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Infection Analysis and Control Strategy of Intravenous Drug Configuration Central Hospital

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Abstract: **Purpose:** Conducting analysis mainly on the infection situation of intravenous drug configuration central hospital and take appropriate infection control strategies in order to reduce its infection rates. **Method:** 300 cases of transfusion patients were randomly divided into experimental and control group of 150 cases respectively. Experimental group of patients took systemic infection prevention and control measures, while control group of patients took merely the traditional nursing intervention. Comparative analysis of infection factors and rate of incidence were conducted on both groups of patients. **Results:** the main causes of infection in the drug configuration central hospital were operator personnel and storage of drugs *etc.*. Infection rate of the experimental group was lower than that of the control group, which the difference was statistically significant ($P < 0.05$). **Conclusion:** Strengthening attention towards the relevant factors in order to achieve minimum incidence of infections in the hospital.

Keywords: intravenous drug configuration centre; infection; control strategies

Introduction

Pharmacy Intravenous Admixture Service (PIVAS) is an international popular configuration management method for a new drug. It is operated by the specially trained personnel in compliance with the standard of cleanliness under a closed operating environment. It is a place to undergo aseptic procedures strictly for intravenous infusion of the drug configuration. Its main functions are to ensure centralized management and configuration of hospital intravenous infusion of drugs, in order to minimize the possibility of pollution from microorganisms and heat *etc.*, and to improve the safety of the intravenous infusion drug configuration. Currently, intravenous infusion is almost the most widely clinically used route of administration, in which more than 80% of the hospitalized patients were treated with this administration route. If drug infusion is not configured strictly in compliance with the standards such as confusion of environment and personnel management, configuration of intravenous infusion drug could be easily disqualified, or even cause hospital infections [1]. Therefore, strengthening hospital infection control of PIVAS can effectively reduce hospital infections caused by drug infusion configuration. It not only guarantees clinical results, but also is an important part to ensure safety of infusion and control hospital infections effectively.

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Materials and methods

1.1 General information

The research subjects in this study were 300 patients who received infusion therapy in our hospital during January 2015–January 2016. The patients were randomly divided into experimental and control groups with 150 cases respectively. As for the control group, there were 85 males and 65 females whose ages were in a range of 20–75, which mean age was 48.5 (±10.5). On the other hand, the experimental group was consisted of 87 males and 63 females whose ages were in a range of 22–75, which mean age was 47.5 (±11.5). It was comparable for both groups that showed no significant difference ($P > 0.05$) in terms of gender, age *etc.*.

1.2 Research Methods

In order to improve the level of intravenous drug use in our hospital, PIVAS has developed a method of infection control, including: 1) establishing quality control team. Such quality control team is set up according to the hospital's need, in order to involve in quality control mainly related to content inspection, monitoring, control, feedback *etc.*. Every day the inspection team verifies the finished infusion bags to check on color change, precipitation, leakage, foreign matter and other phenomena. Disinfection procedures are conducted regularly for bacterial cultivation[2]. 2) Strengthening the set up of regulations. Conducting regular discussion regarding problems encountered in our department management. Developing appropriate provision, work flow, rules and regulations, requirements etc. on the parts that are weak and need to be improved. Developing appropriate contingency plans and solutions to emergencies that may arise. 3) Operating rules strictly. During the configuration process of intravenous drug use, the ability of drug-configuring staffs in compliance with the aseptic operation has a decisive role on the overall quality of drugs and whether contamination happens. Therefore, PIVAS must be clear with the norms and standards of various processes. Relevant operators should have the basic qualifications and operation skills, in compliance strictly with the aseptic operation requirement and avoid flow of personnel as possible. 4) Compliance strictly with the quarantine disinfection system. PIVAS must control strictly the personnel's pass in and out from the site. Protective clothing of the personnel should be disinfected and washed regularly, whereby disinfection and cleaning should be done immediately when contamination happens. When pass in and out from the clean area, they should follow dressing in accordance with the relevant requirements and standards. 5) Strong infusion pollution control. Strict implementation of disinfection and isolation principle as well as aseptic operation techniques which is developed by PIVAS. Simplify operational procedures appropriately and shorten drug delivery time to minimize the chance of contamination. 6) Improving the accuracy of the infusion configuration. During processing of drug configuration, personnel are required to ensure strict control on infusion and drug quality, degree, dosage *etc.*. Reviewers should prevent the appearance of inertia thinking and dependent mentality. They should communicate timely with the medical staffs about any parts in doubt. They also should ensure infused drug with unclear identity, incomplete packaging and illegible labeling not be moved into cabin. Cabin personnel should strictly enforce multiple checking and confirmations standard[3] in order to minimize error rates and ensure the quality of the infusion configuration.

1.3 Statistical method

Using SPSS18.0 statistical software for statistical analysis of data. Measurement of data were presented as mean ±

standard deviation ($\bar{x}$ ±s), using t test; count of data was presented as rate (%), using χ2 test .($P < 0.05$) indicates a statistically significant difference.

Results

2.1 Sampling results

50 times spot checks through the PIVAS in our hospital found that 86 cases might trigger hospital infections. One of the most common events is the improper operation of drug configuration by personnel, followed by improper storage sequence of drugs, as shown in *Table 1*.

Table 1 Sampling results of infected phenomenon of PIVAS (n，%)

Risk events	Cases	Ratio
Improper operation by pharmacy dispensing staffs	43	50.00
Improper storage order of drug	27	31.40
Improper air disinfection of the drug configuration center	10	11.63
Improper hands disinfection by the operator	6	6.98
Total	86	100.00

2.2 Infection rate comparison between both groups

Findings showed that the infections incidence of patients from the experimental group was significantly lower than the one from the control group, which the difference was statistically significant ($P < 0.05$), as shown in *Table 2*.

Table 2 Infection rate comparison between both groups

Group	Cases	Infection cases	Infection rate
Experimental group	150	13	8.67
Control group	150	46	30.67

Discussion

PIVAS is still in a development phase or even starting phase for majority of hospitals in our country. Due to limitation of experience and conditions, there are some unavoidable problems during the operations. For an example, hospital infection due to intravenous drug configuration and storage as well as during the transportation process is a very serious problem. Regular or irregular spot checks of work quality of PIVAS in hospital which were carried out during January 2015 – January 2016 showed that hospital infection risk segment during work process mainly includes the following aspects [4]:

Ambient air disinfection of drug configuration failed: infusion configuration should be carried out in a clean room in compliance with air disinfection standards. However, intensive indoor mobility as well as door of clean room or window for delivering liquid is not in the closed state due to negligence during the operation may cause indoor air purification out of control. This may lead to indoor air cleanliness not up to the standard regulations, which not achieving desirable air purifying effect. When extracting drug liquid with a syringe, simultaneous exposure of the needle and piston to disinfection-failed air may easily contaminate drug liquid with bacterial or dust, leading to potential hospital infections.

Hand disinfection by dispensing staff failed: for clinical work, there is a small number of operators whose sterile

concept are not strong. They do not put enough emphasis on their hands cleaning. They do not perform hands hygiene practices strictly and incomplete hand washing before dosing operation. While the operators mostly use their hands to grip syringe horizontally during drug liquid configuration, their hands are in direct contact with the syringe barrel and piston. When wearing gloves during the operation, if breakage of gloves happen, improper hands disinfection becomes source of pollution, causing risk for hospital infections.

Not fully comply with specifications during dispensing: since intravenous drugs configuration process involves a number of work aspects, a part of works that is not operated in strict accordance with the specifications can easily lead to the occurrence of the hospital infections. Violation of specifications during operations of intravenous infusion configuration as well as checking system is not enforced strictly, resulting in inappropriate phenomenon of drug liquid configuration such as too concentrated of the configured drug liquid, liquid infusion tag errors *etc.*: Disinfection failure of dosing apparatus is also one significant risk causing drug liquid contamination to induce hospital infections. Dosing process may lead to generation of infusion particles due to reasons such as drugs are not dissolved completely or drugs configuration time too long, *etc.*.

Drug liquid storage and transportation do not meet the requirements: From PIVAS workflow, drug liquid needs to go through storage and transportation processes from pharmacy and department before it is sent to PIVAS by clinical department. During these processes, it is difficult for the operating personnel to gently take and put all drugs and liquids, especially under a situation whereby schedule is tight and workload is large. Turbulence in liquid may inevitably result in collision and friction between each other, which may lead to loose and leakage of bottle, even causing pathogenic bacteria or dust from the air to take the opportunity to enter the drug liquid [5].

In order to avoid infections during intravenous drug configuration, a complete hospital infection management system should be first established. PIVAS should combine the actual work situation of our departments. Besides, relevant provisions “Hospital Infection Control Measures” of the hospital infection control branch should be in accordance. Various rules and regulations of the hospital infection management such as cleaning and hygiene, disinfection and isolation, occupational protection as well as disposable medical supplies management *etc.* should be completed. The measures taken could make the control and prevention of hospital infections based on the rules. In addition, the departmental organizational structure of the hospital infection management should be further improved, which hospital infection management team such as director, head of deployment and hospital infection control professionals should be established. Hospital infection controls must be in charged by professionally trained personnel. Bacteriological monitoring on clean room air, operating console, surface of items, disinfectant and staffs’ hands should be done every month regularly. Besides, weekly checks should be conducted on a fore mention objects. Rectification should be done immediately once failure identified, and responsible, include the results in the year-end assessment.

Besides, strengthening the cleaning, disinfection and sterilization management of clean room is also important on the prevention of hospital infections in order to ensure safety of drug configuration. Clean area should be cleaned daily and weekly based on the cleaning systems, while cleaning at any time when it is necessary to ensure the cleanliness for configuration environment. Cleaning supplies in different areas should be differentiated, where one cleaning supply is fixed to be used at one room. After using, they should be cleaned and disinfected daily. Configuring drug liquid laminar flow workbench as well as ground and items surface should be washed and cleaned with disinfectant. Clean room is washed and disinfected thoroughly with disinfectant weekly. In order to avoid the emergence of resistant strains, the disinfectants type used by PIVAS should be replaced every six months for another new type.

Hands hygiene practices should be trained on all staffs, whereby they can only work after passing the assessment. Staffs who enter the clean room must ensure their hands be thoroughly cleaned and disinfected according to the “seven-step hand-washing” procedures and requirements. Then, they should wear sterile clothing, sterile gloves,

disposable hat, mask, shoes set before entering the clean area. The operator who suffer from upper respiratory tract infection or fever *etc.* should be prohibited from the post. If found gloves damaged during drug configuration process, the gloves should be replaced before the operation. If hand skin injured, the personnel should be replaced to continue the operation, while the hand wound of the injured personnel should be treated in accordance with the regulations.

All personnel should carry out aseptic dispensing practices strictly. They must dress according to the regulations, washing hands strictly, and emphasize various aspects of the operation to maintain absolute sterility when they enter the operating room. All sterile items should be strictly checked before the operation. Syringe used must be assigned to the medicine, whereby one person in charge of one medicine using one syringe and needle. No mixing is allowed, therefore different syringe must be used to configure different drug liquid. During the drug liquid configuration process, the operating console must be cleaned with a 75% alcohol for disinfection after completion of each patient's drugs configuration, in order to keep the environment clean. Meanwhile, the gloves should be kept moist to reduce generation of particles, and thus prevent the occurrence of hospital infections. Strict pharmaceutical aseptic procedures management is an important part in reducing hospital pollution. Air flow in clean area should be understood and clear as possible when configuring drugs. Drug liquids configured in the cleanest area and strict adherence to the aseptic operating practices is the safest. In order to minimize turbulence amplitude when configuring drug liquids, the required items should be placed neatly, orderly, and unified in the horizontal laminar flow bench to ensure the items be easily reached. This action does not cause greater turbulence or reflux, and can minimize the impact on air cleanliness, thereby reducing the possibility of hospital infections[6].

Liquid storage and transportation management are important in controlling the infections. Drug liquid alternative prescriptions should be in charged by professional, and has a good sense of hospital infections prevention and control. Preparing a prescription plan in accordance with the use of drug liquids in order to avoid accumulation of large number of drug liquids in long term. Attention should be paid for gently collecting and transporting drug liquids. Drug liquids alternatives should be placed in a special storage room. Indoor temperature and humidity should be maintained properly, whereby room temperature at 20–25 ℃ and humidity of 40–70% are appropriate. On the other hand, setting freezer temperature at 2–10 ℃ is appropriate. Attention should be paid to the storage of liquid alternatives. They should be placed in order and according to the date of manufacture, whereby drugs with a more recent expiry date should be placed in front and used first; while drugs with a later expiry date should be placed behind and used later.

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