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The anaesthetist as determinant factor of quality of surgical antimicrobial prophylaxis. A survey in a university hospital

• I.C. Gyssens, J.T.A. Knape, G. Van Hal and J.W.M. van der Meer

Introduction

Antimicrobial drugs account for 13-37% of the drug budget in European hospitals; 30% of the antimicrobial use is for prophylaxis [1]. The timing of surgical prophylaxis and its organizational aspects have rarely been analysed. Recently, suboptimal timing of antibiotic prophylaxis was found to be associated with a significant higher rate of wound infections in a large series [2]. Intravenous administration of the drug during induction of anaesthesia within 30 min before incision is a generally accepted standard [3]. In this practice, anaesthetists administer the antibiotic. In the University Hospital of Nijmegen, \pm 1600 operations/month are performed on inpatients in 7 operating departments. An estimated 30% of patients are receiving perioperative prophylaxis with antimicrobial drugs. Prophylaxis is almost exclusively started in the operating room. In the first phase of our quality-of-use study of surgical antimicrobial prophylaxis, we had measured deficient timing of prophylaxis in 2 out of 3 of these operating departments [4]. The results were discussed with the surgeons. The anaesthetists seemed to play a major role in the timing of surgical prophylaxis, but their point of view was not known. Because a large staff of 44 anaesthetists rotated in a working schedule in all operating departments, we wanted to interview all of them by means of an inquiry. In preparation of the implementation of new guidelines by the department of clinical pharmacy, we studied the anaesthetists' perception of the organization of prophylaxis in the surgical departments and their views on optimizing practice. In order to evaluate administration cost, we also asked the anaesthetists about their usual methods of administered antimicrobial prophylaxis.

Methods

All 44 staff members (seniors and residents) of the department of anaesthesiology who were performing anaesthesias were sent a pre-numbered questionnaire by internal mail. The forms were distributed and collected by a senior staff member of the department of anaesthesiology, who added an introductory letter, and urged on nonresponders for three weeks. The forms were then returned so that anonymity was preserved.

The form contained three blocks of precoded questions on four pages. To fill in the form, only a few minutes were required. Anaesthetists were asked for their usual ways of administration of intravenous antimicrobial drugs for prophylaxis, i.e. by bolus injection of 3-5 min or i.v. infusion over 15-30 min, and the reasons for their choice in terms of safety, time, habit and cost. They were asked questions about the transmission of the antibiotic order by the surgeon and its relation to the timing of the operation in 7 operating departments of the hospital, both for scheduled and

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Keywords

Anaesthesiology
Antibiotics
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Abstract

In actual surgical antimicrobial prophylaxis, the anaesthetist administers the drugs at induction of anaesthesia. In the first phase of our quality-of-use intervention study on antimicrobial drugs in a large university hospital, information on the practice of antimicrobial prophylaxis was needed. The staff of 44 anaesthetists was interviewed by means of a questionnaire. Response rate was 36/44 (82%). The anaesthetists' method of administering surgical prophylaxis was rather uniform and inexpensive: cephalosporins were almost exclusively administered by bolus method. The main reason was that infusion was more cumbersome (range 77-85%). Communication between surgeon and anaesthetist was reported to be poor, and in two out of three operating departments, orders of prophylaxis transmitted at or after induction accounted for more than 80%. Seventy-seven percent of the responders asked the surgeon if prophylaxis was necessary if they were in doubt; 20% responded that they checked it systematically. The data collected by the inquiry proved useful in the process of optimizing surgical prophylaxis in our hospital.

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emergency procedures. Space was allowed for comments. Finally, they were asked for their attitude toward measures to improve the organization of antimicrobial preoperative prophylaxis. Absolute and relative frequencies of responses to the questionnaire were tabulated.

Results

Thirty-nine (87%) staff members returned the form. Three returned the form blank. Thirty-six forms of responders (82%) were used for analysis. Considering the age classes younger than 35 years ($n=24$, mostly residents), 35-45 years ($n=14$, mostly staff members), and older than 45 years ($n=6$, senior staff members), no difference in age (<35 yr, 35-45 yr, >45 yr) could be found between responders and non-responders (chi-square, $p = 0.88$).

Way of administration

All anaesthetists but one administered prophylactic cefazolin and penicillins only by bolus injections (97%) (Table 1). Gentamicin was administered only

by bolus injection in 62%.

The main reasons for this choice seemed to be practicality (range 77-85%) and habit (range 65-94%) (Table 2). Although 48% considered i.v. infusion safer for gentamicin, this view did not always determine their choice of administration: 29% gave gentamicin solely by i.v. infusion (Table 1). A difference in cost was not a major issue; on the average, 33% thought there was no difference and 42% had no opinion on the subject.

Communication of prophylactic orders

Table 3 shows the different ways in which the anaesthetist was informed about the need for administration of preoperative antibiotics for the three departments where the timing had been recorded. The questionnaire gave five possible kinds of communications, and one 'unknown'. Also multiple replies were given. In the operating department of surgery (SURG), replies indicated that the majority of orders were transmitted at earliest at or after induction: 27.5/31 (89%). In the operating department of orthopaedic surgery (ORTH), about half the replies

Table 1 Usual way of administration of prophylactic antibiotics by anaesthetists

	Frequency distribution (%) of replies				
	Ampicillin ($n=35$)	Flucloxacillin ($n=33$)	Cefazolin ($n=35$)	Cefuroxime ($n=34$)	Gentamicin ($n=34$)
Bolus injection	34 (97)	32 (97)	34 (97)	27 (79)	21 (62)
i.v. infusion	0	0	0	4 (12)	10 (29)
Both methods	1 (3)	1 (3)	1 (3)	3 (9)	3 (9)

Table 2 Reasons for choice of i.v. administration by anaesthetists

	Frequency distribution (%) of replies				
	Ampicillin	Flucloxacillin	Cefazolin	Cefuroxime	Gentamicin
Safety ($n=33$)					
i.v. bolus safer	0	0	0	0	0
i.v. infusion safer	3 (9)	2 (6)	4 (12)	6 (18)	16 (49)
no difference	20 (61)	21 (64)	19 (58)	17 (52)	9 (27)
no opinion	10 (30)	10 (30)	10 (30)	10 (30)	8 (24)
Time ($n=30$)					
i.v. infusion more cumbersome	25 (85)	23 (77)	23 (77)	23 (77)	23 (77)
bolus more cumbersome	0	0	2 (6)	1 (3)	0
no difference	5 (15)	7 (23)	5 (17)	6 (20)	7 (23)
Habit ($n=32$)					
always bolus method	30 (94)	26 (81)	28 (88)	25 (78)	21 (65)
always i.v. infusion	0	0	2 (6)	2 (6)	6 (19)
varying methods	2 (6)	2 (6)	2 (6)	4 (13)	4 (13)
no opinion	0	4 (13)	0	1 (3)	1 (3)
Cost ($n=32$)					
bolus is more expensive	0	0	1 (3)	0	0
i.v. infusion is more expensive	8 (25)	8 (25)	7 (22)	7 (22)	8 (25)
no difference	10 (31)	11 (34)	10 (31)	12 (37)	11 (34)
no opinion	14 (44)	13 (41)	14 (44)	13 (41)	13 (41)

Table 3 Communication between surgeon and anaesthetist concerning antimicrobial prophylaxis

	Scheduled operations			Emergency operations		
	SURG	ORTH	ORL	SURG	ORTH	ORL
Operating department						
Number of anaesthetists responding	33	32	34	29	29	28
<i>Replies of early communication</i>						
a. antimicrobial drug sent with the patient to the operating room	0	4	24	0	0	5
b. order preoperatively written in medical chart	0	0	0	0	1	0
c. order transmitted orally before the patient is in the o.r.	2	9	0	2	5	2
combinations of a, b or c	1	4	5	4	2	2
<i>Replies of late communication</i>						
d. order transmitted orally at induction of anaesthesia	10	9	1	6	11	3
e. asked for by the anaesthetist at/after induction	9	1	1	13	6	7
combinations of d and e	8	1	0	2	0	1
Other combinations	1	2	1	0	0	0
f. unknown	2	2	2	2	4	8

SURG = Surgery, ORTH = Orthopaedic Surgery, ORL = Otorhinolaryngology

indicated also late communication. However, in the operating department of otorhinolaryngology (ORL), 29.5/32 (92%) of the replies indicated that the drug was sent with the patient.

The question on communication between the surgeon and the anaesthetist was repeated for emergency (unscheduled) operations (Table 3). The majority of orders was transmitted at earliest at or after induction of anaesthesia: in this situation not much difference was observed between the operating departments.

Contribution to quality

The questions and replies of this part of the questionnaire are presented in Table 4. One fifth of the responders would systematically ask the surgeon at

induction about the need for prophylactic antimicrobial drugs. Thirty-nine percent assumed that no prophylaxis was necessary if the surgeon did not inform them. Nevertheless, more than three quarters would ask him if in doubt.

Standardizing measures

Ninety-one percent of the responding anaesthetists agreed that written information in the record was necessary for the individual patient. Three thought that oral information would suffice. Five anaesthetists (three staff members, two residents) wrote comments on the deficient communication and two suggested that the policy of operating department ORL (preoperatively written order) be adopted.

Table 4 Point of view of anaesthetists on contribution to quality and standardizing measures of surgical prophylaxis

	Frequency distribution (%) of replies	
	Agree	Do not agree
If the surgeon does not inform you of the need for perioperative prophylaxis for a patient, this means that:		
You systematically ask the surgeon for it (n=35)	7 (20)	28 (80)
No prophylaxis is necessary (n=28)	11 (39)	17 (61)
You ask the surgeon if you are in doubt (n=35)	27 (77)	8 (23)
Oral information that is passed from the surgeon to the anaesthetist regarding perioperative prophylaxis concerning an individual patient is in your opinion:		
Not necessary if written information is available (n=27)	14 (52)	13 (48)
Necessary (n=32)	25 (78)	7 (22)
Written information from the surgeon in the record of the patient regarding perioperative prophylaxis is in your opinion:		
Not necessary because oral information is sufficient (n=27)	3 (11)	24 (89)
Necessary (n=34)	31 (91)	3 (9)

Discussion

Although anaesthetists play a crucial role in the practice of antimicrobial drug prophylaxis in surgery in most hospitals, they consider it the responsibility of the surgeon, and no studies have been performed on organizational aspects. The present inquiry informed the department of clinical pharmacy about the weak points in the organization. The inquiry identified operating departments where communication between surgeon and anaesthetist on antimicrobial drug prophylaxis was good and others where it was particularly poor. There was an association between the relative frequencies of replies of 'late' communication for the operating departments SURG, ORTH and ORL in the inquiry, and the delayed administration (after surgical incision) recorded in those departments during the quality-of-use study [4].

Furthermore, anaesthetists seemed to play an important role in reminding the surgeon of prophylaxis, as three quarters stated that they checked it if in doubt. However, such reminders occurred late in or after induction of anaesthesia, again resulting in a delay of prophylaxis.

The variety of replies concerning communication of prophylaxis within some operating departments probably reflect a diversity of practices due to the absence of protocols. In the unit ORL which had a standardized policy of sending the prophylactic antibiotic with the patient, replies were rather uniform. The diversity of practices in the other departments was identified as a negative critical factor impeding quality. We advocated a hospital-wide uniformity in the administration procedure of surgical antimicrobial prophylaxis. Almost all anaesthetists had a favourable reaction to the policy of pre-operatively written drug orders by the surgeon. We subsequently implemented a pre-operative patient checklist that included the need for antimicrobial prophylaxis. The inquiry informed us that our plans to implement the least expensive way of administration of prophylactic antibiotics, i.e., bolus injection [6], corresponded with the actual practice of the anaesthetists. Although cost factors were not perceived by the majority of the responding anaesthetists, we learned that other motives such as practicality made bolus injection already the preferred way of administration for prophylactic beta lactams. Concerning gentamicin, there was a common but erroneous belief that slow i.v. infusion would reduce the risk for toxicity. However, gentamicin can be safely injected over 3-5 min [7], and, both from a pharmacodynamic and pharmacokinetic point of view, there are indications that high initial peak concentrations are most effective and not associated with higher toxicity [8].

The information provided by this inquiry proved useful in an educational setting during the implementation of new guidelines [5]. Antibiotic committees, consisting of consultant microbiologists, clinical pharmacists, infectious disease physicians and clinicians should involve anaesthetists in new strategies to improve surgical prophylaxis.

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References

- 1 Hekster YA, Barrett CW. Formulary antibiotic surveillance program. *J Pharm Clin* 1987;6:335-42.
- 2 Classen DC, Evans RS, Pestotnik SL, Horn SD, Menlove RL, Burke JP. The timing of prophylactic administration of antibiotics and the risk of surgical-wound infection. *N Engl J Med* 1992;326:281-6.
- 3 Abramowicz M. Antimicrobial prophylaxis in surgery. *Med Letter* 1989;31(806):105-8.
- 4 Gyssens IC, Geerligts IEJ, Nannini-Bergman MG, Knape JTA, Hekster YA, Van der Meer JWM. Optimising the timing of antimicrobial drug prophylaxis in surgery: an intervention study. *J Antimicrob Chemother* 1996;38:301-8.
- 5 Gyssens IC, Geerligts IEJ, Dony JM, Van der Vliet JA, Van Kampen A, Van den Broek PJ, Hekster YA, Van der Meer JWM. Optimising the quality of antimicrobial drug use in surgery: an intervention study. *J Antimicrob Chemother* 1996, in press.
- 6 Gyssens IC, Lennards CA, Hekster YA, Van der Meer JWM. The cost of antimicrobial chemotherapy. A method for cost evaluation. *Pharm Weekbl [Sci]* 1991;13(6):248-53.
- 7 Mendelson J, Portnoy J, Dick V, Black M. Safety of the bolus administration of gentamicin. *Antimicrob Agents Chemother* 1976; 9:633-8.
- 8 Gilbert DN. Once-daily aminoglycoside therapy. *Antimicrob Agents Chemother* 1991;35:399-405.