Rev esp cir ortop traumatol. 2010;**54(3)**:149-155

Revista Española de Cirugía Ortopédica y Traumatología

www.elsevier.es/rot

ORIGINAL ARTICLE

Medication reconciliation at hospital admission and discharge in an orthopedic surgery and traumatology department

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Received January 5, 2010; accepted January 26, 2010

KEYWORDS
Discharge information;
Medication compatibility;
Safety promotion

Abstract
Purpose: To evaluate the results of a medication compatibility and drug information programme at discharge in an orthopaedic surgery and traumatology department.
Materials and methods: Patients with more complexity in their home treatment, admitted in this facility during 2008 were included in the study. Preadmission regimens were recorded and the patents were asked about medication-related problems (PRM) and drug adherence. On the day of discharge, prescribed medication was reconciled with the outpatient treatment, resolving discrepancies with the prescribers. Finally, the patients were given a complete list of their medications after the care episode and recommendations on their treatment with oral explanation. We conducted a survey of the physicians to ask about their compatibility programme knowledge and their assessment.
Results: 243 patients were selected, in whom 102 (42%) PRMs were detected. The major discrepancies were found in antithrombotic drugs (25%) and analgesics and anti-inflammatory drugs (21%). The most frequent were: therapeutic duplication (53%) and interactions (27%). The PRMs were classified according to their severity: 65% would not have caused harm to the patient and 35% would require monitoring.
Regarding the survey, the overall evaluation of the programme was "very good" for 100% of the physicians.
Discussions: Medication compatibility has proved to be a useful strategy for improving the safety of our patients as part of a system to reduce health risks and improving quality of care.

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1888-4415/$ - see front matter

PALABRAS CLAVE
Información al alta;
Conciliación de prescripción;
Promoción de seguridad

Conciliación de la medicación al ingreso y al alta hospitalaria en un servicio de cirugía ortopédica y traumatología

Resumen
Objetivo: Evaluar los resultados de un programa de conciliación e información de medicación al alta hospitalaria en un servicio de cirugía ortopédica y traumatología.
Material y método: Se incluyeron los pacientes ingresados durante 2008 con mayor complejidad en su tratamiento domiciliario. Éste se registró y se confirmó, mediante una entrevista con el paciente, la adherencia a éste, así como problemas relacionados con la medicación (PRM). A partir de la epicrisis, se conciliió la medicación prescrita con el tratamiento ambulatorio y se resolvieron las discrepancias con el facultativo encargado. Por último, se entregó al paciente el listado completo de su medicación a partir del episodio asistencial y recomendaciones sobre su tratamiento, con la explicación verbal de éste. Realizamos una encuesta de satisfacción a los traumatólogos para conocer el conocimiento del programa y su valoración.
Resultados: Se seleccionaron 243 pacientes; en 102 (42%) se detectaron PRM. Las principales discrepancias se encontraron en fármacos antitrombóticos (25%) y analgésicos y antiinflamatorios (21%). Las discrepancias más frecuentes fueron la duplicidad terapéutica (53%) y las interacciones (27%). Los PRM se clasificaron según su gravedad: el 65% no habría causado daño al paciente y un 35% requeriría monitorización.
Resultados: En cuanto a la encuesta de satisfacción, la valoración global del programa fue «muy buena» para el 100% de los facultativos.
Discusión: La conciliación de medicación se ha mostrado como una estrategia útil para aumentar la seguridad de nuestros pacientes, en el marco de un sistema de reducción de riesgos para la salud y mejora de la calidad asistencial.

Introduction

Patient safety is a topic that is increasingly preoccupying in scientific circles, professional collectives, health institutions, and, of course, the administration. Above all, this stems from two publications from the United States Institute of Medicine: the first of these, "To err is human", reviews the medical literature published on adverse effects and damages produced as a result of medical attention, and concludes that in 2.9 to 3.7% of cases, hospitalisation incurred adverse effects in the patient.[1] The researchers estimated that approximately half of the adverse effects were caused by hospital errors.[2,3] In the second of these publications, "Crossing the quality chasm," the authors declared that the safety of the patient is a fundamental component of care quality.[4]

Medication errors constitute one of the principal causes of damage to hospitalised patients; approximately 2% of patients admitted to hospitals experience a preventable error in medication.[5]

The transition between levels of care and transfer of patient charges creates situations that are especially vulnerable to medication errors.[6] Additionally, between 30 and 70% of medical orders for hospital admission carry unjustified discrepancies.[7] Conversely, upon patient discharge, studies have shown that up to 60.1% of medications prescribed contain compatibility errors.[8]

Programmes for medication compatibility are designed precisely in order to prevent medication errors at care transition points and consist of obtaining a list that is as complete as possible for previous medication given to the patient for evaluation against medications prescribed following the care transition, after a change in primary care, or upon hospital discharge, in order to detect unintentional discrepancies.

Organisations such as the Joint Commission on Accreditation of Health Care Organisations have required since 2006 that all health care centres accredited by them have procedures developed in order to guarantee adequate medication compatibility when the patient is transferred to another caregiver.[9]

More recently, in December 2007, the National Institute for Health and Clinical Excellence, together with the National Patient Safety Agency of England, published a solution guide for medication compatibility in hospital admissions.[10]

Our hospital has been using a medication compatibility programme upon hospital discharge in the orthopaedic surgery and traumatology department since 2006.

There are several factors that make errors in compatibility ever more frequent:

- Concomitant diseases and multiple medications. The increased life expectancy of humans means that patients enter the hospital under chronic medication.
- Health registries. One single patient can have several medical specialists involved in his/her treatment. The lack of singular registries where the totality of medications

taken by the patient can be compiled complicates the effort to maintain a consistent, regular treatment at a given time, for example, upon hospital admission.
- Characteristics of hospital stay. The current tendency is that hospital stays are consistently shorter, which can lead to regular medications being overlooked.
- The adaptation to hospital practices at times means that, upon discharge, the patient is sent with the medication he/she was given while admitted, which can be distinct from that which was taken prior to admission.

The objectives of our study were the following:

- Register and analyse the discrepancies found in the regular medication prescribed to the patient and those given upon hospital discharge.
- Classify problems related to medication (PRM) and evaluate their severity.
- Increase the safety in medication use through medication compatibility.
- Inform patients on an individual basis, both verbally and in writing, of the treatment to be followed after discharge from the hospital.
- Evaluate the level of satisfaction in the medical personnel of the orthopaedic surgery and traumatology unit with the medication compatibility programme and the medical information provided upon discharge.

Material and methods

We performed a retrospective study at a referral hospital department in the Autonomous Community of Valencia, with 330 beds, during the year of 2008 in patients admitted to the orthopaedic surgery and traumatology unit.

A pharmacist performed a daily review of the patient census list obtained from the hospital patient management information system *IRIS*. Patients older than 50 years were chosen from this list. Subsequently, the level of complexity of the case was assessed using the patient information from the Outpatient Information System. Inclusion criteria included age (patients older than 50), number of drugs prescribed in normal treatment (more than 3), clinical situation (renal or hepatic failure), and underlying diseases that justified inclusion (epilepsy, diabetes, etc.). The final selection was the decision of the pharmacist in charge of the programme, following an evaluation of the patient in all of the criteria. We designed a form for data collection where all of the patient's information was registered: reason for admission, date for surgical intervention, chronic treatment prescribed to the patient and his/her dosage, chronic pathological background, and allergies/intolerances to medications.

In the first 24 hrs following admission, the patient or family members were interviewed in order to confirm adherence to the prescribed treatment, self-medication habits, phytotherapy use, etc.

Once the complete list of home medications owned by the patient was obtained, it was reviewed in order to detect possible discrepancies upon hospital admission. At the time of hospital discharge starting at the epicrisis, the treatment prescribed by the attending traumatologist was also assessed. The discharge report was put together using the organiser on the *Alta hospitalaria* (Hospital discharge) programme: we evaluated the medication prescribed upon discharge together with the normal medications taken by the patient in order to avoid duplications between both prescriptions, interactions, or discrepancies in dose, duration of treatment, intake regimen, omission of treatment, contraindications, etc. In the case of detecting any discrepancies, as well as registering them, the pharmacist contacted the physician in charge of the patient's case in order to resolve the issue.

We considered the following as unjustified discrepancies: therapeutic duplicity, interactions, omission of treatment, incorrect administration, incorrect dosage, etc. From this point on, we created a report using the INFOWIN information programme, which was then given to the patient in a folder along with general recommendations on how to take the medication. This document consisted of three parts: a complete list of all medications that the patient leaves the care process with (both the normal and discharge prescriptions), a visual chronogram or a time management plan for drug intake, along with a picture of the drug container, the optimum form of administration and intake regimen, and a brief review of each medicine that constitutes a part of the patient's treatment.

When the report was given to the patient, it was accompanied by an explanation of the most relevant aspects of the treatment, especially with regard to the new drugs prescribed, doubts were resolved, and emphasis was placed on the most adequate form of administration and adherence. Furthermore, the patients and family members were given a telephone contact for 24 hr pharmacy service in order to resolve doubts once at home.

The severity of discrepancies was evaluated using the guide provided by the National Coordinating Council for Medication Error Reporting and Prevention,[11] which classified them into: 1) no potential damage (includes categories A-C); 2) requires monitoring or intervention in order to prevent damage (includes category D), and 3) potential damage (includes categories E-I) (table 1).

Pharmaco-therapeutic interventions that were performed classified in the following manner:

1. Safety. It prevents adverse effects, interactions, and allergic reactions.
2. Efficiency. The start or suspension of a medication rests on duplicity with another normal treatment, modification of dosage, intake regimen, or treatment duration.
3. Indication. Interventions in which a prescription for a necessary drug in the patient's clinical situation or suspension of a drug that is not indicated.
4. Educational. Inform the patients on their treatment, above all with new drugs prescribed upon hospital discharge in order to increase the effectiveness and adherence by comprehension and understanding, both with the patients and family members.

Upon finalising the study, we performed a satisfaction survey with the medical staff in the orthopaedic surgery and traumatology unit in order get their evaluation of the compatibility programme. We designed an anonymous

Table 1 Classification of the severity of the medication discrepancies. National Coordinating Council for Medication Error Reporting and Prevention

Category A	There is no error, but it is possible that one is produced
Category B	Error that does not reach the patient and causes no damage
Category C	Error that reaches the patient, but probably causes no damage
Category D	Error that reaches the patient and that will require monitoring/interventions
Category E	Error that would have caused temporary damage
Category F	Error that would have caused damage that would have required hospitalisation or a prolonged stay
Category G	Error that would have caused permanent damage
Category H	Error that may have required vital support
Category I	Error that would have been fatal

survey with 9 questions in order to measure the level of understanding of the programme (question 1), the physician's opinion on the results seen in the patient (questions 2, 3, and 4), partial evaluation of the different aspects of our work (questions 5, 6, 7, and 8) and overall evaluation of the programme (question 9).

Results

During this period, we admitted 943 patients, 243 of which complied with the programme inclusion criteria. Mean age ± standard deviation of the informed patients was 68 ± 11.6 (range: 27–90), with 66% women and 34% men. All patients included in the study remained until hospital discharge. Mean hospital stay time was 6 ± 1 (range: 1–20) days.

The diagnoses upon admittance of the patients included in the study are summarised in table 2.

PRM were found in 102 (42%) of patients included in the study.

The principal findings for unjustified discrepancies are summarised in table 3. Figure 1 shows the therapeutic groups implicated in unjustified discrepancies.

In the table, one can observe that the discrepancies that appear with greatest frequency among those detected upon admission are duplicity and incorrect administration. Duplicities were associations between non-steroidal anti-inflammatories (NSAI), opioides, benzodiazepines, and laxatives.

Among the unjustified discrepancies that appeared upon hospital discharge, more than half of these (53%) were therapeutic duplicities; 39 patients presented NSAI and analgesic duplicity, 9 of proton pump inhibitors (PPI), and one of 2 antihypertensives of the same group. The interactions found upon hospital discharge were among antithrombotic drugs (low molecular weight heparins, prescribed upon hospital discharge) and anti-platelet drugs (aspirin, clopidogrel and triflusal, normal patient treatment), prescribed before admission. Cases were considered to be unjustified discrepancies when there was no indication on the discharge letter what the patient should do with his/her normal anti-platelet medication while taking the heparin drugs.

Examples of incorrect prescriptions were errors in the dosage intervals and prescriptions of long-acting benzodiazepines in elderly patients.

Table 2 Admission diagnoses for patients in the study

Diagnosis on hospitalisation	Value (%)
Gonarthrosis	27
PRM	10
Hallus valgus	10
Coxarthrosis	9
Meniscopathy	5
Prosthesis loosening	4
Arthroscopy	4
THR	3
Impaction fracture	2
Cuff tear	2
Carpel tunnel syndrome	2
Impingement syndrome	2
Others	20

THR: total hip replacement. PRM: problems related to medication.

Cases of incomplete prescriptions that were detected were lack of indication of the duration of treatment, antibiotics, and low molecular weight heparins.

Three patients allergic to anti-inflammatories received prescriptions for the drugs upon discharge.

Pharmaco-therapeutic interventions were classified as shown in table 4. Furthermore, all patients included in this study received an educational intervention and were informed as to the most relevant aspects of their treatment and the new drugs that had been prescribed, indicating maximum doses, above all in the case of analgesics and anti-inflammatories, and the proper method of administration (interactions with other drugs and foods).

PRM were classified according to severity. Sixty-five percent caused no damage to the patient and 35% would have required monitoring in order to confirm damage.

The evaluation of acceptance rates for recommendations both in caregivers and patients regarding discrepancies upon discharge was 97%, and only 26% upon admission.

The results of the questionnaire given to the medical personnel at the orthopaedic surgery and traumatology unit are shown in table 5.

Table 3 Short summary of the principal findings for unjustified discrepancies

	Total	Admission	Discharge
No. discrepancies	111 (100%)	19 (17%)	92 (83%)
No. of discrepancies/patient	1.09	1.11	1.07
No. discrepancies that reached the patient	19	19	0
Type of discrepancy, n (%)			
Duplicate treatment	55 (50)	6 (35)	49 (53)
Interaction	26 (22)	1 (5)	25 (27)
Incorrect prescription	5 (5)	2 (10)	3 (3)
Incorrect administration	5 (5)	4 (20)	1 (2)
Improper medication	5 (5)	2 (10)	3 (3)
Treatment omission	5 (5)	1 (5)	4 (5)
Ineffective treatment	1 (1)	1 (5)	—
Adverse event	2 (2)	1 (5)	1 (2)
Incomplete prescription	5 (5)	1 (5)	4 (5)
No. of discrepancies that reached the patient	19	100%	—
Doctor/patient response			
Medication suspended	84	8	76
Prescription change (dosage, schedule, etc.)	8	8	4
Start medication	5	1	4
Complete prescription (doses and treatment duration)	4	0	4
Drug change	2	1	1
Not change	8	5	3

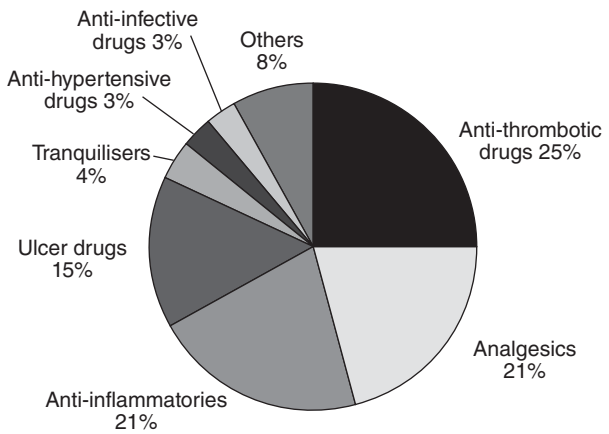

Figure 1 Description of the pharmaco-therapeutic groups implicated in unjustified discrepancies.

Discussion

The evidence of the elevated number of medication errors produced during care transfers has been described in various studies;[12-16] indeed, some studies published on medication compatibility indicate that these processes can reduce medication errors by up to 70% and can reduce the adverse effects of medications by about 15%.[17]

Table 4 Classification of pharmaceutical interventions

Type of intervention	n	%
Safety	78	70
Efficiency	18	16
Indication	15	14

In our study, 42% of patients presented unjustified discrepancies. Other authors have produced higher rates, such as Moriel et al (71.4%),[18] Delgado et al (52.7%),[19] Cornish et al (60%),[7] Wong et al (70.7%)[20] and Stuffken et al (63.1%).[21] This difference can be attributed to the different methods employed in these studies, as medication compatibility in these studies was performed between the normal medication and that prescribed upon hospital admission, and between the medication prescribed upon admission and that given upon discharge.

The highest discrepancies were seen in duplicity and interaction. Duplicities between analgesic and anti-inflammatory drugs were due to the fact that the majority of patients in this study had chronic degenerative osteoarticular processes occurring. When, following surgery, they received their discharge prescriptions, they were normally prescribed a different analgesic regimen without specifying whether or not they should stop taking the normal drugs, and this created duplicities that could lead to the appearance of adverse effects in the patient, especially on the gastrointestinal level. The PPI produced a similar result. These patients took a PPI, in association with NSAI treatment, in order to prevent the adverse effects on the digestive tract, as recommended by the Spanish Association of Gastroenterology and Rheumatology.[22] In general, omeprazole was prescribed upon discharge, and the case was considered a duplicity if the patient normally took other PPI.

Regarding interactions, the association between low molecular weight heparin (LMWH) prescribed upon hospital discharge and anti-platelet drugs for chronic treatment in the patient was the most prominent. The majority of patients that were admitted to the traumatology unit received some type of surgical intervention. It is common practice at our hospital that the anaesthesiologist suspends anti-platelet medications prior to the procedure. Following the intervention, and during the admission process, LMWH is administered and continued following discharge at prophylactic levels. At times, this can last a month, for example, following an intervention for gonarthrosis.

The association between LMWH and acetylsalicylic acid is considered to be a pharmacological interaction, although in low doses (75 to 100mg/day), many authors consider that the advantages outweigh the risks in some patient groups. The association between LMWH and dipridamol appears to produce a slight haemorrhage (although prothrombin levels were maintained during the therapeutic interval), for which

Table 5 Results of the caregiver satisfaction survey

	None (%)	Little (%)	Regular (%)	Good (%)	Very good (%)
Do you understand the programme?	—	27.3	27.3	36.4	9.1
Do you believe that the patients will better comprehend their treatment?	—	—	—	45.5	54.5
Do you believe the clinical results improved in the patient?	—	—	9.1	54.5	36.4
Do you believe that patient safety increased?	—	—	—	18.2	81.8
	Not important (%)	**Little importance (%)**	**Regular (%)**	**Important (%)**	**Very important (%)**
Review of outpatient medication upon admission	—	9.1	—	18.2	72.7
Review of treatment prescribed upon discharge	—	—	—	27.3	72.7
Interview with patient upon discharge	—	—	18.2	18.2	63.6
Provide written information regarding the medication	—	—	—	18.2	81.8
	Very bad (%)	**Bad (%)**	**Regular (%)**	**Good (%)**	**Very good (%)**
Overall programme evaluation	—	—	—	72.7	27.3

precautions are recommended. The same recommendations go for clopidogrel and ticlopidine.[23]

The discharge sheet did not, in any of the cases, specify to the patient if he/she should continue his/her anti-platelet treatment, while the LMWH is administered.

The analysis of these data required a protocol on the use of the associations when the patient is discharged, since this is a point of debate as yet unresolved.

With regards to the satisfaction survey, although half of the physicians affirmed that they knew little of the work methods for this question, it received a "very good" overall evaluation in 100% of caregivers. This was also the predominant opinion regarding partial evaluation of all care aspects in the programme. The patient impact was considered to be very positive, with increased treatment comprehension and improved clinical results.

Conclusion

The intervention of a specialised pharmacist in the process of medication compatibility prevents medication errors in care transfers, such as admission and discharge from hospitals, and guarantees care continuity in the patients. We believe that medication compatibility must be performed in a consistent manner at hospitals in order to increase patient safety within the framework of a system with reduced health risks and an increase in care quality.

Funding

This programme on compatibility at our hospital was made possible due to a grant from the consultation programme of the Valencian Society of Hospital Pharmacy, with funding from the Regional Ministry of Health of the Valencian Government.

References

1. The Institute of Medicine. To err is human: Building a safer health system. Washington, DC: National Academy PR; 2000.
2. Leape LL, Brennan TA, Laird N, Lawthers AG, Localio AR, Barnes BA, et al. The nature of adverse events in hospitalized patients. Results of the Harvard Medical Practice Study II. N Engl J Med. 1991;324:377-84.
3. Brennan TA, Leape LL, Laird NM, Hebert L, Localio AR, Lawthers AG, et al. Incidence of adverse events and negligence in hospitalized patients. Results of the Harvard Medical Practice Study II. N Engl J Med. 1991;324:370-6.
4. The Institute of Medicine. Crossing the Quality Chasm. A new health system for the 21st century. Washington, DC: National Academy PR; 2001.
5. Leape LL. Error in medicine. JAMA. 1994;272:1851-7.
6. Rozich JD, Resar RK. Medication safety: One organization's approach to the challenge. Journal of Clinical Outcomes Management. 2001;8:27-34.
7. Cornish PL, Knowless SR, Marchesano R, Tam V, Shadowitz S, Juurlink DN, et al. Unintended medication discrepancies at the time of hospital admission. Arch Intern Med. 2005;165:424-9.
8. Lessard S, De Young J, Vazzana N. Medication discrepancies affecting senior patients at hospital admission. Am J Health Syst Pharm. 2006;63:740-3.
9. Joint Commission on Acreditation of Health Care Organizations. Comprehensive accreditation manual for hospitals. Oakbrook Terrace; 2006. IL: Joint Commission Resources; 2005
10. National Institute for Health and Clinical Excellence (NICE), National Patient Safety Agency. Technical patient safety solutions for medicines reconciliation on admission of adults to hospital [consulted on 11/09]. Available from: http://www.nice.org.uk/guidance/index.jsp?action=byId&o=11897.

11. The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP). NCC MERP Index for Catergorizing Medication Errors (citado). [consulted on 11/09]. Available from: http://www.nccmerp.org/pdf/indexColor2001-06-12-pdf.
12. Montesinos S, Soler E, Rocher A, Ferrando R, Ruiz del Castillo J, Ortiz I. Resultados de un proyecto de control y adecuación del tratamiento médico habitual tras el alta quirúrgica. Cir Esp. 2007;82:333-7.
13. Montesinos S, Soler E, Ferrando R. Aumento de la comprensión y la adherencia. Disminución de los errores en el tratamiento al alta en pacientes quirúrgicos. Aten Farm. 2008;10:21-8.
14. Foster AJ, Muff HJ, Perterson JF, Gandhi TK, Bater DW. The incidence and severity of adverse events affecting patients after discharge from the hospital. Ann Inter Med. 2003;138:161-7.
15. Vira T, Colquhoun M, Etchells E. Reconciliable differences: Correcting medication errors at hospital admission and discharge. Qual Saf Health Care. 2006;15:122-6.
16. Pardo MA, Aznar MT, Soler E. Consúltenos: programa de información al alta hospitalaria. Desarrollo y resultados del primer año de funcionamiento en 5 hospitales. Farm Hosp. 2008;32:323-30.
17. Rozich JD, Howard RJ, Justeson JM, Macken PD, Lindsay ME, Resar RK. Standardization as a mechanism to improve safety in health care. Jt Comm J Qual Saf. 2004;30:5-14.
18. Moriel MC, Pardo J, Catalá RM, Segura M. Estudio prospectivo de conciliación de medicación en pacientes de traumatología. Farm Hosp. 2008;32:65-70.
19. Delgado O, Picó JN, Martínez I, Serrano A, Anoz L, Fernández F. Errores de conciliación en el ingreso y en el alta hospitalaria en pacientes ancianos polimedicados. Estudio prospectivo aleatorizado multicéntrico. Med Clin (Barc). 2009;133: 741-4.
20. Wong JD, Bajcar JM, Wong GG, Alivia SM, Huh J, Cesta A, et al. Medication reconciliation at hospital discharge: Evaluating discrepancies. Ann Pharmacother. 2008;42:1373-9.
21. Stuffken R, Heerdink ER, De Koning F, Souverein PC, Egbert CG. Association Between Hospitalization and Discontinuity of Medication Therapy Used in the Community Setting in the Netherlans. Ann Pharmacother. 2008;42:933-9.
22. Lanas A, Martín-Mola E, Ponce J, Navarro F, Piqué JM, Blanco FJ. Estrategia clínica para la prevención de los efectos adversos sobre el tracto digestivo de los antiinflamatorios no esteroideos. Recomendaciones de la Asociación Española de Gastroenterología y de la Sociedad Española de Reumatología. Gastroenterol Hepatol. 2003;26:485-502.
23. Baxter K, editor. Interacciones farmacológicas. Stockley. 2 ed, Pharma Editores S.L. (Barc). 2007.