

BRIEF ORIGINAL

Difficulties with the prescription and administration of antibiotics in routine hospital emergency department care: a survey study

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Objective. To detect the problems hospital emergency room staff have when prescribing and administering antibiotics.

Methods. A 14-item questionnaire was designed to assess staff members' knowledge of the importance of starting antibiotic treatment promptly, assigning appropriate dosing intervals, adjusting for renal function, and switching to oral therapy. Agreement with each item was expressed on a 5-point Likert scale. Items with a rate of appropriate response of less than 75% were targeted for specific attention.

Results. Two hundred questionnaires were distributed to the staff and 150 were returned completed (response rate, 75%). The following items were targeted for attention based on rates of appropriate response of less than 75%: clear medical orders (65%), understanding the implication of early empirical antibiotic therapy on prognosis in serious infections (67%), estimation of the prevalence of renal insufficiency (42%), assumption that a creatinine serum level under < 1.6 mg/dL is safe (33%), use of glomerular filtration rate to adjust dose according to renal function (47%), and an understanding of switching from intravenous to oral treatment (60%).

Conclusions. This study revealed the difficulties medical and nursing staff have in prescribing and administering antibiotics in a hospital emergency department. The results can facilitate improvements in antibiotic therapy by pinpointing areas to target for specific training interventions or the design of electronic prescribing aids.

Keywords: Antibiotics, prescription. Antibiotics, administration. Surveys. Patient safety. Quality improvement.

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Detección mediante encuesta de las dificultades con las que se encuentra el personal sanitario en la prescripción y administración de antibióticos en la práctica clínica diaria de un servicio de urgencias hospitalario

Objetivos. Detectar las barreras con las que se encuentra el personal sanitario en la prescripción y administración de antibióticos en un servicio de urgencias hospitalario (SUH).

Método. Se diseñó una encuesta con 14 ítems para valorar el grado de conocimiento de la importancia de la precocidad en el inicio de tratamiento antibiótico, los intervalos de dosificación adecuados, el ajuste a la función renal y la terapia secuencial. Las respuestas a cada ítem fueron cualitativas con 5 categorías. Se consideró que los ítems que obtuvieron una respuesta correcta menor del 75% precisaban de una intervención específica.

Resultados. Se recogieron 150 encuestas cumplimentadas de las 200 repartidas entre el personal sanitario (tasa de respuesta del 75%). Los ítems con una respuesta correcta menor del 75% y que por tanto se consideró que requerían de una intervención específica fueron: la claridad en los órdenes médicos (65%), el conocimiento de la implicación del tratamiento antibiótico empírico precoz en el pronóstico de las infecciones graves (67%), la estimación de la prevalencia de la insuficiencia renal (42%), un valor de creatinina sérica inferior a 1,6 mg/dl considerado como seguro (33%), el filtrado glomerular como parámetro que se debe utilizar para ajustar la dosis a la función renal (47%) y el conocimiento de la terapia secuencial (60%).

Conclusión. Este estudio permite conocer las dificultades con las que se encuentra el personal sanitario a la hora de prescribir y administrar antibióticos en un SUH y facilita el diseño de estrategias de mejora que incluyan desde formación específica a técnicas de prescripción electrónica.

Palabras clave: Prescripción de antibióticos. Administración de antibióticos. Encuestas. Seguridad del paciente. Estrategias de mejora.

Introduction

Early administration of antibiotics in a hospital emergency department (ED) improves morbidity and mortality, and reduces hospital stay time of patients

with serious infectious processes¹⁻³. But there are other aspects that are important in the prescription of antibiotics. Prescription according to renal function and dosage with appropriate intervals is essential, especially in the first 24 hours for drugs with a short half life^{4,5}. Fur-

thermore sequential therapy (or "switch therapy") or changing the route of antibiotic administration from intravenous (iv) to oral (po) may save costs, shorten the length of hospital stay and reduce the adverse effects of iv administration⁶.

In a recent study in our ED we noted certain aspects of prescribing and administering antibiotics which are improvable⁷. The main one was improving the time to administering the first dose, which often exceeded a median of 3 hours from ED arrival. The delay in prescribing and administering the first dose of antibiotic from ED arrival may be multifactorial and dependent on external factors: number of patients waiting and number of patients occupying the areas of first visit and observation, among others.

However, in this work we emphasize that time to first dose of antibiotic after ED arrival often exceeded 2 hours, even in patients with severe sepsis and septic shock. In this case we believe that the factors directly involved related to the ED care process. Therefore,

The present study aimed to identify the variables affecting this delay and determine which ones are susceptible to improvement. We considered that that one option would be to analyze the difficulties that ED professionals encounter when prescribing and administering antibiotic treatment by means of surveys.

Method

This cross-sectional observational study was conducted in the ED of a tertiary university hospital in an urban area attending 85,000 annual visits. Based on previous studies published in the literature, a survey consisting of 14 items was designed to assess the knowledge and the difficulties the medical personnel of the ED encountered in prescribing and administering antibiotics in daily practise⁸. Table 1 shows the survey, whose items mainly evaluated four aspects: when antibiotic treatment was initiated, dosage ranges, the renal function setting and consideration of switch therapy. The responses to each item were qualitative with 5 categories (1: never agree, 2: seldom agree, 3: sometimes agree, 4: generally agreement and 5: always agree with the wording of the item). By item, the answer generally agree or always agree, on the one hand, and never agree or seldom agree, on the other, were accepted as correct. It was considered that the items receiving less than 75% correct response required specific intervention.

Surveys were distributed randomly during the month of November 2013, at the beginning of the work shift (doctors and nurses) and collected at the end of the shift. Surveys not completed were re-distributed in the following days.

Data were analyzed using SPSS 17.0. Categorical variables were analyzed with Fisher's exact test. When not meeting the conditions of application, non-parametric tests were used. Differences with p value <0.05 were considered significant. The study was approved by the

Table 1. Model of the survey "Barriers to change" in the prescription of antibiotics in the hospital emergency department (ED)

1. Early antibiotic treatment
1.1. The doctor's orders are generally clear about antibiotic prescription in the ED.
1.2. Early antibiotic treatment is important, but does not influence the prognosis in infectious diseases.
1.3. It usually takes a long time to decide whether or not a patient needs antibiotics.
1.4. In general the first dose of antibiotic is postponed until administration of the usual medication.
1.5. Generally, antibiotic prescription is delayed until culture results are received.
1.6. The difficulty in achieving IV access produces a delay in starting antibiotic treatment.
1.7. Prescribed antibiotics are usually not immediately available in the ED.
1.8. Antibiotic administration is often postponed until the patient is transferred from the ED to a ward.
2. Dosing Intervals
2.1. Administration of oral antibiotics is usually delayed until mealtimes.
2.2. In general, drugs, including antibiotics, are not administered during the night period.
3. Dosing adjustment according to renal function
3.1. Renal failure is often a problem when prescribing antibiotics.
3.2. Serum creatinine <1.6 mg / dL is considered safe, especially in elderly patients.
3.3. To adjust antibiotics according to renal function it is the same to use creatinine values or glomerular filtration rate.
4. Sequential therapy
4.1. Sequential therapy (switch from intravenous to oral antibiotic) is a possibility in the ED.

Previous reports of mistreatment occasionally refer to police reports, medico-legal reports or court orders.

Clinical Research Ethics Committee of Hospital Clínic, Barcelona.

Results

Were collected 150 completed surveys of 200 distributed among ED professionals (response rate 75%), of which 59 were completed by doctors (39%) and 91 by nurses (61%). Table 2 shows the overall results while Table 3 and Figure 1 show the percentage of correct answers for each item.

Items with $\geq 75\%$ correct answers and therefore not considered a problem when prescribing or administering antibiotics were: administration of the first dose of antibiotic is not usually deferred to that of regular medication (75%), prescribed antibiotics are generally found in the ED (81%), the first dose of antibiotic was rarely postponed due to transfer to a ward (92%) and finally, drugs in general and particularly antibiotics are administered during the night period (78%).

Items with lower than 75% correct response and therefore requiring a specific intervention were: clarity in medical orders (65%), knowledge of the implication of early antibiotic therapy in the prognosis of severe infections (67%), the estimated prevalence of renal failure (42%), serum creatinine <1.6 mg / dl considered as sa-

Table 2. Overall results of the surveys

	1. Never (%)	2. Rarely (%)	3. Sometimes (%)	4. Generally (%)	5. Always (%)
Medical orders are clear	3	8	25	47	18
Early antibiotic treatment is important, but does not influence the prognosis	38	29	13	13	8
Much time spent on the decision-making process	16	36	30	16	3
The first dose is delayed until administration of the usual medication	46	29	16	10	0
Wait for culture results before prescribing antibiotic	47	23	12	8	10
Difficulty in obtaining intravenous access delays the first dose	31	21	21	21	7
Antibiotics not immediately available in the ED	48	33	12	4	3
Antibiotics postponed until transfer from the ED to a ward	71	21	4	3	1
Oral antibiotics postponed to meal times	19	25	32	15	9
No nocturnal administration of drugs	49	29	15	8	--
Renal failure is often a problem (prevalence estimate) in antibiotic prescribing	9	21	28	31	11
Serum creatinine level <1.6 mg / dL considered safe, especially in elderly patients	11	22	33	25	8
To adjust antibiotics according to renal function it is the same to use creatinine values or glomerular filtration rate.	25	22	33	25	8
Awareness of the concept and the possibility of sequential therapy in the ED	5	16	18	35	25

SUH: Servicio de urgencias hospitalario.

Table 3. Percentage of correct answers on each item

	All surveys n = 150 (%)	Physicians n = 59 (%)	Nurses n = 91 (%)	P
1. Medical orders are clear (usually or always)	65	88	50	0.02
2. Early antibiotic treatment is important, but does not affect prognosis (seldom or never)	67	90	51	0.01
3. Much time spent on the decision-making process (seldom or never)	52	60	47	0.2
4. The first dose is delayed until administration of the usual medication (seldom or never)	75	84	68	0.1
5. Wait for culture results before prescribing antibiotic (seldom or never)	70	63	74	0.3
6. Difficulty in obtaining intravenous access delays the first dose (seldom or never)	52	44	57	0.3
7. Antibiotics not immediately available in the ED (seldom or never)	81	86	77	0.4
8. Delay the administration until transfer from the ED to a ward (seldom or never)	92	97	89	0.4
9. Administer oral antibiotics with food (seldom or never)	44	43	44	0.5
10. No nocturnal administration of drugs (seldom or never)	78	83	74	0.1
11. Renal failure is often a problem (prevalence estimate) in antibiotic prescribing (generally or always)	42	46	40	0.5
12. Serum creatinine value <1.6 mg / dL is considered safe, especially in elderly patients (seldom or never)	33	47	23	0.06
13. To adjust antibiotics according to renal function it is the same to use creatinine values or glomerular filtration rate (seldom or never)	47	76	28	0.001
14. Awareness of the concept and the possibility of sequential therapy in the ED (usually or always)	60	60	60	0.5

ED: hospital emergency department. Highlighted in gray are items for which there were significant differences between physician and nursing staff.

fe (33%), glomerular filtration as a parameter to be used to adjust the dose according to renal function (47%) and knowledge of switch therapy (60%).

Table 3 also shows the percentages of correct ans-

wers by doctors and nurses for each item. The items showing statistically significant doctor-nurse differences in correct answers were: the perception of clarity in medical orders, awareness of the importance of early em-

pirical antibiotics for prognosis in serious infections and aspects related to adjustment according to renal function.

Discussion

In a previous study performed in our ED⁷ we observed certain deficiencies in prescribing and administering antibiotics, so we aimed to detect the difficulties encountered by ED professionals when prescribing and administering them. Although there are some international scientific publications on the topic⁸, to our knowledge this is the first work in our setting that uses survey methods for the previously described objective.

In general, it is considered important that the first dose of antibiotic should be administered early, but the effect on prognosis is largely unknown. In addition, it is thought that it takes too long to decide whether a patient needs an antibiotic and, particularly for nurses, medical orders are too often unclear. There are doubts about whether to prescribe and administer an antibiotic it is necessary to wait for culture results, and finally the possibility of switch therapy is not widely known. These aspects can be improved by introducing a training program for both doctors and nurses, focusing mainly on the importance of early empirical treatment on prognosis in cases of severe sepsis and septic shock⁹. The training strategy could consist not only of theoretical sessions, but in presentation of clinical cases by the staff that includes further discussion¹⁰. Furthermore, it is possible to design specific practical training to acquire or improve the ability of placing peripheral lines in certain cases, for instance in elderly patients or those who have previously received treatments and suffered phlebitis as a side effect. Although training strategies have proven useful, there has been much discussion about whether their efficacy is maintained over time, so we propose refresher sessions and regular evaluation of the most important aspects¹¹.

The scheme used for the prescription and administration of oral antibiotics is another area susceptible to improvement. In general, prescription systems both manual and electronic favor their intake with meals (breakfast, lunch and dinner) for oral medication, and this may not be right for antibiotics in which the pharmacokinetics influence blood levels (eg. the night period lasts longer than recommended for logistic reasons)¹². To improve this aspect it might be useful to propose that prescription systems allow a fixed dosing interval for certain drugs, including antibiotics, and encourage prescription of antibiotics with a long half-life and therefore fewer daily doses, when possible.

The concept of correct or appropriate empiric antibiotic treatment concerns not only to the use of antibiotics whose in vitro sensitivity is adequate for isolation, but also that they be administered by an appropriate route of administration, at correct doses, reaching the source of infection, and used in combination with other antibiotics when indicated^{10,13}. However, a topic that deserves special consideration in the ED setting is adjust-

ment of the antibiotic according to renal function and the correct dose interval. The reasons for non-adjustment are: underestimation of the prevalence of renal failure, considering creatinine values below 1.6 mg / dL as safe, and ignorance of the fact that creatinine value does not directly correspond with glomerular filtration rate (GFR), since that depends on the age and sex of the patient. We think that training sessions for these aspects would be useful to improve this. We also think the estimated GFR should be included in basic ED lab tests using the MDRD equation 4 and that a warning should appear when the GFR is less than 60 ml / min in the electronic prescription system^{14,15}.

The main limitation of the study is that it is based on non-validated methodology. However, we think this is a novel approach which is closer to reality. Also, we would encourage other centers to implement it in their EDs, which would allow for comparison of results and reproducibility.

In conclusion, our results help establish the basis for

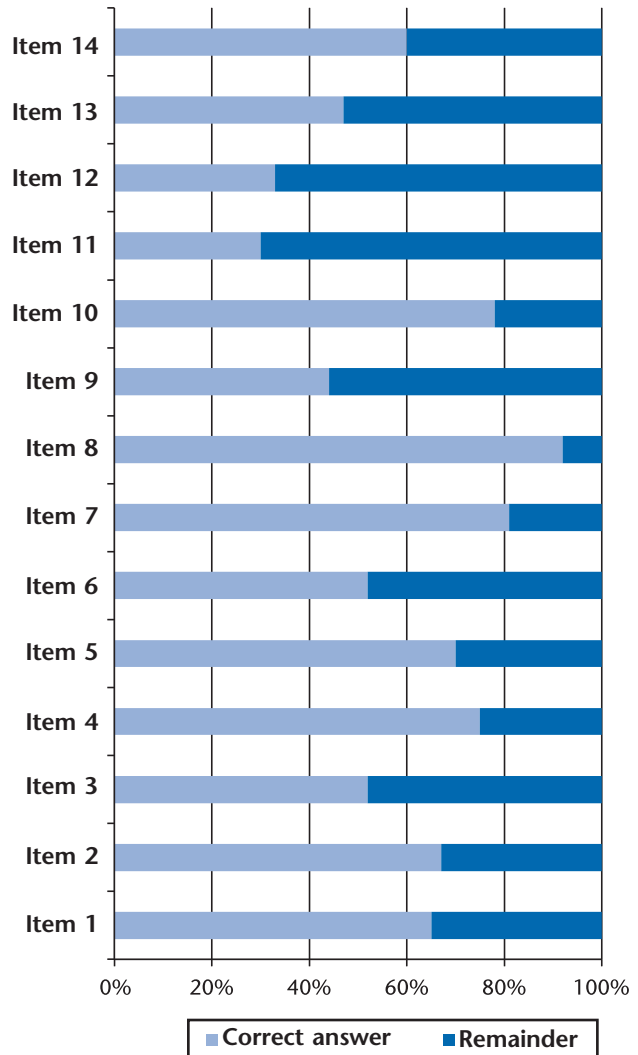


Figure 1. Graphic representation of correct answers for each item (see items in Table 1).

the design of strategies for improvement, including the identification of patients at risk, training strategies and multidisciplinary work, as well as the development and improvement of computer techniques, to improve the quality of care and safety of patients starting antibiotic treatment in the ED.

Conflict of interest

The authors declare no conflict of interest.

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