



Nursing research on a new silver-based antibacterial agent for pneumonia

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Abstract

As a highly contagious bacterium, pneumonia can cause a series of respiratory diseases, and its treatment has become a concern of people. This study mainly discusses the nursing research of a new silver-based antibacterial agent in the treatment of pneumonia. The following procedures were performed: (1) a sterilized expectoration suction device was inserted into the nasopharynx (7–8 cm), and the nasopharyngeal secretions were sucked by controlling the pressure of the suction device; and (2) the catheter was washed with 2 mL of sterilized physiological saline, and the sample was immediately sent to the laboratory for bacterial culture of the lower airway and respiratory secretions to determine viral antigens. The drug resistance coefficient of the lysozyme, benzoate, and pneumonia bacteria is 4.5–26.8%. In addition, the fourth generation sefalos posephin and pneumonia bacteria presented drug sensitivity, and the drug resistance coefficient is 13.1–33.3%. The sensitivity to the new silver-based antimicrobial agent and lopenem is 100%. The sensitivity of other germs is between 2 and 5%. The results of the study indicate that the antibacterial properties of the new silver-based antibacterial agent increase with the degree of amino acid substitution of the same sample concentration. The new silver-based antibacterial agent has excellent antibacterial properties against *Klebsiella pneumoniae*.

Keywords Pneumonia treatment · New silver-based antibacterial agent · Microscopic observation · Drug resistance · Viral antigen

Introduction

Pneumonia is a common infection of multiple pathogens, which brings great difficulties to its treatment. At present, the prevention and treatment of pneumonia in China mainly depends on various antibiotics and related vaccines. With the continuous strengthening of antibiotic monitoring in China, the traditional strategy of inflammation prevention and treatment using multiple antibiotics has gradually been

replaced, and the development of new anti-inflammatory drugs is essential.

As a new antibacterial agent, the new silver-based antibacterial agent has been recognized for its non-side effect. The new silver-based antibacterial agent is not only effective in the prevention and treatment of pneumonia, but also in the treatment of other inflammations. As a new antibacterial agent, the new silver-based antibacterial agent has brought benefits to clinical settings.

The treatment of pneumonia involving multidrug-resistant *Acinetobacter calcoaceticus*–*Acinetobacter baumannii* (MDR Acb) complex is limited, and the optimal treatment has not been determined. More patients in the sulbactam group used ventilator (89.3% vs 69.0%), bilateral pneumonia (79.8% vs. 60.7%) and combination therapy (84.5% vs 53.6%), especially carbapenems (71.4% vs. 6.0%), while more patients in the tigecycline group had delayed treatment (41.7% vs. 26.2%) (Ye et al. 2016). His research is only an assessment of the duration of treatment, without further explanation on the situation of treatment. The new coronavirus pneumonia is highly contagious. In order to prevent the

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disease from aggravating further, continuous renal replacement therapy (CRRT) was applied in the early stages of high inflammation according to guidelines and expert consensus (Huibin) (Ning et al. 2020). After continuous treatment, the patient's symptoms were significantly relieved. In the early stages of CRRT treatment, the new coronavirus pneumonia treatment can suppress inflammatory factors and improve patient prognosis (Ning et al. 2020). This treatment decelerated the disease and did not fundamentally solve it. The effects of corticosteroid-based therapy and the factors that affect treatment outcome in patients with idiopathic nonspecific interstitial pneumonia (iNSIP) are not fully understood. The long-term treatment response of iNSIP patients and the factors affecting treatment outcomes were investigated through a multi-center study in Korea. The Interstitial Lung Disease (ILD) research team investigated ILD patients from 2003 to 2007. The patients were divided into two groups to compare treatment responses: the response group (improved forced vital capacity (FVC) $\geq 10\%$ after 1 year) and the non-responsive group (FVC $< 10\%$). Multiple logistic regression analysis was used to evaluate the factors that influenced treatment responses. A total of 261 iNSIP patients were enrolled in the study. The content of the research is based on investigations and has not been experimentally evaluated. In sepsis and severe cases of community-acquired pneumonia, it is important to use antibiotics as early as possible. This was believed to be caused by *Streptococcus pneumoniae*, *Staphylococcus aureus*, legionella, or influenza. A study by Prekker described a case of a healthy person who appeared in an urban emergency department (ED) in the north-central United States due to fever, hip pain, severe hypoxemia, and diffuse lung infiltration. In the emergency department, doxycycline, methylprednisolone, and amphotericin B were also given empirically. The respiratory tract culture eventually grew bacillus dermis, and the patient survived (Lee et al. 2017). His research samples are few and lack use-value.

Materials and methods

Antibacterial effect of the new silver-based antibacterial agent

Silver nanoparticles are the radiation of silver ions, which can slowly release ions (Prekker and Smith 2017). The nanoparticles cannot release ions if surrounded by many insoluble substances in the microscopic environment. Silver ions are slowly released from the particles by oxidation. Particle size, surface functionalization, temperature, and surrounding physical environment affect the release rate of silver ions. Without dissolved oxygen in the solution, the silver nanoparticles are almost insoluble and cannot release silver ions. The release of silver ions is promoted by doping small amounts

of other active metals in the polymer (Özvatan et al. 2016). The new silver-based antibacterial agent directly acts on bacterial cells, destroying the cell membrane structure, forming pores that expel the necessary ions and nutrients from the cells, resulting in bacterial death. The molecular mechanism and path of cell membrane destruction depend on many parameters, such as amino acid arrangement, membrane lipid composition, and peptide antibiotic concentration. The new silver-based antibacterial agent inhibits the synthesis of bacterial DNA and RNA, preventing enzymes formed by the formation of cell walls, which reduces the function of ribitol and protein synthesis, and interferes with the aerobic respiration of cells by folding protein blocks (Gurrera et al. 2016). Moreover, the new silver-based antibacterial agent has antiviral properties, can inhibit the fusion and release of viruses, and prevent infection and virus infection through the direct interaction between the envelope of the membrane virus and the molecules on the host cell surface. Because of these broad properties and activities, and the short time required to inhibit bacterial proliferation, new silver-based antibacterial agents have become excellent candidates for the development of new antibacterial agents (Machuki et al. 2019; Usonis et al. 2016).

Sterilization of antibacterial agents

The sterilization process of antibacterial agents is to hinder the reproduction of bacteria and destroy their structure and basic functions. The four main processes are described below.

The process of bacterial reproduction hinders biochemical synthesis to maintain a complete structure, preventing bacteria survival. For example, DNA, RNA, and related active enzymes are affected. Cell membranes play an important role in the normal operation of cells. POLIMISUN has multiple cationic polar groups and linear peptides of fatty acids, changing the permeability of the cell membrane. The pressure inside and outside the cell membrane is inconsistent, resulting in the loss of various amino acids. Related cytotoxins, such as nestin and masin, further release cyclophosphatidylcholine antibiotics, and under its action, the compound will form a ring and cholesterol. The cholesterol compound contained in the fungal cell membrane is degraded, hindering the formation of these antibiotics (Miletin and Chan 2016). At this time, the energy conversion of the cell needs to be considered:

$$n_c = (\mu_{1-\partial/2} + \mu_{1-\partial})^2 s^2 (1 + 1/k) / (\mu - \mu_c)^2. \quad (2)$$

In the formula, μ represents the average value of energy conversion, and μ_c represents the energy value before energy conversion. The difference between the two reflects the change in energy data when the cell is degraded. If the

cholesterol compound bacteria and virus membranes do not contain cholesterol compounds, it will further destroy the cell plasma membrane, and will not develop drug resistance (Mulder et al. 2016; Wang 2018). The hydrophilic part of the macrocyclic lipid antibiotic combines with the cell membrane to form water pores, causing the leakage of amino acids, ionic groups, and other substances in the cell, causing the death of bacteria (Tembo et al. 2018; Dias et al. 2016):

$$s = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n^2 + n_1 - 2}}. \quad (3)$$

s is the average number of bacteria, s_1 and s_2 represent the changes before and after they multiply. Some antimicrobial peptides will destroy the original morphological membrane structure of tumor cells, causing the leakage of important substances, such as nucleic acids, proteins, and ionic groups, resulting in the death of tumor cells (Hibi et al. 2017).

Destroying the structure of biological enzyme: bacterial respiration and other energy metabolism processes are catalyzed by biological enzymes to complete various biochemical reactions (Serebrovska et al. 2017; Nelson et al. 2016). If the amino acid group and the functional group of the amino acid group are destroyed, the function of bacteria cannot be effectively exerted, and the energy metabolism of cells is hindered.

Antibacterial agents cause DNA, RNA, and enzymes to lose their biological effects. The antibacterial power of the antibacterial agent is directly related to the structure and composition of the bacterial cell wall, which is in the outermost layer of the cell. It gives cells a specific shape and protects bacteria. A damaged cell wall prevents cell growth and also results in cell death. When treated with the same antibacterial agent, the thickness and chemical composition of the cell wall vary with the type of cell, with different antibacterial effect (Korkmaz Ekren et al. 2016). The degree of interference of antibacterial agents on the synthesis of peptide glycerol reflects the antibacterial effect (Isaacs 2017).

The cell wall is a colorless and transparent film-like substance with a certain hardness outside the biological cell membrane. It consists of lipoproteins, lipids, polysaccharides, fibrous, and other macromolecular substances. Antibacterial agents can damage the bacterial cell structure by destroying the synthesis of these substances (Fujishima et al. 2019; Jiang 2020).

Pathological features of pneumonia

Children with pneumonia in different environments can be divided into city pneumonia (CAP) and hospital pneumonia (HAP). In China, nosocomial pneumonia (HAP) is the most common complication. This brings difficulties and problems to the treatment of pneumonia, and the mortality rate

is relatively high. A child's immune system is not sufficient, and the respiratory tract is prone to infection. Moreover, due to their disease characteristics, children with pneumonia have a low resistance to infection. At the same time, the immune function of children in many types of chemotherapy is often damaged to varying degrees. Therefore, the superposition of the child's drug toxicity and the increase in the size of the pellets are all conditional pathogens. Children's meningitis can cause adverse consequences, such as death, disability, and mental sequelae. Normally, the reproduction of *S. pneumoniae* will further affect the content of hemoglobin and the average cardiac output (Kulkarni 2016).

$$O_{(L/min)} = \frac{126 \text{ mol/min} / M^2 \times \text{BSA}}{13 \times \text{Hb} \times (S_a O_2 - S_v O_2)} \times 100\%. \quad (4)$$

Among them, $O_{(L/min)}$ represents the total cardiac output. H_b is the content of hemoglobin. When the content of hemoglobin decreases, the content of $O_{(L/min)}$ will increase, further affecting the function of the body. Many plasma pneumonia infections, which have similar properties to other pneumonias, are relatively mild and a reliable diagnosis to confirm microbiological diagnosis are lacking. There are many possibilities that the infection cannot be detected. In previous methods, molecular recognition was used to characterize the popular features of MP, but this molecular recognition was hindered by the genetic homogeneity of plasma. When bacteria form biofilms, they are not only insensitive to antibiotics, but they also block the attacks by the host's immune system. Therefore, the formation of biofilms is closely related to the propagation of pneumococcus. To date, studied cholamine strains, due to their invasiveness, usually do not contain planktons and can form biofilms in vitro. This shows the possibility that pneumococcus forms a biofilm in the body (Liu et al. 2019a).

New silver-based antibacterial agent modification mechanism

A rubber becomes a part of a silicone rubber elastomer, and the reinforcing effect is more superior, which can further enhance the basic performance of the silicone rubber. The nano-titanium dioxide antibacterial agent has excellent drug resistance and good antibacterial properties, and is widely used in silicone rubber materials. However, due to inorganic nanoparticles, strong surface polarity, and a large number of hydroxyl groups on the surface, it is easy to aggregate to form secondary particles. When added to a matrix rubber, the nanoparticles become larger due to agglomeration, the surface hydroxyl groups become larger, and cannot be evenly dispersed. The basic characteristics of the rubber are reduced, and the antibacterial effect cannot be fully reflected. With the increase of MP tolerance, the difficulty of

MP treatment increases due to the limitations of the body's antibiotic usage. In addition, with the deepening of research, it was found that immune injury and injury play an important role in the etiology of MP. Consider the role of IL-16 and IL-11 as cain in the inflammatory site of the disease, and the possible role of vitamin D in immune regulation in respiratory infections (Yang et al. 2018; Jun et al. 2019).

The coupling agent of ethylene trienoic acid broccoli can change the new silver-based antibacterial agent. The active groups at both ends of the coupling agent molecule act as a bridge that bonds TiO₂ and the silicone rubber matrix. The bond at the bridging end and the active functional group of the coupling react with the hydroxyl group of the new silver-based antibacterial agent. Due to the rate of molecular diffusion effect, the other end of the vinyl and silicone rubber matrix reacts, followed by the coupling vinyl. The ethyl silicone TiO₂-Ag composite material and silicone rubber are matrixed; therefore, the “a” bridge structure connected the coupling agent polystyrene and the silicone rubber material on the surface of the new silver-based antibacterial agent. Therefore, the compatibility between TiO₂ and the silicone rubber matrix is greatly improved. The TiO₂-Ag antibacterial agent treated with this modifier diffuses with the silicone rubber polymer chain during the vulcanization process and has a high compatibility with the silicone rubber matrix, improving the dispersibility of the silicone rubber. At the same time, the new silver-based antibacterial agent particles become the cross-linking point of the network structure, connecting to the silicone rubber through a chemical bond to become a part of the silicone rubber. With enhanced effect, it can further improve the performance of the silicone rubber (Haessler et al. 2017).

Organic antibacterial agent

Organic antibacterial agents are mainly other substances with hydroxyl functional groups, including more than 300 kinds of fungicides, preservatives, fungicides, and algae. The advantages of organic antibacterial agents are their excellent bactericidal effect and diversity. These mainly includes the fourth-grade ammonium salt compound, double citrulline compound, and fourth-grade phosphate. The negatively charged bacteria adsorbed by the fourth-level

cationic antimicrobial agent died due to energy limitation. The role of the fourth-level ammonium salt contacted by the cell wall resulted in the uneven distribution of charge, the deformation of the membrane structure, the leakage of material body cells, and even “dissolution” death. Due to the electrostatic interaction between the fourth-level ammonium salt and bacteria, the fourth-level ammonium salt opened holes in the cell wall, causing the bacteria to die. AIF is on the mitochondrial membrane. When the cells are affected by a signal, the new silver-based antibacterial agent will coagulate the tuberculosis chroma protein and DNA fragments independently of proteases, and promote the death of brain cells. Pneumonia bacteria are mainly distributed in astrocytes and are related to the formation of cellular skeletons. The performance level of GFAP in BM patients has significantly increased. This is of great value for the early diagnosis of BM. Bone marrow-related protein 7/11 (MRP7/11) is a calcium ion-binding protein produced by a mononuclear Mclovac. It mainly exists as a heterodyne MRP7/11 that plays a biological role and is an important molecule related to internal damage.

Antibacterial experiment of new silver-based antibacterial agent

The main instruments used in the experiment are shown in Table 1. In this experiment, the polymer was prepared by simple precipitation polymerization by double binding of monomer end groups. The pneumonia bacteria were dissolved in 30 mL of absolute ethanol, stirred well at 50 °C. After the solution became transparent, a new silver-based antibacterial agent was added, and a white precipitate was generated in the solution. The stirring was continued for 3 h at 80 °C. After the reaction, it was centrifuged at 4000 rpm/min for 20 min, and the reaction solution was removed to obtain a polymer containing the pneumonia bacteria. Absolute ethanol was added and shook twice, with the use of thermostat to dry, seal and store.

Sample collection

A sterilized expectoration suction device was inserted into the–nasopharynx (7–8 cm), and the nasopharyngeal

Table 1 Main instruments used in the experiment

Equipment	Model	Manufacturer
Electronic analytical balance	AR114CN	HHUS
Electric constant temperature drying oven	DHB-8135A	Jinghong Experimental Equipment Company
Constant temperature stirring mixer	DF-100S	Yuhua Instrument Company
PH meter	PB-10	Leiqi Instrument Factory
Microscope	JSM-638LV	Meike Company
Specific surface area instrument	ASAP 2020	Ultrasound Instruments Corporation

secretions were suck by controlling the pressure of the suction device. The catheter was washed with 2 mL of sterilized physiological saline, and the sample was immediately sent to the laboratory for bacterial culture of the lower airway secretions, and viral antigens of respiratory secretions were measured.

Determination of pneumonia virus antigen

Separate the nasopharyngeal secretion sample in a vortex stirrer at 1200 r/min, centrifuge for 4–15 min, pour off the supernatant, precipitate, wash the precipitate with PBS and stir for 3–4 times, and finally dissolve in 200 μ l PBS solution. Precipitate the medium to make it a cell suspension. Move 25 μ L of the cell suspension from the 6 holes in the spray tube and the glass. After standing in the air for 5 min, fix the glass with cold acetone and take it out to dry it completely.

Add two drops of sample or corresponding fluorescent solution in each well to completely cover the test sample. Place the slide in a wet box and fill it at 36 °C for 10–20 min in an electric furnace. After the reaction time is over, the slides are washed and soaked 3 times with the pre-set PBS. After drying, the plate was sealed with a blocking solution, covered with a glass cover, and observed with a fluorescence microscope. Two apple green fluorescent cells found in a 100-fold field of view indicate a positive result, and is negative if otherwise. The positive contrast provided by the kit is handled in the same way.

Detection of sterilization ability

The sterilization ability can be evaluated by three methods: direct counting, sterilization rate, and static bacteria circulation. The determination and detection of various methods, because the morphology and detection operation of antibacterial substances are different, so there are many detection methods. The bacteriostatic circle index bacteriostatic ring method is generally used in experiments to demonstrate bactericidal properties. The bacteria are activated, reaching the logarithmic phase. At this time, the concentration was adjusted to 5 mL using sterilized physiological saline, mixed with the health-care solution, put into a petri dish and solidified, and used as a test plate. The antibacterial agent required for the experiment was processed into a disc shape and placed near the center of the plate. After culturing at 36 °C for 10 h, a blanking ring (static ring) without bacterial proliferation appeared around the dish. The diameter of the bacteriostatic ring was measured, compared with the standard ring, and the antibacterial power of the antibacterial material was evaluated.

The minimum inhibitory development concentration is one of the important data to determine the antibacterial effect of antibacterial agents. In general, the determination

of the minimum bacteriostatic concentration in the 530 nm bacterial liquid (optical density, OD) of optical density value obtained by using spectrometry is compared with the control group, the sample under test, and the mixed bacteria after 24 h. The minimum concentration of the sample under test (OD = 1) and the sample under bacterial test is low. First, a three-fold dilution method is used to form a series of concentrations of the test sample. A 0.5 mL of the test object sample with a specific concentration was added to a 3 mL of bacteria in the centrifuge tube. A 50- μ L liquid (liquid concentration of about 5–15 cfu/mL) and 300- μ L LB medium, seal the centrifuge tube, 2 h later after putting it in the refrigerator and contacting the bacteria, the OD value was measured with a UV-visible spectrometer after completely shaking the culture solution for 12 h. The result is the average of three parallel experiments. In order to prevent the bacterial solution of the tested sample from participating as a positive control group, nutrient solutions of the tested samples of different concentrations cannot be used as the negative control group.

Statistical methods

Using SPSS17.0 software's perforation correlation number method, the relationship between the resistance of pathogenic bacteria and the dosage of antibacterial drugs was analyzed. The correlation coefficient $r > 0$ indicates a positive correlation, and $r < 0$ indicates a negative correlation. $H \leq 0.3$ means that there is no correlation or low correlation between the two. A score of $0.4 < H \leq 0.6$ indicates a high correlation between the two. $P < 0.05$ indicates statistically significant correlation.

Results and discussion

Analysis of pathogen detection results

Pathogen detection results are shown in Fig. 1. A total of 104 patients were tested for bacterial culture and drug susceptibility, accounting for 35.3% of all cases. A total of 50 samples were collected from the mouth, throat, secretions, and sputum. Twenty-five pathogenic bacteria (64.1%) including pneumoniae (nine strains) and pseudomonas aeruginosa (seven strains) were cultured. New silver-based antibacterial agents (33 cases), CTX (five shares), Escherichia coli (five cases), Candida (10 cases), and heterogeneous citrate (one case). The infection rates of gram-negative bacteria, gram-positive bacteria, and fungi were 48%, 35.9%, and 17.6%, respectively.

The antimicrobial susceptibility results are shown in Table 2. Escherichia coli and pneumonia bacteria have 86.6%, 85.1%, 67.4%, 75.5%, and 69.2% resistance to CRO,

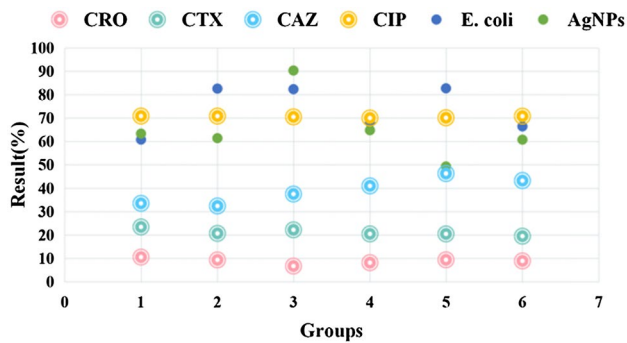


Fig. 1 Pathogen detection results

Table 2 Antimicrobial susceptibility results

Groups	n	<i>Klebsiella pneumoniae</i>	<i>Pseudomonas aeruginosa</i>	<i>Candida</i>	<i>E. coli</i>
Control group	35	3.25	4.55	1.88	1.99
Test group	29	2.35	3.22	2.3	2.44
New silver-based antimicrobials	35	3.31	3.42	6.3	5.2
<i>Candida</i>	29	2.33	3.46	4.57	5.68

CTX, CAZ, CIP, and new silver-based antibacterial agents. The resistance of antibacterial agents to pathogens was 85.1%, 78.8%, 43.9%, 69.7%, and 45.1%, respectively. These strains have relatively low resistance to enzyme inhibitor compounds. The drug resistance coefficient of lysozyme and benzoate and pneumonia bacteria is 4.5–26.8%. In addition, the fourth generation sefalos posephin and pneumococcal glucosinolates also have drug sensitivity, with a drug resistance coefficient of 13.1–33.3%. The sensitivity to the new silver-based antimicrobial agent and lopenem is 100%. Yuanshengsu has moderate resistance to pneumonia, with drug resistance ranging from 30.8 to 59.3%. The sensitivity of other germs is between 2 and 5%.

Analysis of antibacterial properties of new silver-based antibacterial agents

The antibacterial properties of the new silver-based antibacterial agent are shown in Fig. 2. The antibacterial test results showed that the antibacterial strength increased with the increase of sample concentration through the same degree of pathogen replacement, and the minimum inhibitory concentration of the synthesis gate of chitosine with approximately 40% of the chitosine replacement may reach 0.2%. Under the same sample concentration condition, the antibacterial property of the new silver-based antibacterial agent also increases with the increase of the degree of

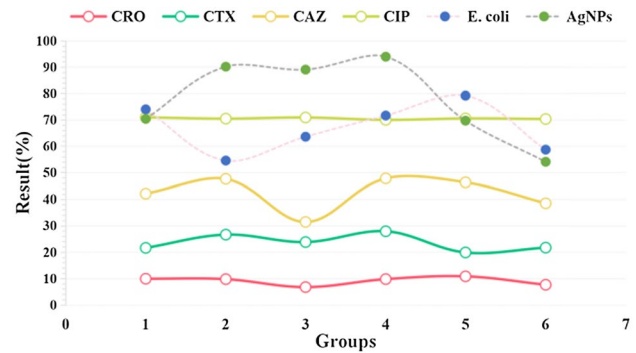


Fig. 2 The antibacterial changes of new silver-based antibacterial agents

amino acid substitution, and the new silver-based antibacterial agent has excellent antibacterial property to *Klebsiella pneumoniae*. Before the antibacterial mechanism explains the phenomenon, the electrostatic interaction between the conjugated contents increases the hydrophobicity of the conjugated substances on the cell wall due to the same mixing property, thus achieving better static bacteria effect. The new silver antibacterial agent has higher antibacterial activity than piperacillin, indicating that there are many factors affecting the real sterilization process of the solution. One of the factors includes the long chains of new silver-based antimicrobials. The hydrophilicity of the antibacterial molecules may also be a factor. If a compound's molecular chain is longer, the overall hydrophilicity of the molecule decreases, and dispersed contact with the cell membrane may make adsorption more difficult. On the other hand, the increased hydrophobicity of phosphates and tetraphosphates may cause the aggregation of molecules in the aqueous phase, affecting the binding of active phosphoramides in the cell membrane. Moreover, without the influence of hydrophobicity, the recoverability of cell membranes gradually deteriorated.

The inhibiting effect of the new silver-based antibacterial agent on the reproduction of pneumonia bacteria is shown in Fig. 3. As the amount of new silver-based antibacterial agents is reduced, the electrostatic effects of the samples are gradually differentiated. This is a confirmation of the previous hypothesis. By porting OGMA, OGMA and Changes in MTAC and new silver-based antimicrobials, in order to compare the degree of inhibiting effect of pneumonia bacteria on growth, the exclusion factor of inhibiting effect was bactericidal water. Bactericidal water is no antibacterial effect, no effect on the proliferation of coliform negative contrast group, so can be excluded. OGMA has no bactericidal property but with protein adhesion tolerance; therefore, it has no bacteriostatic effect. This further inferred that the new silver-based antibacterial agent has a good bactericidal effect. OegMA, the new silver-based antibacterial compound, has

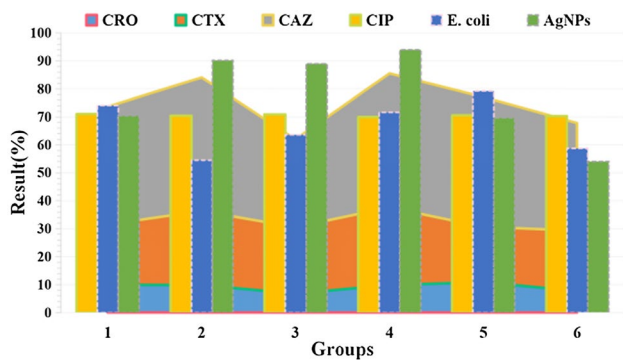


Fig. 3 The effect of the new silver-based antibacterial agent on the reproductive obstruction of root bacteria

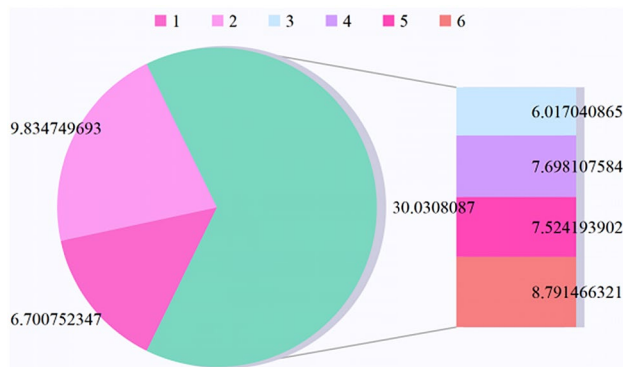


Fig. 4 Dynamic changes of pneumonia bacteria

an effect between OGMA and the new silver-based antibacterial agent. Because both have antibacterial effects, both the bactericidal effect and the attachment of bacteria are inhibited. The results showed that the new silver antibacterial agent had an obvious effect on the reproduction of pneumonia bacteria.

The dynamic changes of pneumonia bacteria are shown in Fig. 4. Exposure to the new silver-based antimicrobials for 50 min significantly reduced the number of pneumonia bacteria. These reductions are due to the smaller gap intervals and larger proportional surface areas of the new silver-based antimicrobials, which are not inert but help the bacteria to adhere to the molecular surface. On the other hand, the pore of molecular structure will hinder the growth of bacteria, which may lead to the decrease of some bacteria. When the bacteria were mixed with the new silver-based antibacterial agent, the reproduction of the bacteria was significantly inhibited after 8 min of contact. In addition, all cultures of *E. coli* become inactive within 6 min. However, the new silver-based antimicrobials reduced pneumonia germs by 76.5% and 89.6% within 6 and 8 min, eventually inactivating all pneumonia germs after 15 min. TGC and CAZ showed weak antibacterial activity against pneumonia bacteria, weak

drug sensitivity and very limited antibacterial activity. Low plasma concentration may be a reason for the weak antibacterial activity of thiophosphorous; therefore, bloodstream infection is not recommended. High tolerance to pneumonia bacteria may be responsible for the weak antibacterial activity of CAZ. After removing MOX, the bacterial concentration of 13 h single dose was higher than the initial inoculation concentration. This indicates that SM infected persons with low immunity and cannot expel the bacteria by themselves; therefore, a single dose cannot control the pneumonia infection. This may be one of the reasons for the low clinical effect of a single agent therapy on pneumonia infection.

Nursing intervention for pneumonia

The first step is to use the new silver-based antibacterial agents to intervene in the bacteria. Patients with unconscious or long-term transnasal and gastric nutrition received oral care twice a day with suction devices. If the patient is diagnosed as having no effect on the respiratory tract cleaning, sputum aspiration must be changed from previous sputum aspiration to an on-demand sputum aspiration. As required, continuous respiratory therapy devices require respiratory system evaluation, such as pulmonary auscultation, for the management of respiratory warming and humidification. To determine the etiology of pathogens, sputum samples should be collected regularly. Patients underwent direct feeding training or were suggested to undergo rehabilitation with therapists and doctors for further examination. This is an active early rehabilitation training and intervention to gradually guide the patient's initial activities.

Discussion

This topic focuses on upgrading the “Drug Target Database with Therapeutic Effectiveness” (DTD), which comprehensively includes FDA-approved drugs for marketing, drugs that are undergoing or have failed clinical trials, and drugs that are in the research stage and have not yet entered the clinic. Out of their corresponding targets, the cross-link between the drug-target-signal pathway was established for the first time. After upgrading the DTD, successful kinase target and clinical kinase target were compared and analyzed based on the system map information. The multi-target drugs and combination drugs were compared and analyzed based on the network pharmacology method.

The integrated analysis of this information provides more comprehensive data support for subsequent drug research and development and provides a new perspective for the development of multi-directional pharmacology. Specifically, the comprehensive collection of drug targets facilitates machine learning methods to predict potential drug

targets from the human genome, which will greatly reduce a large number of blind screenings in the early stage of drug development and alleviate the burden of the high cost. In addition, the comprehensive collection of drugs currently under research has realized the disclosure of information in the pharmaceutical field, which can balance the “grouping” research in the industry and optimize the use of resources. In addition, the drug-target-signal pathway interaction network helps to find suitable “target pairs” to design multi-target drugs and brings more beneficial options for the treatment of complex diseases.

Carbon-based nanomaterials are technological tools with unique properties (high mechanical strength, high conductivity, attractive optical properties, chemical versatility, etc.) (Chen et al. 2018; Tang et al. 2017; Liu et al. 2019b). Among them, graphene and carbon nanotubes are probably the most commonly used materials in chemical analysis. These carbon nanomaterials can be synthesized by several methods, which can be roughly classified in top-down and bottom-up methods (Lai et al. 2019). Their physicochemical characterization is essential to assure product quality (purity, defects, chemical species on the surface, etc.) and elucidate their structure. In this sense, Raman spectroscopy, electron microscopy, and atomic force microscopy are the most important techniques. Moreover, the synthetic and purification route determines some properties of these materials so they must be carefully selected prior to application (Xiao et al. 2019).

Conclusion

Pneumonia is a common mixed infection of multiple pathogens, which brings great difficulties to its treatment. At present, the prevention and treatment of pneumonia in China mainly depends on the use of various antibiotics and related vaccines. With the continuous strengthening of antibiotic monitoring in China, the traditional strategy of inflammation prevention and treatment relying on the delivery of multiple antibiotics has been gradually replaced, and the development of new anti-inflammatory drugs is essential.

As a new type of antibacterial agent, the new silver-based antibacterial agent has gradually been recognized for its non-side effect. The new silver-based antibacterial agent is not only effective in the prevention and treatment of pneumonia, but also in the treatment of other inflammations. As a new type of antibacterial agent, the new silver-based antibacterial agent has brought benefits to clinical settings. If the contact time of the new silver-based antibacterial agent is 50 min, the number of pneumonia bacteria will be greatly reduced. These reductions are due to the smaller gap spacing and larger surface area of the new silver-based antimicrobial agents. They are not inert

but help bacteria attach to molecular surfaces. The new silver-based antibacterial agent provides important practical value as an effective treatment of pneumonia.

Declarations

Conflict of interest No potential conflict of interest was reported by the author(s).

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