
Antimicrobial practice

The successful introduction of a programme to reduce the use of iv ciprofloxacin in hospital

T. M. A. Weller*

Department of Microbiology, City Hospital NHS Trust, Dudley Road, Birmingham B18 7QH, UK

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The effectiveness of a programme to reduce the use of iv ciprofloxacin was assessed. iv ciprofloxacin was removed from ward stock and discussion occurred regarding appropriate use of the drug. Six months later, a factsheet containing recommendations was distributed to all medical staff and a requirement for justification before prescription was introduced. The programme reduced expenditure on iv ciprofloxacin to 34% of original levels. Savings of >£36 000 were made for two consecutive years. A sustained reduction in the use of iv ciprofloxacin was obtained by a combination of education and restriction.

Introduction

Many recent publications have discussed the need for an overall reduction in antibiotic use and, in particular, of broad spectrum agents.^{1,2} This is driven by the twin concerns of increasing antimicrobial resistance and rising costs. There is plenty of room for improvement as up to 50% of antibiotic use in hospital is inappropriate.³

Many different strategies have been employed in attempts to achieve this objective. An educational approach can produce marked reductions in antibiotic prescribing but the effect is generally short-lived owing to the rapid turnover of staff in health services.⁴ A more prolonged effect can be achieved by restricting the availability of selected antibiotics.^{5–7} The danger with this approach is that a lack of understanding can lead to conflict between those who designed the policy and those affected by it. Prescribing may also be moved to equally inappropriate, but unrestricted, agents. In one study, where restriction was introduced without any educational component, there was actually an increase in the use of the target antibiotic.⁸ We therefore decided to combine the two strategies in order to get a sustained reduction in antibiotic prescribing but also encourage clinicians to understand why a policy of restriction was being implemented.

Methods

City Hospital is a 753 bed hospital located in inner city Birmingham, UK. There is an eight bed intensive therapy unit (ITU) and a six bed high dependency unit (HDU), but no other specialist areas where high antibiotic use would be expected.

The hospital Drugs and Therapeutics Committee discussed the use of antibiotics following a local survey that showed that 40% of antibiotic prescribing was inappropriate. It was decided that a combination of education and restriction of some agents would be used to improve prescribing.

The local survey indicated that, for a number of reasons, iv ciprofloxacin would be the best agent to pilot the technique. This agent was the only quinolone available for iv and oral use at City Hospital. There was a low level of knowledge about the spectrum of ciprofloxacin and the indications for its use. Expenditure on this drug was 20% of the total antibiotic spend, greater than any other antibiotic, and almost all iv use of ciprofloxacin outside ITU/HDU was inappropriate. Furthermore, the incidence of ciprofloxacin resistance within the hospital was small and we wanted to keep it that way.

In January 1999 a letter concerning antibiotic use was circulated to all clinical directors and then cascaded to all

*Tel: +44-121-507-5742; Fax: +44-121-551-7763; E-mail: T.M.A.Weller@bham.ac.uk

consultant medical staff. Appropriate use of iv and oral ciprofloxacin was outlined and comments invited. At the same time iv ciprofloxacin was withdrawn from ward stock and was only available from the pharmacy.

The full restriction policy was implemented in June 1999. A factsheet containing details of the spectrum, cost and recommended indications for both oral and iv ciprofloxacin was distributed to all doctors working in the hospital. Any clinician wishing to use iv ciprofloxacin was required to discuss the case with a senior microbiologist, at least one of whom was available 24 h a day. Use was never absolutely prohibited but more appropriate alternatives were often suggested.

Data on the total spent on antibacterial drugs for 1998, 1999 and 2000 were gathered from the pharmacy computer. Total usage of iv and oral ciprofloxacin and the number of occupied bed-days for the same period were recorded. Expenditure on ciprofloxacin, and the antibiotics most likely to be prescribed instead, ceftazidime and carbapenems (piperacillin/tazobactam was not on the formulary at City Hospital), was also noted. There was no change in the hospital purchase price for any of these agents during the study period. Data on the amount spent on all iv and oral quinolones were also obtained from the chief pharmacists at three neighbouring hospitals.

Results

The expenditure on all antibacterial agents, ciprofloxacin and ceftazidime/carbapenems, is presented in Table 1. The expenditure per 100 occupied bed-days and total use of oral and iv ciprofloxacin (in mg) are also given.

The amount spent on iv ciprofloxacin fell by £20522 in the first 6 months of 1999, after the first part of the strategy was implemented. Another reduction, by £3774, was seen in the 6 months following the introduction of formal restriction in June 1999. Therefore, in 1999 expenditure on iv ciprofloxacin was 43% of that in 1998 and there was a further fall

to 34% in 2000. There was a consequent saving of £34761 in the first year and £43537 in the second year. Expenditure on oral ciprofloxacin rose by £3031 in 1999 and £7247 in 2000, producing net reductions of £31730 and £36290, respectively. Before implementation 56% of iv ciprofloxacin was used in ITU/HDU; in 2000 the proportion had increased to 84% despite the fact that actual use on the units had halved.

Table 1 shows that expenditure on ceftazidime and carbapenems remained essentially the same throughout the study period. More was spent on carbapenems on ITU/HDU during 1999, largely due to an outbreak of multi-resistant *Acinetobacter baumannii*, but the total fell to previous levels the following year. Use in other departments also dropped in 2000. The amount spent on ceftazidime fell slightly and then rose again but remained largely unchanged overall. The total spend on all antibacterial agents throughout the hospital was £33159 (6.8%) lower in 2000 than in 1998.

Expenditure on all quinolones did not decrease in the same way in the three neighbouring hospitals contacted (Figure 1). There were large increases at Hospitals A and C, and at Hospital B expenditure remained relatively unchanged.

Discussion

The programme to reduce inappropriate use of iv ciprofloxacin consisted of four elements. The first two, removal of iv ciprofloxacin from ward stocks and publicity regarding the appropriate use of this agent, simultaneously made ciprofloxacin less accessible and sparked a debate about which antibiotic to use. A marked decrease in the use of iv ciprofloxacin was seen as a consequence of these actions. Formal restriction was introduced 6 months later to consolidate the progress already made. This allowed clinicians time to discuss the options available and clearly define the areas where oral ciprofloxacin was recommended and iv ciprofloxacin was acceptable. The results of the discussion were distilled into a factsheet and distributed to all medical staff.

Table 1. Yearly antibiotic usage and expenditure

	1998	1999	2000
Ciprofloxacin iv total used (mg)	789 300	384 400	289 000
Ciprofloxacin oral total used (mg)	13 017 750	16 096 250	15 541 500
Ciprofloxacin iv total expenditure (per 100 occupied bed-days)	£66 189 (£28)	£31 428 (£14)	£22 652 (£10)
Ciprofloxacin oral total expenditure (per 100 occupied bed-days)	£27 272 (£12)	£30 303 (£13)	£34 519 (£16)
Ceftazidime/carbapenem total expenditure (per 100 occupied bed-days)	£45 421 (£19)	£49 286 (£21)	£44 710 (£21)
Antibacterials total expenditure	£485 929	£455 876	£452 770

Reduction of iv ciprofloxacin use

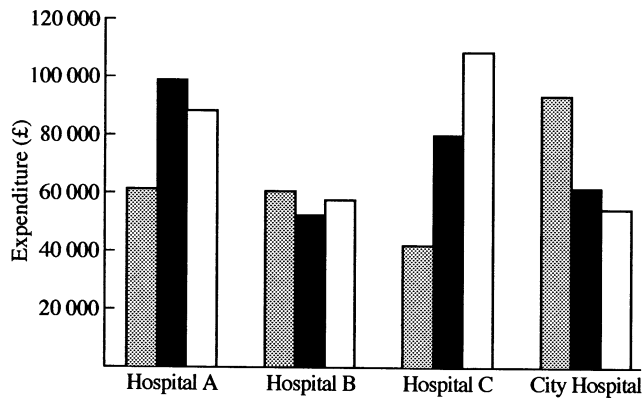


Figure 1. Total expenditure on quinolones per year for four hospitals. Grey bars, 1998; black bars, 1999; white bars, 2000

It is likely that both the educational and restrictive components were needed to produce sustained change. Use decreased most significantly following the first components of the programme and there was little extra improvement when restriction was introduced. However, as the effect of any education is often short-lived,⁴ restriction and justification were used to ensure that old prescribing practices did not recur once staff changed. In this programme the microbiologists were able to use the contact made for authorization as an opportunity to discuss a range of issues regarding antibiotic prescribing. The need for justification every time iv ciprofloxacin was requested served to continually reinforce the policy and its rationale. This is particularly important for junior medical staff who move frequently between hospitals with different antibiotic recommendations.

Although the use of iv ciprofloxacin was easily monitored following implementation of the programme, it was much more difficult to assess whether there were any harmful consequences. We could not study differences in patient outcome or length of treatment as there is no way to define which patients would have received iv ciprofloxacin had it not been for the change in policy. Furthermore, the time period was too short to monitor any effect on antimicrobial resistance.

The effect on expenditure on some uncontrolled antibiotics was recorded in order to assess whether prescribing had moved rather than decreased. The total cost for all antibacterial agents fell by £33 159 in the year following implementation, which was less than the saving made from reduced use of iv ciprofloxacin. It is likely that other antibiotics were used to replace ciprofloxacin to a certain extent but it is not possible to say whether there was an actual reduction in antibacterial use. Expenditure on the iv antibiotics most used as an alternative to ciprofloxacin, namely ceftazidime and carbapenems, increased slightly during the study period. There was a greater use of carbapenems on ITU/HDU

in 1999 when there was a troublesome outbreak of multi-resistant *A. baumannii*. Use returned to below pre-outbreak levels once the outbreak was under control. It appears that ceftazidime may have been prescribed more to avoid the need for justification and microbiologists' approval.

There were two noteworthy changes in the way in which ciprofloxacin was used. First, the increase in oral ciprofloxacin use was five times greater than the simultaneous fall in iv prescription. Therefore, although a financial saving was made, the overall quinolone antibiotic pressure was greater. Secondly, prescription of iv ciprofloxacin outside ITU/HDU virtually ceased. This was largely due to the promotion of the oral form for any patient who was not nil-by-mouth.

The expenditure on all quinolones was also obtained from three neighbouring Trusts in order to determine what was happening to quinolone use where different policies were in operation (Figure 1). At Hospital B unrestricted quinolone use was allowed over the study period and there was little variation in year-to-year use. Hospitals A and C both experienced problems with *Clostridium difficile* in 1999, which resulted in a greater use of ciprofloxacin and levofloxacin whilst cephalosporins were controlled. It is interesting to note that the incidence of *C. difficile*-associated diarrhoea did not change at City Hospital during the study period. The fall in quinolone expenditure, only seen at City Hospital, is likely to be due to the education and restriction programme put in place.

The direct costs of implementing the programme were minimal as both microbiology and pharmacy were already providing continuous cover, and factsheet production was the only other expense incurred. Our experience has shown that it is possible to obtain a sustained reduction in the iv use of one antimicrobial agent with a combination of education and restriction. This has been achieved whilst maintaining the support of the clinicians affected.

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T. M. A. Weller

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