The Analyses of Distribution and Antimicrobial Resistance of Pathogens Isolated from Neurosurgery Ward for Three Years

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Abstract: **Objective:** To investigate the distribution and antimicrobial resistance of pathogens isolated from neurosurgery ward, so that we can provide scientific evidences for clinical to control the nosocomial infection. **Methods:** We analyzed retrospectively the distribution and the antimicrobial resistance of common pathogenic bacteria isolated from neurosurgical patients from January 2010 to December 2013. Vitek 32 automatic measurement system was used. Some used DL system. Some antimicrobial susceptibility test used K-B. **Results:** Results showed that 379 strains bacteria were isolated from neurosurgical patients during the three years, the Gram-negative bacilli was 294 strains (77.57%), Gram-positive cocci was 71 strains (18.73%), and fungi was 14 stains (3.69%). The top five were Pseudomonas aeruginosa (16.89%), Klebsiella pneumoniae (16.36%), Staphylococcus aureus (13.72%), Acinetobacter baumannii (12.40%), and Escherichia coli (6.86%). The methicillin-resistant staphylococcus aureus (MRSA) accounted for 61.54%. The most pathogens were isolated from sputum (93.4%). To Staphylococcus aureus, the drug sensitive rates of linezolid and vancomycin were both 100%, but most of the drug resistant rates were over 80%. Four kinds of Gram-negative bacillus resisted highly to the communal antimicrobial. Especially Klebsiella pneumoniae, the drug resistant rates of cephalosporin, aminoglycosides and sulphonamides were over 80%. **Conclusions:** Gram-negative bacilli were the major germs at the neurosurgical department, and the drug resistances were serious. It is necessary for the clinicians to choose rational antibiotics by the result of antimicrobial susceptibility test, so as to control and prevent the drug resistance effectively.

[Qiyun Fu, Shaotong Zheng. **The Analyses of Distribution and Antimicrobial Resistance of Pathogens Isolated from Neurosurgery Ward for Three Years.** *Life Sci J* 2013; 10(4): 1620-1623]. (ISSN:1097-8135). http://www.lifesciencesite.com 214

Keywords: Neurosurgery; pathogenic bacteria; antimicrobial resistance; antimicrobial susceptibility test

1 Introduction

Neurosurgery patients take with loss of consciousness, poor resistance, more invasive operation, long hospitalization time, using hormone and broad-spectrum antimicrobial agents; all these factors are easy to cause the occurrence of nosocomial infection. The American National Nosocomial Infection Surveillance (NNIS) has indicated that neurosurgery department was third of all the incidence of acquired infection (NNIS, 2004). It is more serious that the resistant rates of bacteria are rising year by year (Liu Xinrui, 2009), and the formation of multiple drug-resistant bacteria are also rising. To understand the distribution and drug resistance of pathogens at neurosurgery ward, and guide the clinical to use rational antimicrobial agents. By retrospective analysis, 379 strains bacteria had been isolated from neurosurgery patients from January 2010 to December 2012.The clinical distribution and the results of drug susceptibility test will be illustrated as follows.

2 Materials and methods

2.1 Sources of strains: 379 strains bacteria had been isolated from neurosurgery patients' specimens during January 2010 to December 2012, including sputum, cerebrospinal fluid (CSF), catheter,pus, secretions, etc. All kinds of specimens met the requirements.

2.2 Isolation and identification of bacteria: Strictly according to the National Clinical Operation Procedure (3)[M], Vitek 32 automatic measurement system was used. Some used DL system .Some antimicrobial susceptibility test used K-B. The results would be interpreted by the Clinical and Laboratory Standards Institute (CLIS, 2010).

2.3 Quality control: Pseudomonas aeruginosa ATCC27853, staphylococcus aureus ATCC25923, ATCC25213 and Escherichia coli ATCC25922 provided by the national clinical inspection center.

2.4 Statistical analysis: WHONET 5.6 software for statistical analysis was used.

3 Results

3.1 Distribution of the pathogens: 379 strains of pathogenic bacteria were isolated from neurosurgery patients' specimens from January 2010 to December 2012. Gram-positive bacteria were 71 strains, accounting for 18.73%; Gram-negative bacteria were 294 strains, accounting for 77.57%; Fungi were 14 strains, accounting for 3.69%. The top five were Pseudomonas aeruginosa (16.89%), Klebsiella pneumoniae (16.36%), Staphylococcus aureus (13.72%), Acinetobacter baumannii (12.40%), and Escherichia coli (6.86%). The methicillin-resistant

staphylococcus aureus (MRSA) were 32 strains, accounting for 61.54%. The most pathogens were isolated from sputum, accounting for 93.4%. The distribution will be illustrated in Table 1and Table 2.

3.2 Antimicrobial resistance: The antimicrobial resistance of Staphylococcus aureus will be illustrated respectively in Table 3. Drug resistant rates of the main Gram-negative bacilli will be illustrated respectively in Table 4.

Table 1 The strains distribution of the pathogens isolated from neurosurgery ward (%) (n=379)

pathogens	strains	Constituent ratios
Gram positive coccus	71	18.73
Staphylococcus aureus	52	13.72
Staphylococcus intermedius	5	1.32
Staphylococcus epidermidis	2	0.53
Others	12	3.17
Gram negative bacilli	294	77.57
Pseudomonas aeruginosa	64	16.89
Klebsiella pneumoniae	62	16.36
Acinetobacter baumannii	47	12.40
Escherichia coli	26	6.86
Acinetobacter lowffii	11	2.90
Others	84	22.16
fungus	14	3.69

Table 2 The specimens distribution of the pathogens isolated from neurosurgery ward (%) (n=379)

specimens	strains	Constituent ratios
sputum	354	93.40
CSF	11	2.90
catheter	4	1.06
pus	2	0.53
secretions	2	0.53
others	6	1.58

Table 3 The antimicrobial susceptibility test of staphylococcus aureus (%) (n=52)

Antimicrobial agents	resistant rate	intermediary rate	sensitive rate
Amoxicillin/acid	94.23	0.00	5.77
Penicillin	80.77	3.85	15.38
Azithromycin	69.23	5.77	25.00
Gentamicin	67.31	3.85	28.85
Clindamycin	67.31	3.85	28.85
cefalotin	67.31	3.85	28.85
Ciprofloxacin	65.38	1.92	32.69
Piperacillin/Tazobactam	63.46	1.92	34.62
Rifampicin	63.46	7.69	28.85
Cefuroxime	61.54	1.92	36.54
levofloxacin	61.54	5.77	32.69
Oxacillin	61.54	0.00	38.46
Tetracycline	40.38	5.77	53.85
SMZ	36.54	1.92	61.54
Vancomycin	0.00	0.00	100.00
Teicoplanin	0.00	0.00	100.00
Linezolid	0.00	0.00	100.00

Table 4 Drugs resistance rates of the main Gram-negative bacilli isolated from neurosurgery ward (%)

Antimicrobial	Acinetobacter baumannii(n=47)	Escherichia coli (n=26)	Klebsiella pneumoniae (n=62)	Pseudomonas aeruginosa (n=64)
Azlocillin	93.62	84.62	91.94	…
Amikacin	85.11	34.62	62.90	32.81
Ampicillin	93.62	84.62	…	…
Ampicillin/Sulbactam	44.68	50.00	90.32	…
SMZ	91.49	84.62	83.87	…
Ciprofloxacin	85.11	88.46	67.74	35.94
levofloxacin	78.72	73.08	62.90	28.13
Meropenem	44.68	3.85	6.45	10.94
Imipenem	44.68	3.85	6.45	10.94
Piperacillin	97.87	…	91.94	68.75
Piperacillin/Tazobactam	68.09	50.00	62.90	56.25
Gentamicin	97.87	…	87.10	62.50
Tetracycline	59.57	…	59.68	87.50
Cefepime	76.60	80.77	72.58	14.06
Cefuroxime	…	88.46	90.32	…
Cefoperazone	93.62	88.46	83.87	57.81
Cefoperazone/sulbactam	34.04	34.62	54.84	23.44
Ceftriaxone	93.62	…	91.94	62.50
Cefalotin	…	92.31	93.55	…
Cefotaxime	89.36	84.62	90.32	62.50
Ceftazidime	87.23	69.23	87.10	37.50

… not recommended using

4 Discussion

From Table 1 and Table 2, we could see that gram-negative bacillus were the main pathogenic bacteria at neurosurgery ward (77.57%), and the majority came from sputum specimens (93.7%). The top five were Pseudomonas aeruginosa (16.89%), Klebsiella pneumoniae (16.36%), Staphylococcus aureus (13.72%), Acinetobacter baumannii (12.40%) and Escherichia coli (6.86%).

In Table 3, the methicillin-resistant staphylococcus aureus (MRSA) were 32, accounting for 61.54%. It is lower than the Zhao Jinying's sport (83.7%) (Zhao Jinying, 2011) .The sensitive rates of vancomycin and linezolid were 100%, but most of drugs resistance were over 80%. MRSA leads easy to outbreaking, treatment difficulty, higher fatality incidence, which should be concerned. Its resistance mechanism are that most of staphylococcus aureus take along with mecA gene, so the penicillin can code low affinity binding protein, and lead to resistance to methicillin, penicillium, cephalosporins, carbapenem and others antimicrobial.

Table 4 implied that the drug resistant rates of four Gram-negative bacillus were serious. To klebsiella pneumoniae, only the carbapenem drugs were lower. all drugs resistant rate were over 50%. Especially to broad-spectrum penicillin and cephalosporin, aminoglycoside,their drug resistant rates were over 80%, which may be related to producing Extend Spectrum β- lactamase (ESBLs), AmpC enzyme and carbapenemases. Multiple drug resistance factors should be concerned, and the resistance mechanism should be tested in order to control nosocomial infection (Chen guoying, 2012). To acinetobacter baumannii, the β- lactam antibiotics resistance was serious. The resistant rate of the third generation cephalosporin was over 70%, but the resistant rate of cefoperazone/shubatan was 34.04%, which should use firstly to treat the infection of acinetobacter baumannii. The resistant rates of imipenem and meropenem were about 45%, which was the highest of four Gram-negative bacilli, which should be concerned. To Escherichia coli, except the drug resistant rates of carbapenem drugs, cefoperazone/shuba and amikacin, the others were over 50%.The above Gram negative bacilli were multi-resistant bacteria, which should be taken great attention. The drug resistance of pseudomonas aeruginosa was better relatively. Except the carbapenem drugs, the drug resistant rate of quinolone, ceftazidime and cefepime were also less than 40%, which can be used as experience for the preferred drug. To tetracycline and aminoglycoside, the drugs resistant rates were all over 50%, which should be selected according to susceptibility test results; These are not consistent to Li Wenlang's sport that aminoglycoside drugs were preferred to treat infection of pseudomonas aeruginosa at neurosurgery (Li Wenlang, 2012). It implies that same kinds of bacteria resistance take long with regional differences. The clinical should choose Antimicrobial in accordance

with the local bacterial resistance characteristics, to reduce the production of drug resistance and improve the effect of anti-infection treatment possibly.

In a word, it is necessary for the neurosurgical clinicians to choose antibiotics according to the result of antimicrobial susceptibility test so as to control and prevent the drug resistance effectively.

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11/6/2013