Rational application of antiseptic drugs in arthroplasty and nursing intervention

Xiuhua Zhao and Chao Wang*
Shandong Provincial Third Hospital, Department of surgery, Jinan, Shandong, China

Abstract: The problem of bacterial resistance caused by the irrational use of antibiotics has become a global public health problem. How to improve the rational application of antimicrobial agents is the focus of attention in the global medical industry. In this paper, we analyze the rational application of antibacterial drugs in arthroplasty and nursing intervention. The results showed that the utilization rate of the first generation cephalosporins was the highest, accounting for 43.91%, followed by lincomycin, accounting for 26.59%. At the same time, we analyzed the wound infection and its distribution and drug resistance after artificial joint replacement. In the selection of drug varieties, cleaning surgery should be the first generation of cephalosporins for the prevention of *Staphylococcus aureus* infection. At the same time, in the process of clinical nursing, the high quality nursing service mode is implemented. The nursing staff should do a good job for the patient's medication guidance after the operation, and charge the attention in the process of drug use.

Keywords: Antiseptic drugs, drug regimen, pathogenic bacteria, drug resistance rate.

INTRODUCTION

The problem of bacterial resistance caused by the irrational use of antibiotics has become a global public health problem. How to improve the rational application of antimicrobial agents is the focus of attention in the global medical industry (Vincent *et al.*, 2011). In order to strengthen the management of antibacterial drugs and improve the clinical application level of antimicrobial agents, the specific regulation activities of Chinese antibacterials have made clear regulations on the use and intensity of antimicrobial drugs at the hospital level (Wolf *et al.*, 2011). It is pointed out that medical institutions should be based on the relevant national standards, guidelines and science according to the different specialty characteristics of various clinical departments (Webster *et al.*, 2017). Establish the index of control and control of antibacterial drugs. The use of antimicrobial agents in various clinical departments is a more difficult target for the domestic medical institutions to control (Wollheim, 2000). The main reason is that the state has not made clear regulations on the use of antimicrobial agents in various clinical departments of medical institutions, resulting in the lack of precise management of antimicrobial drugs and the inaccuracy of the management and control of antimicrobial drugs by medical institutions (Zhao *et al.*, 2016). Therefore, it is an important content of the current clinical work, and also the key to strengthen the management of antibacterial drugs and improve the rational level of the clinical application of antibiotics (Zhang *et al.*, 2015).

Artificial joint replacement is the use of metal, polymer polyethylene, ceramics and other materials, according to the shape, structure and function of human joints, artificial joint prosthesis, through surgical techniques implanted in the human body, instead of the disease joint function, to alleviate joint pain, the purpose of the joint work energy (Liu *et al.*, 2017). It is a new type of orthopedic surgery, which requires strict asepsis in the operation room. Once the infection is infected, it will lead to the failure of the operation directly (Caziuc *et al.*, 2015). It needs two times of implantation and even amputation, which seriously affects the life of the patients (Webster *et al.*, 2017). Therefore, effective prevention and treatment of infection is one of the key factors to ensure the success of artificial joint replacement. According to the related medical literature, effective nursing intervention is applied in the nursing of patients with artificial joint replacement in the clinical department of orthopedics, which plays an important role in improving the clinical nursing effect (Ostojic *et al.*, 2015). It is a common measure to control postoperative infection, and is also an important link in the rational application of antibiotics. This study reviewed the data of 485 cases of joint replacement surgery in hospital from 2015 to 2017. The general data of the patients and the application of antibiotics in the perioperative period were classified and summarized, and the infection of the incision and the distribution of pathogenic bacteria and drug resistance after artificial joint replacement were analyzed. And better analysis of perioperative use of antibiotics in Department of orthopedics patients undergoing joint replacement surgery.

MATERIALS AND METHODS

Clinical data

A total of 485 cases of artificial joint replacement treated in January 2015 -2017 December were studied, including

**Corresponding author:* e-mail: 570947657@qq.com

264 males and 221 females; age 16~72 years, average (49.2±8.7) years old; total hip arthroplasty in 177 cases, artificial femoral head replacement as 162 cases, total knee replacement as 111 and patellar arthroplasty as 35 cases. All patients were approved by ethics committee of our hospital, ethical approval number as 2014STYH2 and all patients signed on the informed consent.

According to the purpose of this survey, a survey on the application of antimicrobial agents in arthroplasty in the Department of orthopedics was designed, and the clinical records of the patients were used as a source of information in a retrospective way. The questionnaire was divided into three parts. The first part was the collection of basic information about the patient's sex, age, and the name of the operation. The second part was the application of the antibacterials given through the vein during the perioperative period (including the use of the first dose, the purpose and reason, the name of the drug, the combination of the use, the duration of the use of the day, etc.). The third part is infection, distribution and drug resistance of pathogenic bacteria.

Diagnostic criteria for incisional infection

Superficial incision infection: the incision is red, swollen, painful, hot or purulent. Deep incision infection: local pain or tenderness on incisions, incision dehiscence, purulent discharge or deep puncture for pus.

Nursing method

The patients in the control group were given routine nursing intervention. The nursing staff closely observed the clinical response of the patients, observed the changes of the patients' symptoms and signs, and recorded the patient's physical data in detail to prevent the occurrence of clinical complications. The patients' temperature and blood pressure were monitored in real time. Inform the doctor and deal with it in time to improve the safety of clinical nursing. In clinical nursing, the nursing intervention with high quality nursing service mode can not only effectively reduce the incidence of patients' clinical complications, but also shorten the hospitalization time, reduce the hospitalization expenses, and improve the patient's nursing satisfaction, and actively give full play to the nursing care. In addition, in the nursing of patients with artificial joint replacement, the high quality nursing intervention can be carried out from the patients' psychology, diet and medication, which can not only improve the patient's clinical compliance, but also improve the compatibility of the patients with clinical treatment and nursing, and effectively shorten the postoperative pain of the patients.

STATISTICAL ANALYSIS

SPSS13.3 statistical software was used to carry out statistical processing of the survey data. The count data were expressed as percent (%), and the χ^2 test was carried out. The difference was statistically significant in $P< 0.05$.

RESULTS

Statistics of the use of antimicrobial agents at different stages

The results showed that 85.97% of the patients were given antibacterials at 0.5~2 h before operation, and the purpose was to implant the foreign body in the operation, to ensure that the drug concentration in the local tissue could kill the invading bacteria during the surgical incision exposure, and 5 patients were given second doses of antibiotics during the operation. The reason was that the operation time was over 3 h to maintain the effective concentration of the drug in the tissue, and 31.54% of the patients continued to use antibiotics after 48 h. As shown in table 1.

Statistics of antibiotic prophylaxis

The results showed that the use of the first generation cephalosporins in the perioperative period was the highest, accounting for 43.91%, followed by lincomycin, accounting for 26.59%. As shown in table 2.

The results showed that the rate of use of prophylactic antibiotics in the perioperative period of arthroplasty in the Department of orthopedics was 100%, of which 362 cases were treated with single drug use, accounting for 74.63%, two combined use of 96 cases, accounting for 19.79%, and 27 use of triple drugs, accounting for 5.56%. As shown in table 3.

Distribution of pathogenic bacteria and resistance rate

There were 13 cases of incision infection in the patients with artificial joint replacement, the infection rate was 2.7%, of which 2 cases were superficial incision infection and 11 cases were infected by deep incision. 38 strains of pathogenic bacteria were isolated and identified in the infected patients, including gram negative bacteria 67.5%, Gram-positive bacteria 32.5%, as shown in table 4. The resistance rates of gram negative bacteria were shown in table 5 and the resistance rates of gram positive bacteria were 6.

DISCUSSION

Drug therapy is a double-edged sword. Antiseptic drugs play a vital role in the prevention and treatment of infectious diseases (Attari, 2016). The widespread and irrational application of drugs directly leads to the spread of drug-resistant bacteria, the occurrence of adverse reactions and the lack of treatment (Berend *et al.,* 2013). The irrational application of antibacterial drugs in the perioperative period is particularly serious, such as the use of antibiotics, miss election of drugs, improper use of drugs, especially the abuse of various advanced

Table 1: The use of antimicrobial agents at different stages

Different stages	Number of cases	Usage rate/%
0.5 to 2 hours before operation	417	85.97%
Intraoperative	21	4.32%
24~48 hours after operation	461	95.05%
More than 48 hours after the operation	153	31.54%

Table 2: Statistics of antimicrobial agents

Antiseptic drugs	Number of cases	Ratio /%
Penicillins	45	9.27
First generation cephalosporin	213	43.91
Two generation cephalosporin	78	16.08
Third-generation cephalosporin	35	7.21
Aminoglycoside	60	12.37
Lincosamides	129	26.59
Other	42	8.65

Table 3: The statistics of antibacterials prophylaxis in perioperative period

Drug use scheme	Number of cases	Constituent ratio /%
Single drug use	362	74.63
Two combined drugs	96	19.79
Triple drug use	27	5.56

Table 4: Distribution and constituent ratio of pathogenic bacteria

Pathogenic bacteria	Number	Constituent ratio
Gram-negative bacteria	25	
Pseudomonas aeruginosa	11	44.0%
Escherichia coli	7	28.0%
Acinetobacter baumannii	3	12.0%
klebsiella pneumoniae	2	8.0%
Enterobacter cloacae	2	8.0%
Gram-positive bacteria	13	
Staphylococcus aureus	7	58.33%
Staphylococcus epidermidis	4	16.66%
Enterococcus faecalis	1	16.66%
Coagulase negative staphylococcus	1	8.33%

Table 5: Resistance rate of main gram negative bacteria to commonly used antibiotics

Antiseptic drugs	*Pseudomonas aeruginosa* (n=11)		*Escherichia coli* (n=7)	
	Number	Drug resistance rate	Number	Drug resistance rate
Ampicillin	11	100%	7	100%
Ceftazidime	5	45.45 %	3	42.85%
Cefuroxime	9	81.81%	4	57.14%
Cefotaxime	4	36.36 %	4	57.14%
Amikacin	3	27.27%	2	28.57%
Levofloxacin	2	18.18%	3	42.85%
Piperacillin	10	90.9 %	7	100%

Table 6: Resistance rate of main Gram-positive bacteria to commonly used antibiotics

Antiseptic drugs	*Staphylococcus aureus* (n=7)		*Staphylococcus epidermidis* (n=4)	
	Number	Drug resistance rate	Number	Drug resistance rate
Ampicillin	6	85.71%	3	75.0%
Tetracycline	4	57.14	4	100%
Clindamycin	1	14.28	1	25.0%
Ciprofloxacin	5	71.42	3	75.0%
Gentamicin	5	71.42	2	50.0%
Vancomycin	0	0.0%	0	0.0%

antibiotics, which aggravates the economic burden of the patients and greatly wastes the medical resources and brings bacterial resistance to the patients (Kang *et al.,* 2003; Boot *et al.,* 2017). According to the results of this study, the first generation cephalosporins should be the first choice for the selection of drug varieties for the selection of the drug varieties and the aminoglycoside antibiotics should not be used as a preventive medicine (Cancienne *et al.,* 2015). It was found that the utilization rates of the second generation cephalosporins and the third generation cephalosporins were 16.08% and 7.21% respectively (Caziuc *et al.,* 2015).

The results showed that the use of the first generation cephalosporins was the highest, accounting for 43.91%. Because the arthroplasty is a clean operation, the operation field is the aseptic part of the human body. There is no inflammation, no injury and no organs such as respiratory tract, digestive tract and urogenital tract (Leng *et al.,* 2004; Li *et al.,* 2015). First generation cephalosporin should be preferred. In this survey, 36 cases were not used before operation, and 153 cases of the day after operation were more than 48 hours, which accounted for the selection of 31.54% drugs (Liu *et al.,* 2017). The preventive medication of type I incision operation should mainly choose drugs for Staphylococcus aureus infection, and aminoglycoside antibiotics have obvious ear kidney toxicity, which should not be used as preventive use. Medicine should be highly valued (Manzat-Saplacan *et al.,* 2015). There is still a high level of drug use and no indication of the time of drug use in the cleaning operation of type I incision, and the use of antibiotics should be further standardized to improve the rational application level of antibiotics (Ostojic *et al.,* 2015).

The time of drug use can not reduce the infection of the surgical site in one step. Instead, it will cause dysbacteria, two infection and adverse reactions, induce the production of resistant strains and cause the occurrence of intractable nosocomial infection, aggravate the economic burden of the patients and waste medical resources (Piro *et al.,* 2002). Antibiotics should be used in aseptic surgery to prevent the use of antibiotics, and cephalosporins should be selected and administered within 0.5 to 2 hours before or after the operation, so that the local tissue in the surgical incision is enough to kill the drug concentration of the invasive bacteria during the surgical procedure (Romanò *et al.,* 2015). Short half-life antibiotics should be given second doses over 3 hours of operation and third times when necessary to ensure the effective concentration of the drugs in the serum and tissue fluid (MIC > 90).The effective coverage time of antibiotics should include the whole procedure and 4 hours after the operation, the total preventive medication time is not more than 24 hours, and the individual condition can be extended to 48 hours. In a clean operation less than 2 hours, preoperative medication can be done once (Raphel *et al.,* 2016).

At the same time, according to the related medical literature, the application of effective nursing intervention in the nursing of artificial joint replacement patients in the clinical department of orthopedics has played an important role in improving the clinical nursing effect (Sheng *et al.,* 2015). In the clinical high quality nursing service mode, in order to ensure the patient in a good ward environment, the ward should be sterilizing regularly, at the same time, the balance of temperature and humidity in the room is ensured, and the patient's clinical practice time should be standardized to create a good rest environment for the patients (Seshiah *et al.,* 2002). At the same time, in the high quality nursing intervention, the nursing staff should also strengthen the patient's morning quality nursing intervention. During the morning nursing intervention, the patient should check the drainage condition of the wound in an all-round way, observe the patient's drainage color closely, ensure the safety of the patient's morning care, and also pay attention to prevent the drainage tube of the patient. In the course of clinical nursing, it is necessary to implement the high quality nursing service mode (Santos *et al.,* 2003; Xiao *et al.,* 2015). The nursing staff should introduce the postoperative attention to the patients, strengthen the communication with the patients, relieve the patient's treatment pressure and eliminate the patient's bad mood after the operation. In the process of attention, ensure that patients master the correct use of drugs, so that patients after clinical normal medication.

CONCLUSION

To sum up, the preventive use of antibacterial drugs in the perioperative period of arthroplasty in the Department of

orthopedics is unreasonable, mainly for the problem of high grade and combination of drugs. It is necessary to strengthen the management of the preventive use of antibiotics in surgical operation and further standardize the application of antibacterial drugs. At the same time, nursing intervention for patients with artificial joint replacement in clinical department of orthopedics is not only effective in clinical efficacy, but also in reducing the incidence of clinical complications, shortening clinical time of hospitalization, alleviating patients' pain effectively and promoting postoperative recovery, which is worthy of application in clinical practice.

REFERENCES

Attari Z (2016). Enhanced ex vivo intestinal absorption of olmesartan medoxomil nanosuspension: Preparation by combinative technology. *Saudi Phar. J.*, **24**(1): 57-63.

Berend KR, Lombardi AV, Morris MJ, Bergeson AG and Adams JB (2013). Two-stage treatment of hip per prosthetic joint infection is associated with a high rate of infection control but high mortality. *Clin. Orthop. Relat. Res.*, **471**(3): 510-518.

Boot W, Gawlitta D, Nikkels PG, Pouran B, van Rijen MH and Dhert WJ (2017). Hyaluronic acid-based hydrogel coating does not affect bone apposition at the implant surface in a rabbit model. *Clin. Orthop. Relat. Res.*, **475**(2): 1911-1919.

Cancienne JM, Burrus MT, Weiss DB and Yarboro S (2015). Applications of local antibiotics in orthopedic trauma. *Orthop. Clin. North. Am.*, **46** (5): 495-510.

Caziuc A, Calin Dindelegan G, Pall E and Mironiuc A (2015). Stem cells improve the quality of colonic anastomoses - A systematic review. *J. Buon.*, **20**(6): 1624-1629.

Kang D and Hainasaki N (2003). Mitochondrial oxidative stress and mitochondrial DNA. *Clin. Cham. Lab. Med.*, **41**(10): 1281-1288.

Leng S and Lu F (2004). Effects of huanglian jiedu decoction on blood glucose and lipid metabolism in type 2 diabetic rats. *Zhon. Lin. Kan.*, **8**(15): 4388-4389.

Li XH, Xu Y and Yang K (2015). Association of THADA, FOXP4, GPRC6A/RFX6 genes and 8q24 risk alleles with prostate cancer in Northern Chinese men. *J. Buon.*, **20**(5): 1223-1228.

Liu Z, Yang R and Shao F (2017). Anastomosis using complete continuous suture in uniportal video-assisted thoracoscopic bronchial sleeve lobectomy. *Mini. Invas. Surg. Oncol.*, **1**(1): 31-42.

Manzat-Saplacan RM and Balacescu L (2015). Is there a correlation between peripheral blood expression of angiogenic transcriptional factors/receptors and colorectal cancer? *J. Buon.*, **20**(5): 1193-1200.

Ostojic SM, Knezevic DR, Perisic M, Jurisic V and Knezevic SM (2015). The importance of choice of resection procedures in T1 and T2 stage of carcinoma of the ampulla of Vater. *J. Buon.*, **20**(5): 1206-1214.

Piro S, Anello M and Di Pietro C (2002). Chronic exposure to free fatty acids or high glucose induces apoptosis in rat pancreatic islets: Possible role of oxidative stress. *Metabolism*, **51**: 1340-1347.

Raphel J, Holodniy M, Goodman SB and Heilshorn SC (2016). Multifunctional coatings to simultaneously promote osseointegration and prevent infection of orthopaedic implants. *Biomaterials*, **84**(26): 301-314.

Romanò CL, Scarponi Si, Gallazzi E and Romanò D (2015). Antibacterial coating of implants in orthopaedics and trauma: A classification proposal in an evolving panorama. *J. Orthop. Surg. Res.*, **10**(20): 157-160.

Santos DL, Palmeira CM and Seica R (2003). Diabetes and mitochondrial oxidative stress: A study using heart mitochondria from the diabetic Goto-Kakizaki rat. *Mol. Cell Biochem.*, **246**(1-2): 163-170.

Seshiah PN, Weber DS and Rocic P (2002). Angiotensin II stimulation of NAD (P) H oxidase activity: Upstream mediators. *Circ. Res.*, **91**(5): 406-413.

Sheng W, Zhang B, Chen W, Gu D and Gao W (2015). Laparoscopic colectomy for transverse colon cancer: Comparative analysis of short- and long-term outcomes. *Int. J. Clin. Exp. Med.*, **8**(9): 16029-16035.

Vincent J, Ernst J and Monique E (2011). Opinion of gastroenterologists towards quality assurance in endoscopy. *Diges. Liver Dise.*, **43**(3): 215-219.

Webster E, Larsen N, Marsh A and Choudhury P (2017). Chlorhexidine gluconate or polyhexamethylene biguanide disc dressing to reduce the incidence of central-line-associated bloodstream infection: A feasibility randomized controlled trial (the CLABSI trial). *J. Hosp. Infe.*, **96**(3): 223-228.

Wolf C, Gu N, Doctor J, Manner PA and Leopold S (2011). Comparison of one and two-stage revision of total hip arthroplasty complicated by infection: A Markov expected-utility decision analysis. *J. Bon. Joint Surg. Am.*, **93**(11): 631-639.

Wollheim C (2000). Beta-cell mitochondria in the regulation of insulin secretion: a new culprit in type II diabetes. *Diabetologia*, **43**(3): 265-77.

Xiao H, Xie P and Zhou K (2015). Clavien-Dindo classification and risk factors of gastrectomy-related complications: An analysis of 1049 patients. *Int. J. Clin. Exp. Med.*, **8**(5): 8262-8268.

Zhang Y, Qi F and Jiang Y (2015). Long-term follow-up after laparoscopic versus open distal gastrectomy for advanced gastric cancer. *Int. J. Clin. Exp. Med.*, **8**(8): 13564-13570.

Zhao S and Dong P (2016). Diabetes and exercise. *Chro. Dis. Prev., Contr.*, **2**(1): 46-48.