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Referents for anti-infectious agents

Antimicrobial stewardship program and quality of antibiotic prescriptions

Indice composite du bon usage des antibiotiques et qualité de l'antibiothérapie

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Abstract

Objective. – National recommendations have been issued to define which optimal organization in hospitals could improve the quality of antibiotic prescription. Our aim was to check whether there was a link between applying these national recommendations and the quality of antibiotic prescriptions.

Patients and methods. – A prospective study was carried out in three French regional hospitals (A to C), to assess how recommendations were applied. Hospital organization was measured with the ICATB score (antimicrobial stewardship index) and the appropriateness of antibiotic prescription was assessed by an audit during 1 week by two investigators, who shadowed physicians during bedside visits, in various medical and surgical departments.

Results. – There was a considerable difference in the organization of these three hospitals in terms of computerized prescriptions, formulary restriction, availability of recommendations, and antibiotic consumption defined as delivered daily-dose. Institution A had strictly followed recommendations for hospital organization, but these were less observed in institution B and C. The prevalence of antibiotic treatment was comparable in the three hospitals, and concerned over 25% of patients. In institution A, 60% of antibiotic prescriptions were inadequate, 23% were not appropriate and 17% were optimal. In institution B, these figures reached 36%, 34%, and 34%, while in institution C they reached 25%, 55%, and 20%, respectively.

Conclusion. – There is no clear link between applying national recommendations for antibiotic prescription and optimization of hospital organization and the quality of antibiotic prescriptions.

Keywords: Antibiotic stewardship; Audit; Guidelines

Résumé

Objectif. – Des recommandations nationales ont été établies pour améliorer la qualité de l'antibiothérapie dans les établissements de santé. Notre but est d'identifier un lien entre ces recommandations de bon usage des antibiotiques et la qualité de leur prescription.

Patients and méthode. – Il s'agit d'une étude prospective menée pendant une semaine réalisée successivement au sein de trois hôpitaux généraux. L'organisation hospitalière était mesurée par le score ICATB, tandis que le caractère approprié de l'antibiothérapie était évalué par un audit des prescriptions réalisé par deux investigateurs accompagnant les médecins lors de leur visite au lit des patients dans des unités médicales et chirurgicales.

Résultats. – Il y avait une différence significative d'organisation des trois hôpitaux en termes d'informatisation, de restrictions de la prescription, de disponibilité des protocoles et de consommation antibiotique mesurée en dose délivrée journalière. L'établissement A suivait la majorité des recommandations concernant l'organisation hospitalière, ces dernières étant moins suivies dans les établissements B et C. La prévalence de l'antibiothérapie était comparable dans les trois hôpitaux, concernant près de 25 % des patients. Dans l'établissement A, 60 % des antibiothérapies étaient inadéquates, 23 % inappropriées et 17 % optimales. Dans l'établissement B, ces résultats étaient respectivement de 36 %, 34 % et 34 %, et dans l'établissement C de 25 %, 55 % et 20 %.

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Conclusion. – Ces données suggèrent qu'il n'y a pas de lien évident entre l'optimisation de l'organisation hospitalière autour de la prescription antibiotique et la qualité de l'antibiothérapie prescrite.

Mots clés : Bon usage des antibiotiques ; Audit ; Recommandations de bonnes pratiques

1. Introduction

There is increasing concern on the quality of antibiotic prescription in hospital medicine as well as in community, since numerous authors report that 30 to 50% of antibiotic prescriptions are inappropriate. [1–3]. Antibiotic use is correlated to the increase of bacterial resistance, an increased morbidity related to infections, and a lengthened hospital stay [4–6]. We have published consecutive studies showing that a high rate of inappropriate antibiotic therapy could be observed throughout the hospital such as in the emergency room and in intensive care departments [3,7–10]. Moreover, we showed that misdiagnosis was a main component of inadequate antibiotic therapy, since at least 30% of the diagnoses had to be reviewed during the hospital stay.

These facts have led to implementing policies having for objective to improve antibiotic therapy, involving mainly infectious disease specialists, microbiologists, pharmacists, and hygienists [6,11–14]. In France, recommendations were made by groups of experts, and then the French National Authority for health (Haute Autorité de santé or HAS) implemented indices of antibiotic prescription quality [12,13]. One of these, the *indice composite de bon usage des antibiotiques* (ICATB) assesses the organization of healthcare institutions promoting the good use of antibiotics with means and implemented actions [12]. This score reflects the institution's level of implication in a strategy aiming at optimizing antibiotic prescription (see below).

A double audit was carried out in three hospitals to determine if improvement of hospital organization was related to the quality of antibiotic prescriptions:

- we calculated the ICATB score for each of these institutions;
- we performed a clinical audit of antibiotic prescriptions at the patient's bedside.

2. Patients and method

A prospective study was made in three general hospitals of South-Eastern France (Provence-Alpes-Côte d'Azur, cities of Draguignan, Antibes, and Grasse), combining the ICATB score with an audit on the quality of antibiotherapy at the patient's bedside, in cooperation with the referent clinician.

Volunteer institutions for this study were comparable in terms of hospital beds (around 320 each) and beds in specialized units (orthopaedic and visceral surgery, internal medicine, pneumology, cardiology, gastro-enterology, obstetrics and gynecology, pediatrics, gerontology), and absence of infectious disease units.

The study was made by two infectious disease specialists, from the Nice University Hospital, for 1 week in each institution. The medical commission members in each institution were met 2 weeks before the survey, as well as healthcare teams (physicians, nurses) to describe the study modalities and to obtain their consent. The information was renewed a few days before the beginning of the study to check this consent.

Hospital organization related to antibiotic stewardship policy was first assessed. Thus, pharmacists, microbiologists, and hygienists were questioned on items relevant to ICATB: presence of an "antibiotics commission", presence of a referent physician in antibiotherapy, presence of adapted computerized drug prescription, training for prescribers, presence of an antibiotic list, and/or controlled dispensation antibiotic list, and/or list with a limited length of treatment, presence of antibiotic consumption monitoring, and planned reevaluation of antibiotic prescription.

The second part of the survey was a prospective clinical audit of antibiotic prescriptions, made by shadowing volunteer physicians during patient bedside visits. The investigators did not interfere in antibiotherapy initiations. All patients treated by curative antibiotherapy were included, surgical antibiotic prophylaxis was excluded. Data was collected in real time in a standardized manner: unit, patient's name, age, sex, diagnosis of infection motivating antibiotic prescription, antibiotic treatment (drug, dose, frequency, and mode of administration). The investigators assessed the appropriateness of antibiotherapy, with a previously published analytic method, according to patient examination and medical file data (Fig. 1) [11,12]. The algorithm allowed sorting antibiotic treatments as non-indicated, (the patient did not need antibiotherapy), inappropriate (the patient needed antibiotic therapy but there were better alternatives or the mode of administration was inadequate), or optimal [11,12]. The evaluation criteria were published national consensus and comparison of the two investigators.

3. Results

Institution A was visited in June 2007, institution B in January 2008, and institution C in April 2008. The hospital units having consented to this audit are presented in Table 1. The pneumology unit in hospital B and digestive surgery unit in hospital C were not audited, because the physicians had not given their consent.

3.1. Hospital organization: indice composite de bon usage des antibiotiques (ICATB) score

A difference in hospital organization was noted among these three hospitals (Table 2). The ICATB score was respectively 12.5/20, 5/20, and 7/20 for institutions A, B, and C. Hospital A had an effective computerized prescription system, available protocols, a list of antibiotics as well as restriction of prescriptions for six of these. Prescribing was controlled with these

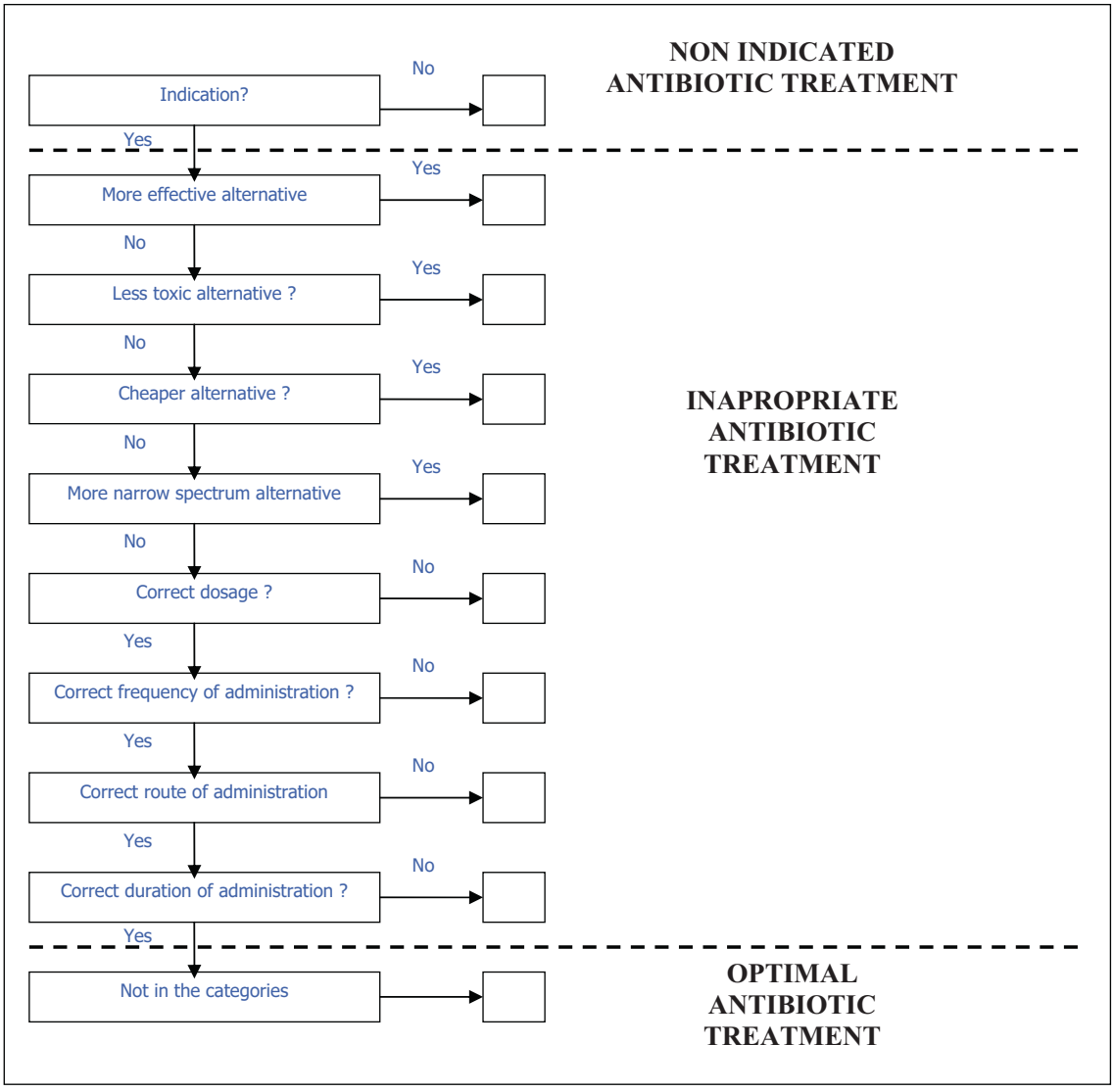

Fig. 1. Analytic flowchart on the quality of antibiotic prescription.
Démarche analytique des prescriptions antibiotiques.

means. This protocol facilitated the daily relationship between the prescribing clinician, the microbiologist, and the pharmacist. Institution B did not have any computerized prescription system or protocols, but presented restrictions of prescription for six antibiotics. Institution C had a partially computerized prescription system, few available protocols, and a list of 14 controlled dispensation antibiotics.

The three hospitals had set up an Antibiotics Commission, which was more effective in institution A since it reassessed local protocols and met once a month. Nevertheless, no institution had a referent physician for antibiotic therapy; this was associated to the absence of continuous training in antibiotic therapy and absence of antibiotic therapy reassessment at 48 to 72 hours.

3.2. Quality of antibiotic prescription

There was a difference in the number of patients visited because of restricted access to some units: 99 in hospital C, and 140 and 112 respectively in hospitals A and B. The prevalence of curative antibiotic therapy was nevertheless comparable, from 25% to 36%. The prescribed antibiotherapies are listed Table 1, and include initiation of treatments as well as on-going therapies during the survey visit. We were not able to list the frequency of antibiotic reevaluation because it was not specifically mentioned in medical files. Analyzing the appropriateness of prescription revealed differences among institutions, with a tendency to a better quality of antibiotic therapy in institution C compared to institution A ($P = 0.071$ according to Fisher's test).

4. Discussion

Government authorities have proposed organizational indicators to healthcare institutions to improve antibiotic prescription, but their impact on the quality of antimicrobial therapy is not documented.

Table 1
Features of patients included in a weeklong survey, antibiotic therapy administration and evaluation.
Caractéristiques des patients inclus lors d'enquête une semaine-donnée, antibiothérapie et son évaluation.

	A	B	C
Patients (n)	140	112	99
Antibiotic treatment (n)	35 (25%)	31 (27%)	36 (36%)
Sex ratio	1.1	1.4	0.97
Median age (range)	63 (1–99)	67 (1–96)	79 (16–103)
Patients per unit/with antibiotherapy			
Intensive care	10/6	11/6	9/8
Internal medicine	24/7	24/7	16/7
Geriatrics	16/3	18/3	28/5
Pneumology	30/8	–	24/10
Diabetology	–	8/3	–
Pediatrics	12/3	7/3	–
Orthopaedics	–	21/4	2/0
Visceral surgery	24/4	23/5	–
Cardiology	24/5	–	18/5
EU admissions	–	–	2/1
Pulmonary infections	22 (62%)	15 (48%)	23 (64%)
Urinary infections	6	5	6
Others	7	11	7
Empiric antibiotherapy	25 (71%)	29 (93%)	23 (64%)
Antibiotic combinations	12 (34%)	11 (35%)	14 (39%)
B-lactams + Quinolones	6	8	7
B-lactams + Aminoglycosides	3	3	5
Other antibiotic combinations	3	–	2
Monotherapy	23	20	22
Cephalosporins	12	8	10
Amoxicillin-clavulanic acid	6	6	4
Quinolones	3	2	6
Others	1	4	2
Optimal antibiotic therapy	6 (17%)	10 (32%)	13 (36%)
Non indicated antibiotic therapy	21	11	8
Non-appropriate antibiotic therapy	8	10	15
More appropriate alternative	5	5	8
Less toxic alternative	1	4	3
Cheaper alternative	1	–	–
Narrower spectrum alternative	1	–	–
Inadequate dose	–	1	4

Table 2
Composite index of antibiotic stewardship among three general hospitals.
Indice composite du bon usage de antibiothérapie (ICATB) au sein de trois hôpitaux.

	A	B	C
ICATB1	4	4	2
Presence of an "antibiotic commission"[a]			
ICATB2			
Presence of a referent physician in antibiotic therapy	0	0	0
ICATB5			
Computer connection	1	0	1
Computerized drug prescription	2	0	1
ICATB6			
Training of new prescribers	0	0	0
ICATB3			
Antibiotic protocols[b]	2	0	0.5
ICATB4			
List of available antibiotics	0.25	0.25	0.25
List of controlled dispensation antibiotics	0.5	0.5	0.5
Controlled with a limited duration of treatment	0.25	0	0
ICATB7			
Evaluation of antibiotic consumption	0	0	0
ICATB8			
Monitoring of antibiotic consumption	2.5	0.3	0
DDD according to data provided by the pharmacy	332	548	na[c]
Total	12.5	4.75	7.25

DDD: defined daily dose.
[a] ICATB1–antibiotics commission: one meeting per year = 1 point, two meetings per year = 2 points, more than three meetings per year = 4 points.
[b] ICATB3–protocols dedicated to antibiotics: no = 0, yes = 2 with the following weighted correction: antibiotic prophylaxis (0.5), antibiotherapy (1), antibiotherapy in the EU (0.5).
[c] Available information but possibly false result because of typing mistakes.

Our study reveals the heterogeneity in the implementation of national recommendations in three hospitals of our region, and the absence of any direct link with the quality of antibiotherapy.

Several authors have described the implementations of antibiotic stewardship among European hospitals [14–16]. Between 1994 and 2004, 50 to 80% of surveyed hospitals had written protocols for prophylactic and curative antibiotic therapy [15,16]. Nevertheless, little data was available on the presence of an infectious disease specialist, and the reassessment of antibiotic therapy seemed limited, concerning 17 to 46% of hospitals [16–18].

More recently, a prospective study made in the North of France had for objective to identify control measures impacting antibiotic consumption [19]. Nominative delivery was the measure most likely to induce a lower antibiotic consumption, and was especially effective if it was associated to an automatic interruption of delivery [19,20]. Likewise, computerized prescription was an adequate tool to decrease the rate of inappropriate antibiotic therapy. A computerized alert monitoring treatment initiations facilitated the prescription of antibiotic therapy for 482/932 prescriptions (52%), decreased its planed length (19%), stopped or optimized the antibiotic therapy (16% and 15% respectively) [21]. Finally, Amadeo and al surveyed 977 French hospitals; they found a positive correlation between ICATB and antibiotic consumption, expressed in defined daily dose (DDD) [22]. Nevertheless, elements of ICATB had a variable impact on DDD, and computerized systems were determining factors. Likewise, if penicillin consumption was impacted positively by the effective implementation of ICATB items, that of cephalosporins and quinolones was not [22].

Thus, ICATB appeared as a combination of means quantitatively regulating antibiotic therapy: protocol use, restricted access to some antibiotics, continuous training, and computerized systems decreased antibiotic consumption [6,11,22].

Our results were communicated to every institution's medical commission, and each hospital considerably improved its organization to implement national recommendations, the medical teams were in fine sensitized to the antibiotic stewardship policy.

The pertinence of a means indicator such as ICATB is probably related to the important volume of inadequate antibiotic therapy. Accordingly, a 30% decrease of the volume of antibiotic therapy has been reported without significant impact on the morbidity and mortality related to infections, including in the ICU [1,3,7–10,23].

Our study suggests that a satisfactory ICATB score is not necessarily associated to a good quality of antibiotherapy. This result could be related to the main limitation of our study, i.e. the low number of curative antibiotherapies assessed (92 patients). The other limitations are the disparities of visited units (Table 1) and, despite our method, the difficulty to find reproducible evaluation criteria for some qualitative criteria of antibiotherapy. Finally, only three hospitals were studied, because clinical and therapeutic audits at the patient's bedside at a hospital level are time-consuming.

The absence of any link between the quality of hospital organization and the quality of antibiotic therapy has already been suggested in infectious diseases [24]. The pertinence of protocols implemented to improve antibiotic therapy has been contested, and reassessment has sometimes proved worse than using empiric antibiotic therapy [24,25].

More than 40% of the patients are referred to our infectious diseases department by the emergency unit when available [26]. Since there are usually no infectious disease department in general hospitals, infected patients are dispatched to various wards, depending on bed availability. Experience in clinical laboratory practice and infectious diseases are highly variable in these wards.

Obviously, such a complex clinical itinerary of infected patients, with many structural and human factors interfering, makes it difficult to decide whether or not to prescribe an antibiotic. Hospital leaders and policy makers should keep this in mind, and consider involving physicians and collaborative laboratories in specific networks.

Disclosure of interest

The authors have not supplied their declaration of conflict of interest.

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