was to describe the utilisation patterns of antibiotics in the ETU setting at a teaching hospital, Sri Lanka in terms of the most common type of antibiotic prescribed, indications and determine associated direct cost.

This was a prospective cross-sectional study, undertaken at the teaching hospital Karapitiya, Sri Lanka. The study population was patients who were admitted to the hospital ETU during the two-week period from 01/05/2016 to 15/05/2016. Only patients who received antibiotics were included in the study. The study was approved by the Ethics Review Committee, Faculty of Medicine, University of Ruhuna Sri Lanka and prior approval were also obtained from the director of the hospital, and the consultant physician and nurse in charge of the ETU.

Data collection

Data were collected prospectively from patients' records by checking bed head tickets (BHT) and other medical records for antibiotics use. Public hospitals in Sri Lanka record all the patient's information including diagnosis, patient examination detail, lab tests performed, drugs prescribed and manually. Demographic characteristics including age and gender were recorded. The name of the antibiotic, strength, dose, dosage form, frequency and duration of the regime, and indication were written down from the BHT. The cost of antibiotics was obtained from the estimate of the Sri Lanka Medical Supply Division (MSD), the department responsible for supplying all the medicines and devices to the public hospitals.

Measures

The direct cost for antibiotics and the average number of antibiotics per prescription was calculated. The cost was estimated in Sri

Lankan Rupees (LKR) and converted to US dollar-based on online World Bank currency conversion rate.

Data analysis

Data were analysed descriptively using Microsoft Excel™ including mean (SD), median (IQR) were used to describe the interval data, whereas proportion and percentages were used to describe the nominal data.

RESULTS

General data

During the study period, total 556 patients were admitted to ETU and 414 patients' BHTs were reviewed; the rest were not found due to transfer to other wards, hospitals or death. Of these, 156 (38%) were prescribed at least one antibiotic. The total number of antibiotics prescribed (one or more than one antibiotic) among the 156 patients was 271. Two or more antibiotics were prescribed in 29% (n=45) of all encounters and in the remainder (71%) a single antibiotic was initiated and continued. The average of prescribed antibiotics was 1.73 per patient. Generic names had been used in 96% of antibiotic prescriptions but 3% of amoxicillin/clavulanic acid combination therapy and 1% of metronidazole prescriptions had used brand names.

The mean age of the patients on antibiotics was 56 (SD=21) years old. Most of the patients received antibiotics were geriatric patients with 61-80 y old (n=71) 45.4%. About two-thirds of the patients who received antibiotics were males (62%).

Utilization patterns of antibiotics

From the 271 antibiotic prescriptions issued from the ETU, cephalosporins 32% (n=87) were the most common prescribed antibiotic group followed by penicillins 31% (n=83). The most frequently prescribed antibiotics are illustrated in fig. 1. Fixed-dose combinations constituted 18% (n=50) of all prescriptions; amoxicillin/clavulanic acid was 9.4% (n=49) and piperacillin/tazobactam was 6% (n=3). Most antibiotics were administered as intravenous bolus or infusion (78%, n=211), oral and ophthalmic preparations were accounted for 21% (n=57) and 1% (n=3) encounters respectively.

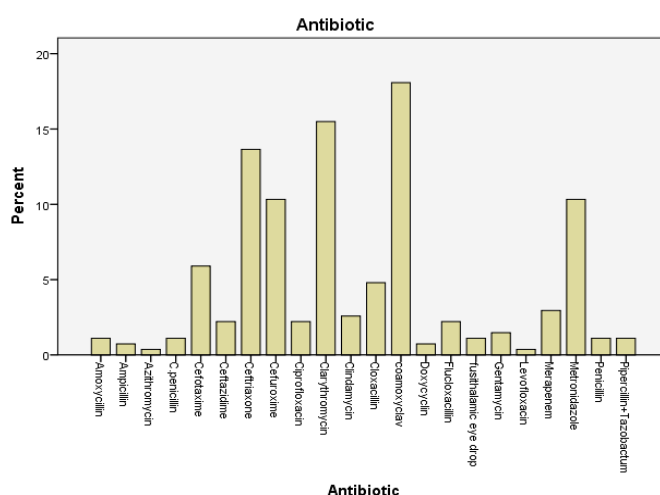


Fig. 1: Distribution of all antibiotics prescribed in ETU at the teaching hospital site, Sri Lanka

Indications for the prescriptions

Antibiotics were prescribed for the diagnoses listed in table 1. About one-third of the instances antibiotics were prescribed for URTIs (31%) followed by injuries (12%). However, about 22% of the prescriptions did not have a clear indication for prescribing an antibiotic.

Direct cost for antibiotics

The direct cost of antibiotics used in ETU for the 156 patients during the study period, was calculated. The unit prices of each antibiotic were obtained from the estimations of the MSD. The total acquisition cost for antibiotics for 156 patients was LKR.48647.41±371.88, the average cost of antibiotics per patient per day was LKR.311.84 and

the average cost of antibiotics per day in ETU was LKR3243.16. Intravenous antibiotics were the highest expenditure including clarithromycin (LKR17938.06), clindamycin (LKR6078.15) and

amoxicillin/clavulanic acid (LKR4976.76). The reported costs for intravenous medications were excluding the costs associated with the administration.

Table 1: Distribution of all diagnosis for prescribing antibiotics in ETU at the teaching hospital site, Sri Lanka

Diagnosis	Frequency	Percentage
Upper respiratory tract infections	49	31%
Injuries	19	12%
Cellulitis	7	5%
Pneumonia	11	7%
Meningitis	4	3%
Urinary Tract Infections	6	3%
Sepsis	9	6%
Leptospirosis	3	2%
Snake bites	3	2%

DISCUSSION

Over one-third of the patient received an antibiotic in the ETU with URTIs categorised as being the most common indication and cephalosporins as the most widely used antibiotics. Intravenous route was the most used antibiotic administration route. About a quarter of the ETU prescriptions did not include a clear indication for prescribing of an antibiotic. The majority of the indirect costs for antibiotics were associated with parenteral administration and required consumables.

Despite the fact that most URTIs have viral aetiology, therefore antibiotics are not usually indicated and when used they have neither cured (reduced the symptoms/prevented complications) nor shorten the duration of URTIs [20]. We found that considerable number of patients still received antibiotics for URTIs at ETU. While the reason was not recorded for any patients, we suggest that this could be due to patient demand or satisfaction, or high-risk patient as a prophylaxis to avoid secondary bacterial infection. As Ong *et al.* (2007) reported that the physicians were more likely prescribed antibiotics for URTIs on patient expectation or demand [21]. However, in this study the prevalence of prescribing antibiotics for URTIs was comparatively lower than that found in similar studies in this region [6]. Nevertheless, it was observed from this study that overall level of antibiotic prescribing remains high compared to the WHO standard and future review of the Sri Lankan ETU antibiotics prescribing criteria will be appropriate corrective action to consider [12].

Over two-thirds of antibiotics administration in ETU was intravenously or intramuscularly. The use of parenteral antibiotics is usually justified by either the immediate need to initiate therapy or if the patient cannot or not permitted at the point of admission (e. g. planned surgery) take oral antibiotics. The direct cost for antibiotics was calculated based on the actual injectable antibiotics, not including the consumables used for their administration. The highest expenditure was for IV clarithromycin followed by IV clindamycin. Based on the principles of the global IV/oral switch campaigns, once the need for IV administration is ceased and the patient can tolerate oral medication the switch should occur. It was estimated that when adding the indirect cost (administration equipment, consumable and nursing time) each parent rally administered dose may cost up to 100X of the cost of oral dose. Consequently, any dose given parent rally that could have been given orally must be considered to be a waste of resources [22].

Additionally, in this study found that the top five antibiotics were amoxicillin/clavulanic acid (18.1%), clarithromycin (15.5%), ceftriaxone (13.7%), cefuroxime and metronidazole (10.3% for both) and cefotaxime (5.9%). An observational study on utilization of parenteral anti-infective agents in the ETU of a tertiary care hospital has found that 400 patients (45.2%) received parenteral anti-infective agents. According to their results, cephalosporin, aminoglycosides and metronidazole had accounted for about 70% of total antimicrobial used. Another study (n=885 patients) found that 45.2% (n=400) of all patients received parenteral anti-infective agents. Cephalosporin, aminoglycosides, and metronidazole

accounted for about 70% of total antimicrobial use [23]. Ojeniran *et al.* (2010) found that antibiotic prescribing in ETU was 14.5% of all prescribing of which 42% were broad-spectrum antibiotics [4].

Culture and sensitivity reports were available for patients who were given penicillin only in a study to measure empiric use of antibiotics in ETU adherence to guidelines in 534 patients with a suspected infection found that in 105 cases (19.7%) positive cultures were obtained regardless of antibiotic type [24].

Another prospective study of antibiotic prescribing in ETU reviewed 104 patients over a two-week period and found that most prescribed antibiotics were for UTIs followed by pulmonary and cutaneous infections. Only in 84.5% of cases was the indication of use for antibiotics recorded [25]. An audit of 93 patients' files reviewed in ETU found that the antibiotics prescribed conformed to diagnosis in 70% of all reviewed files, based upon expert opinion [26]. In this study there were two or more antibiotics prescribed in 28.84% of 156 prescriptions. Gupta, *et al.* (2004) found at least two antimicrobial agents per prescriptions for most of the patients admitted to the medical ward. In this study, beta-lactams accounted for 60% of all prescriptions, followed by fluoroquinolones at 32.5% [23]. When combining three criteria (indication, choice and route of administration), only 54% of prescriptions were considered optimal, 31% were debatable, and 15% were not considered justified. Additionally, cephalosporins were the most prescribed antibiotic group which did not agree with the findings of another study on the use of antibiotics in ETU which found amoxicillin/clavulanic acid was the most prescribed antibiotic [3].

Asserayet *et al.* (2009) found that the most frequently prescribed antibiotics were beta-lactams (penicillin 43%, cephalosporin 2% and fluoroquinolones 22%). The choice conformed to local and national guidelines in 78% of cases [26]. In a study related to sepsis, antibiotics were prescribed only for 61% of all patients the rest were initiated with antibiotics when they were admitted into the inpatient unit [27].

From all prescriptions for antibiotics in this study, 95.58% used generic names. Government hospitals in Sri Lanka require their practitioners to prescribe in generic names to reduce the cost of procuring a specific brand for a small number of patients. Similarly, the highest cost was related to the use of broad-spectrum antibiotics as empirical therapy as was found by Kaur *et al.*, (2014).

LIMITATIONS

This study had some limitations including the location; limited to only one hospital site, the sample size was small (n=156) and the period was short (two weeks). The only complete medical records found were prescription copies not patients' notes, bed tickets or files. Only antibiotics supplied by the hospital pharmacy were calculated as direct cost; however, indirect cost such as antibiotics purchased by the patient, culture tests, supply, consumable for parenteral therapy and storage costs were not analysed. We did not collect any information related form patients to explain the extent of their expectation of an antibiotic form a physician.

CONCLUSION

This is the first study of antibiotic utilisation and direct cost of antibiotics in ETU in teaching hospital site. The study made a detailed assessment of the prescriptions containing antibiotics prescribed in ETU. The study revealed that geriatric patients (61-80 y) were the highest antibiotic consumers in the unit. Mostly generic names of antibiotics were used. Patients' records were found to be incomplete when compared to pharmacy prescriptions records. Indication and culture sensitivity test records appeared inadequate. The most common indication for antibiotic therapy at ETU was URTI, where antibiotics are not indicated in most cases.

RECOMMENDATION

It is recommended that:

1. A future larger study is conducted that involves multiple centers and a longer observation period to achieve a more accurate picture of the national antibiotic stewardship.
2. It will also be beneficial if both the direct and the indirect cost are calculated to indicate accurate antibiotic use burden on the health system.
3. Careful consideration of the need to administer parenteral doses in patients with normal GI function.
4. An antibiotic campaign and educational program targeting medical staff and the public about antibiotic resistance and the irrational use of antibiotics.
5. Implementing antibiotic stewardship in all hospitals where decisions about certain antibiotic prescribing is approved by infection control committee to reduce hospital-acquired microbial resistance.

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AUTHORS CONTRIBUTIONS

All the author have contributed equally.

CONFLICT OF INTERESTS

Declared none

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