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Antibiotic prescribing on two medical wards at St. Luke's Hospital: what scope for improvement?

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ABSTRACT: Antibiotics are frequently prescribed drugs and form a significant part of the hospital budget. The literature suggests that prescribing is not without problems and may need constant review. We have no data relating to our hospital. This study aims to explore some aspects of antibiotic use in our setting. Records of all patients prescribed antibiotics on two medical wards over a 4 month period were analysed for indication, choice of antibiotic, outcome and cost. There were 126 patients: 54% males; 75.4%, >60 years old; 62% were admitted because of infection. Of the whole group, 8.7% received antibiotics with no evidence of infection and no indication for prophylaxis. There were 118 infections, 64% respiratory, 13.5% urinary and the rest of miscellaneous sites; 14% of infections were nosocomial. Microbiological studies were available in only 29% of infections. For 6 patients, the antibiotics prescribed were relatively contraindicated because of impaired hepatic and renal function. There was one adverse drug reaction. The total drug cost was Lm2181.79; i.v. treatment accounted for 93% of this cost and ceftazidime for 60%. There is room for improvement in the selection of antibiotics and their route of adminstration. The hospital microbiologists and the Antibiotic Policy should be consulted more often. Laboratory diagnosis of infection and biochemical patient monitoring are inadequate. Restricting i.v. treatment could reduce cost very substantially.

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Introduction

Antibiotics are among the most frequently prescribed (and misused) drugs. The topic has been extensively reviewed[1]. In a London hospital,[2] in 1981, 28% of patients received antibiotics and 28% of these were for "medical cases"; 70% of prescriptions were for infection, the remainder for prophylaxis. In only 50% of cases was the prescriber able to specify which organism he/she suspected might be the cause of the infection. Lower respiratory tract and urinary "infections" accounted for 39 and 20% of prescriptions respectively. Interestingly, the same investigators found that as many as 40% of prescriptions for lower respiratory tract "infections" were unjustifiable[3]. In 1977, a similar study in a North American hospital[4], revealed that 34.2% of all patients received antibiotics (21.4% medical), and as many as 64% were either not indicated or had the wrong dose or the choice of drug was inappropriate; all when measured against the hospital's own policy.

Several cost-containment policies have been attempted with variable degrees of success. Formularies with a shift towards generic prescribing, prescribing protocols and assertive drug-use evaluation processes have all been tried in an attempt to improve prescribing and reduce costs[5-8]. Educational interventions are possibly the best method as the prescriber's prerogatives are retained while at the same time he/she has attention drawn to possible alternatives, with supporting evidence provided by the ward pharmacist[9].

The reality of economic constraints coupled with spiralling costs inevitably result in tighter prescribing policies. Without input from the clinician, tight policies are doomed to failure and without some data on what is actually happening at ward level, clinical input by doctors cannot be objective. Also, clinicians alone have not been as successful as a team effort combining clinician and ward pharmacist[1, 10].

In our hospital, the cost of antibiotic prescribing has been difficult to calculate and there is little data on the spectrum of infection, organ systems involved, reasons for prescribing and outcome. Overt infection is generally easy to suspect and diagnose. On the other hand, the isolation of the pathogen can be difficult. Problems of sampling technique and timing, microbiological methods and previous empirical treatment all contribute to the difficulty. In clinical practice, it is often necessary to treat empirically and given the severity of infection in the hospital setting, the intravenous route is commonly used. The reason may be either that the patient is too ill to swallow medication, or adequate blood levels can be reliably achieved only thus, or the drug itself is only available as an intravenous preparation. Notwithstanding these problems, it was our impression that antibiotics were not always prescribed for good reason, neither was the intravenous route always justified. Therefore, anything

which could be done to shift from a predominantly parenteral to an oral route would have obvious advantages to patients, healthcare staff and hospital managers trying to contain costs[11]. We wanted to confirm and quantify some of these issues in order to be better placed at offering guidelines or at altering practice. At the same time, we wished to explore the areas of potential and actual adverse drug reactions and the financial implications of our antibiotic prescribing.

The aims of this study therefore, were to determine which antibiotics were prescribed, the route of administration, the degree and relevance of clinical monitoring and the costs of the antibiotic therapy actually incurred with the proportion attributable to intravenous therapy. As a result, areas might be identified where improvement in prescribing and in cost containment could be achieved.

Patients & Methods

All patients, admitted to two medical wards over a four month period (October 1991-February 1992), were screened by the ward pharmacists. Prescriptions for antibiotics were identified and subsequently monitored for actual delivery of the drug to the patient, together with its route of administration and any adverse reaction. The medical records were analysed for patient characteristics, the admitting illness and any other conditions, final diagnosis, complete drug history, treatment duration and mode of delivery, and laboratory investigations.

Cost of each antibiotic was calculated from unit cost to the hospital multiplied by the number of doses given, according to route of administration, in each patient. Medical and nursing time, cost of infusion sets and other ancillary items were not taken into account.

Results

There were 126 patients who received antibiotics; 54% were males and 75.4% were over 60 years of age. Infection was the reason for admission in 62%. In the remainder, antibiotics were either prescribed for infection which developed after admission or as prophylaxis. However, 8.7% of patients received antibiotics without having any evidence for infection nor an indication for prophylaxis.

A total of 118 infections were identified, 64% respiratory (Table 1), 13.5% urinary and the rest of miscellaneous sites (Table 2). Of the total, 14% were considered to be nosocomial. Of the 126 patients, 42.9% had an infection as well as another illness on admission. Multiple infections occurred in the same patient in 10% of cases. The diagnosis of infection was supported by positive microbiological tests in 34 instances (28.8%); in 4 of these by serology.

Table 1 - Classification of 76 respiratory infections

pneumonia	12
bronchopneumonia	12
aspiration pneumonia	3
hypostatic pneumonia	6
bronchitis	16
infective exacerbation of COPD	9
asthma with "infection"	5
doubtful & unclassifiable	13

Table 2 - The spectrum of 118 infections in 105 patients

site of infection	community acquired	nosocomial	microbiology available
respiratory	73	3	13
urinary	5	11	10
gastrointestinal	5	0	3
wound	1	3	3
joint	1	0	1
infectious disease	6	0	4

Minor abnormalities of plasma biochemistry were common. In 6 patients, (5%), they were considered to be severe enough by the clinical team to make a relevant entry in the case notes and/or to investigate further. In spite of this either no apparent cautionary note was found even though the choice of antibiotic was relatively contraindicated, or no follow-up biochemistry was undertaken. There was renal impairment in three patients who received full doses of ceftazidime, cefuroxime and cephalexin. Two patients had hepatic dysfunction and received metronidazole and erythromycin. One patient, who had both renal and hepatic disease, received gentamicin and metronidazole.

There was only one adverse drug reaction: a rash due to co-trimoxazole. We did not consider inflamed venous access sites as adverse reactions. These were, however, common and often could be attributed to the antibiotic especially where either no other i.v. drugs were in use, or where the antibiotic is notorious for causing venous inflammation, for example erythromycin.

The antibiotics which were prescribed during the period of this study are listed in Table 3, together with their unit cost. The total cost of antibiotics for treating 118 infections in 126 patients amounted to Lm2181.79; with 69.8% of this being due to i.v. erythromycin,

Table 3 - Unit cost (Lm) of each antibiotic used

	i.v.		oral	
antibiotic	cost	dose	cost	dose
ampicillin	0.08	500mg	0.01	250mg
cloxacillin	0.51	500mg	0.04	500mg
co-amoxiclav	1.26	1.2g	0.16	375mg
cefuroxime	0.70	750mg	0.46	250mg
ceftazidime	4.44	1g	-	-
ceftriaxone	13.74	2g	-	-
cephalexin	-	-	0.03	250mg
ciprofloxacin	5.10	100mg	0.43	250mg
co-trimoxazole	0.69	320mg	0.10	480mg
erythromycin	1.18	300mg	0.01	250mg
flucloxacillin	0.35	250mg	0.03	250mg
gentamicin	0.11	80mg	-	-
metronidazole	0.45	2.5g	0.01	250mg
nalidixic acid	-	-	0.03	500mg
neomycin	-	-	0.07	500mg
netilmicin	1.18	150mg	-	-
tetracycline	0.90	250mg	0.01	250mg

ceftazidime and cefuroxime (Table 4). There were 210 prescriptions indicating that several patients received combined therapy.

Table 4 - Total cost (Lm) of each antibiotic (n = patients) and the percentage of total cost of i.v. therapy

	i.v.		oral		cost	
antibiotic	n	cost	n	cost	cost	iv %
ampicillin	12	10.84	16	6.37	17.21	63
cloxacillin	10	105.02	4	13.59	118.61	89
co-amoxiclav	12	194.25	23	49.33	243.58	80
cefuroxime	32	326.19	1	3.51	329.70	99
ceftazidime	8	860.31	-	-	860.31	100
ceftriaxone	1	7.60	-	-	7.60	100
cephalexin	-	-	7	8.58	8.58	0
ciprofloxacin	1	122.40	4	43.14	165.54	74
co-trimoxazole	-	-	7	0.72	0.72	0
erythromycin	9	315.56	23	8.35	323.91	97
flucloxacillin	3	28.05	3	2.58	30.63	93
gentamicin	14	21.56	-	-	21.56	100
metronidazole	4	28.92	3	1.27	30.19	96
nalidixic acid	-	-	3	1.82	2.40	0
neomycin	1	1.82	-	-	1.82	100
netilmicin	1	15.84	-	-	15.84	100
tetracycline	-	-	8	3.59	3.59	0

Discussion

The most common organ systems with infections, in patients admitted to the two medical wards studied, were respiratory and urinary. It was obvious from the case notes that the majority were not immediately life-threatening. Many were secondary, such as exacerbations in COPD, or in patients with urinary catheters.

Respiratory infections dominated (Table I). Three cases were considered to be nosocomial and therefore could have justified second-line antibiotic choices. All the rest (about 70 cases), with rare exception, would have been effectively treated with ampicillin and erythromycin, alone or in combination, as these were community acquired infections. Yet, there were only 28 and 32 prescriptions for ampicillin and erythromycin respectively (some prescriptions for ampicillin were for urinary tract infection). This suggests that second-line drugs were used in at least half the cases. Since microbiology played a minimal role in antibiotic selection, clinical criteria must have been used, criteria which, evidently, do not correspond with currently recommended practice[12]. It would require further study to address this issue, to determine whether or not in fact, such prescribing was justified, and whether or not the present antibiotic policy is up-to-date.

Table 4, illustrates the frequency of intravenous antibiotic use: 108 out of 210 prescriptions. Therefore, even using the same preparation, but reducing the number of days on i.v. therapy, could have a significant impact on cost. Further benefits would be an increased convenience to staff and patients, and a reduction in morbidity.

Prescription of antibiotics without any indication whatsoever is of some concern. In a study based in a UK teaching hospital,[8] less than 2% of their prescriptions were found to have no indication whatsoever as compared with our 8.7%. Furthermore, in 10.3% of cases, antibiotics were chosen which were relatively contraindicated by the abnormal biochemical tests present. Fortunately there were no serious consequences to patients. Surprisingly, there was only one adverse drug reaction in this study.

Substantial expense was incurred when treating the few patients with life threatening infection. The use of high cost drugs, sometimes in combination, is often mandatory in such clinical circumstances.

For common infections, particularly of the respiratory tract, it would require more rapid microbiological techniques to be developed and/or implemented; and even then, the organism would have to be sensitive to the first line drugs, in order to permit effective rationing of prescriptions.

In conclusion, some recommendations are offered which may help improve prescribing policy and contain costs:

- First line antibiotics (as recommended in the hospital antibiotic policy) must be kept up to date by regular consultation between microbiologist, pharmacist and relevant specialist clinician.
- Respiratory and urinary tract infections are the commonest infections on medical wards and cheap, effective, oral preparations are available but apparently under-utilised.
- Clinicians must seriously consider giving precedence to oral therapy but, if the i.v route is chosen, this should be changed as early as possible.
- Better use should be made of microbiologists' expertise.
- Ward pharmacy-based monitoring services targeted towards specific antibiotics should be developed.

References

1. Guglielmo PJ. Practical strategies for the appropriate use of antimicrobials. Pharmacy World and Science 1995; 17 (4): 96-102.
2. Moss F, McNicholl MW, McSwiggan DA, Miller DL. Survey of antibiotic prescribing in a district general hospital. I. Pattern of use. Lancet 198; 2: 349-52.
3. Moss F, McNicholl MW, McSwiggan DA, Miller DL. Survey of antibiotic prescribing in a district general hospital. II. Lower respiratory tract infection. Lancet 198; 2: 407-9.
4. Castle M, Wilfer CM, Cate TR, Osterhout S. Antibiotic use at Duke University Medical Centre. JAMA 1977; 237: 2819-22.
5. Rivkin-Berman J, Zaran FK, Rybak MJ. Pharmacy-based antimicrobial-monitoring service. Am J Hosp Pharm, 1992; 49: 1701-1706.
6. Sisca TS. Pharmacist-managed drug therapy helps meet requirements for drug use evaluation. Am J Hosp Pharm, 1992; 49: 81-83.
7. Durbin WA Jr, Lapidas B, Goldman DA. Improved antibiotic usage following introduction of a novel prescription system. JAMA, 1981; 246: 1796-1800.
8. Hampson JP, Corkill JE, Griffiths LR, Murray A, Bartzokas CA, Smith JC. Evolution of a method to collect and analyse antimicrobial prescribing data in a United Kingdom hospital. Pharmacy World & Science 1994; Vol 16 (5): 208-216.
9. Avorn J, Soumerai SB, Taylor W, Wessels MR, Janousek

J, Weiner M. Reduction of incorrect antibiotic dosing through a structured educational order form. Arch Intern Med 1988; 148: 1720-4.
10. Kowalsky SF, Echols RM, Peck F Jr. Preprinted order sheet to enhance antibiotic prescribing and surveillance. Am J Hosp Pharm 1982; 39: 1528-9.
11. Frighetto L, Nickoloff D, Martinusen SM, Mamdani FS, Jewesson PJ. Intravenous to oral stepdown program: four years of experience in a large teaching hospital. Ann Pharmacother 1992; 26: 1447-51.
12. Antimicrobial Policy. Government Health Services Publication, Department of Health, Malta. 1992; 161.