Full Length Research Paper

Analysis on adverse reactions caused annually by cases of antibiotic use in a hospital of China

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This study aims to investigate adverse reactions caused by antibiotics, and promote clinically safe, effective and rational use of antibiotics. Data on antibiotic use were obtained from the First Affiliated Hospital of Liaoning Medical College of China from September 2009 to May 2010, summarized and statistical analyses were carried out respectively on antibiotic dosage, times of adverse reactions caused by antibiotics, drug administration routes and drug forms. The findings of this research revealed that antibiotics have many adverse reactions, but they can be prevented and controlled, and we should pay attention to clinical monitoring during drug use. Hence only safe, effective and rational use of antibiotics can effectively show the efficacy and reduce the incidence of adverse reactions.

Key words: Antibiotics, adverse reaction, clinical application.

INTRODUCTION

In clinical practice, antibiotics are the most commonly used drugs in recent years, accompanied by the increase of antibiotic type and dosage forms, the occurrence of adverse drug reactions frequently reported, so drug safety is an important problem in the clinical application process. Data on antibiotic use were obtained from the First Affiliated Hospital of Liaoning Medical College of China from September 2009 to May 2010.

METHODOLOGY

Records of 6900 cases of antibiotic use and that of adverse reactions were collected from the First Affiliated Hospital in September 2009 to May 2010. To summarize the data of antibiotic use in the Department of Pharmacy in our hospital in September 2009 ~ May 2010, and make statistical analysis respectively on antibiotic dosage, times of adverse reactions caused by antibiotics, drug administration routes and drug forms according to Clinical use of antibiotics management policies (Chinese Ministry of Health).

RESULTS

Drug varieties and use frequency

Amoxicillin in penicillins, cefuroxime in second-generation cephalosporins, azithromycin in macrolides and compound preparations of Augmentin and Sulbactam in β -lactamase inhibitors exceed 500 times of use, in which, compound preparations are up to 575 times. β -lactams take a dominant position in clinical drug use today and the next is macrolides, aminoglycosides, such as gentamicin, are often used in the Department of Gastroenterology, and tetracyclines, chloramphenicols and others have been mostly phased out due to serious side effects and for external use, as shown in Table 1.

Clinical manifestations of adverse reactions caused by antibiotics

The adverse reactions caused by antibiotics involved many organs and systems, mainly including allergic

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Table 1. Drug varieties and use frequency.

Variety	Drug example	Dosage unit / time
β-lactams	Penicillin VK (Penicillins)	112
	Amoxicillin (Penicillins)	518
	Ampicillin (Penicillins)	450
	Cefradine (First-generation Cephalosporins)	387
	Cefalexin (First-generation Cephalosporins)	463
	Cefuroxime (Second-generation Cephalosporins)	538
	Cefaclor (Second-generation Cephalosporins)	422
	Cefoperazone (Third-generation Cephalosporins)	441
	Cefixime (Third-generation Cephalosporins)	119
	Cefpirome (Fourth-generation Cephalosporins)	55
	Augmentin (Compound preparation)	530
	Sulbactam (Compound preparation)	575
Macrolides	Roxithromycin (14-membered ring)	111
	Azithromycin (15-membered ring)	570
	Acetylspiramycin (16-membered ring)	459
Aminoglycosides	Gentamicin	95
Tetracyclines	Terramycin	34
	Aureomycin	36
Chloramphenicols	Chloramphenicol	55
Others	Others	30

reactions, neurotoxicity, hepatotoxicity, renal toxicity and superinfection, as shown in Table 2. The allergic reaction was mainly caused by penicillin and cephalosporin. Impurity in the penicillin and its metabolites is a semi-antigenic material (thiazolyl acyl form), which bind tissue protein to form antigen in the blood, and formation of the whole antigen can induce the body to produce IgE antibodies.

Drug administration routes

The common drug administration routes are oral administration, subcutaneous injection and intravenous infusion, as shown in Table 3.

We found that adverse drug reactions caused by intravenous infusion up to 63.52%, intravenous infusion was the main formulations of the antibiotic drugs causing adverse reactions.

Drug forms

The common drug forms are tablet, capsule, injection, etc, as shown in Table 4. We found that different forms of a particular drug cause different absorption bioavailability, and improper drug dosage can also cause adverse reactions.

DISCUSSION

Relationship between drug varieties and adverse reactions

It can be seen from Table 1 that the commonly used antibiotics in clinical are primarily β-lactams and secondarily macrolides and aminoglycosides. We should pay attention to the compatibility of drugs in the use of antibiotics, to avoid the synergistic effects of virulence (Hai-ying et al., 2006). The combination of cephalosporins with other nephrotoxic drugs may aggravate kidney damage, such as aminoglycosides and potent diuretics; two aminoglycoside antibiotics should not be used at same time or continuously locally or systemically used, otherwise it will increase ototoxicity (Xin-min Liu, 2010).

Relationship between drug administration routes and adverse reactions

For drug administration routes, intravenous infusion is the main route causing adverse drug reactions. Doctors usually adopt intravenous infusion for inpatients, as shown in Tables 2 and 3. In this report, 3811 cases of adverse drug reactions are caused by intravenous infusion, accounting for 63.52% of the total, followed by

Table 2. Clinical manifestations of adverse reactions caused by antibiotics and number of cases.

Antibiotics	Penicillins	Cephalosporins	Aminoglycosides	Macrolides	Tetracyclines	Chloramphenicols	Others
Allergic shock	2	1	1	0	0	0	0
Serum disease	7	5	1	0	0	0	0
Drug fever	9	6	0	0	0	1	1
Allergic reaction	96	221	5	38	2	0	0
Neurotoxicity	56	106	46	76	10	5	2
Renal toxicity	0	59	66	0	0	0	3
Hepatotoxicity	4	26	0	69	9	3	2
Blood toxicity	3	39	0	0	0	40	1
Gastrointestinal toxicity	40	95	0	621	12	10	3
Immunotoxicity	0	26	0	0	11	4	2
Cardiotoxicity	26	0	0	0	0	0	1
Specific reaction	0	0	0	0	0	2	1
Superinfection	10	37	0	0	12	5	0

Table 3. Drug administration routes and proportions.

Drug administration route	n	Proportion (%)
Intravenous infusion	3811	63.52
Oral administration	1372	22.87
Intramuscular injection	315	5.25
Intravenous injection	301	5.02
Subcutaneous injection	102	1.70
Local injection	32	0.53
Intraperitoneal drug use	14	0.23
Intrauterine drug use	18	0.30
Local external use	21	0.35
Intracutaneous injection	14	0.23
Total	6000	100.00

1372 cases of oral administration, accounting for 22.87% of the total. Intravenously infused drugs directly enter blood vessels and take effect rapidly, while oral drugs are digested, absorbed and

screened in intestinal tract, which also increases the incidence of adverse drug reactions caused by intravenous infusion (Su-jiao and Liang, 2008). The difference in drug administration routes is

related to drug absorption and distribution and also affects the speed, intensity and duration of drug efficacy, intravenous drugs directly enter blood circulation and take effect immediately,

Table 4. Analysis on adverse antibiotic reactions and drug forms.

Analysis	Powder injection	Injecta	Tablet	Capsule	Powder	Controlled release form	Spray	Others
Total times of use	3876	12109	18953	790	77	9052	421	7
Times of adverse reactions	143	451	13	19	2	19	7	0
Percentage	3.68	3.70	0.68	2.40	2.59	0.20	1.66	0

prone to adverse reactions, and oral stimulant drugs can cause nausea, vomiting, etc. In principle, oral administration is better than intravenous infusion in treatment, and safe and effective treatment should be provided (Ren-wei Shi, 2011).

Relationship between drug forms and adverse reactions

Different forms of a particular drug cause different absorption in body, that is, difference bioavailability, and improper drug dosage can also cause adverse reactions. It can be seen from Table 4 that intravenous infusion has maximum bioavailability can causes most adverse reactions, followed by powder injection, and tablets are used frequently, but its bioavailability is limited, so the incidence of adverse reactions is significantly lower (Zheng-chun et al., 2004).

Preventive measures for adverse antibiotic reactions

Medical care staff should be familiar with the "Clinical antibiotic application guide and principles" for drug use instructions (Bin et al., 2001; Amsden, 2005), master the indications, contraindications, pharmacokinetics and adverse reactions of antibiotics (Wen-zhen, 2004), rationally use drugs according to the physiological state of patients. For example, pregnant women should cautiously use or not use the drugs that is able to pass through placental barrier (Jian-cheng Liang, 2005); patients with liver or renal insufficiency and elderly patients should use drug with caution (Lanzoni et al., 2005). If narrow-spectrum antibiotics are effective, do not use broad-spectrum antibiotics (Li-xin and Xiu-mei, 2004). Select appropriate dosage regimens, drug administration routes, dosage and treatment course, and if necessary, combine with plasma concentration for monitoring (Ding and Salvi, 2005; Hua-cheng and Li-shi, 2005). Patients should actively cooperate with the treatment and tell doctors about family history, allergic history and other situations, so that doctors can make quick and accurate diagnosis (Zhong-wei, 2005). Clinical pharmacists should pay attention to ADR reporting and monitoring work to promote clinical rational use of antibiotic drugs, and find more drug safety information in

order to explore ADR mechanism in depth (Zhi-qiang, 2006).

In conclusion, β -lactam and macrolide antibiotics are the most widely used in clinical, but antibiotics cause allergic reactions, toxic reactions and specific reactions, superinfection and other adverse reactions, and drug administration routes and drug forms can also cause the occurrence of adverse reactions. Therefore, we should rationally and specifically use antibiotics and minimize the adverse reactions in treatment. Doctors should be familiar with the types, contraindications and adverse reactions of the antibiotics used, clarify the medication purposes before drug use, and learn about patient's conditions and severity, so as to specifically select drug and its form and dosage and make detailed, rational and effective regimens. Once adverse reactions are found, take immediate rescue measures. Only in this way, we can achieve the purpose of effective and rapid treatment.

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