

Application Effect of Medium-Length Peripheral Catheter in Critically Ill Patients Undergoing Hepatobiliary Surgery

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Abstract: *Objective:* To investigate the effect of using peripheral medium-length catheters in critically ill patients undergoing hepatobiliary surgery. *Methods:* A retrospective analysis of the nursing experience and effect of using medium-length catheters for infusion in 102 critically ill patients undergoing hepatobiliary surgery from March 2021 to April 2022 was conducted. *Results:* All 102 patients had successful catheter placement with no catheter-associated infections, blockage, decannulation, or breakage. However, four cases had blood oozing from the puncture site, but it resolved after changing the dressing. *Conclusion:* Medium-length catheters are superior to traditional infusion tools in terms of benefit; thus, they deserve to be widely promoted in clinical practice.

Keywords: Medium-length peripheral catheter in critically ill patients; Application effect

Online publication: March 30, 2023

1. Introduction

Critically ill patients undergoing hepatobiliary surgery require many different types and large amounts of infusion. The infusion pathways commonly used in clinical practice include peripheral venous catheter, central venous catheter (CVC), peripherally inserted central catheter (PICC), *etc.* Repeatedly puncturing the blood vessels with needles not only causes pain to patients, but also leads to various adverse events, such as fluid infiltration and catheter-related infection. CVC, PICC, and so on are not only difficult to operate, but also associated with high cost, complications, and high qualification requirements for operators; thus, they are unable to meet the needs of critically ill patients for rapid and safe infusion. A key concern among medical staff is in the selection of infusion access, which must be both easy to operate and suitable for critically ill patients, so as to reduce infusion risks and complications^[1]. The medium-length catheter is a peripheral venous access device, usually inserted through the basilic vein, cephalic vein, or median cubital vein, with a length of 7.5–20.0 cm^[2], and its tip reaching the subclavian vein, but not exceeding the distal axillary vein^[3]; its flow rate is 900 mL/min, and drug dilution is rapid, allowing continuous infusion of stimulating, highly osmolar, and strongly acidic and basic drugs. The recommended retention time is 1–6 weeks^[4]; thus, it can meet the needs of patients for infusion of complex medications and medium- to long-term rehydration. From March 2021 to April 2022, 102 critically ill patients under our department received infusion therapy with medium-length catheters.

2. Data and methods

2.1. General information

A total of 102 critically ill patients who received infusion therapy with medium-length catheters under the Department of Hepatobiliary Surgery of Shaanxi Provincial People's Hospital from March 2021 to April 2022 were selected as the observation subjects. Inclusion criteria: (i) expected infusion treatment time of more than 7 days; (ii) normal routine blood and blood coagulation time; (iii) informed consent given by the patients and their families. Among the 102 patients who met the inclusion criteria, 56 were male and 46 were female; their mean age was 40.8 ± 13.5 years (31–73 years); there were 35 cases of acute severe suppurative cholangitis, 12 cases of pancreatoduodenectomy, 31 cases of liver cancer, 13 cases of acute severe pancreatitis, 7 cases of gallbladder cancer, and 4 cases of cholangiocarcinoma.

2.2. Design

2.2.1. Operator qualification

Puncture operator: all puncture operators were members of the intravenous therapy team who had obtained relevant qualifications in our department. Maintainer qualification: the maintenance was carried out by nurses who had obtained the Registered Nurse certificate, in which their skills for performing such procedures were approved by their instructor, and they performed under the supervision of their instructor; student nurses were not allowed to perform the procedure.

2.2.2. Catheter selection

Medium-length catheters made of medical silicone material, with integrated connection, three valves, and specifications of 4Fr, 3Fr, were selected.

2.2.3. Inform consent

Before catheter placement, the nurses explained the purpose, risk, *etc.*, to the patients and their families, and the patients signed the informed consent ^[5].

2.2.4. Procedural approach

Patient health education was done before catheterization. The catheter was placed in a sterile environment, and the circumference of both arms and the length of the preset tube were measured. The patient was required to extend his/her arm 45° – 90° forward from the trunk. The skin was wiped and disinfected with 2% chlorhexidine gluconate ethanol solution at the puncture point and left to dry in air. Maximum sterile barrier was established, the catheter was pre-flushed with normal saline, and the integrity of the catheter was inspected. B ultrasound was used to check the blood vessels in the upper arm; brachial or cephalic vein is routinely selected, and arteries and veins are strictly distinguished to prevent accidental arterial injury. The puncture point was located at one third of the upper condyle of the humerus to the apex of the armpit. The skin was disinfected the second time at the puncture point and left to dry in air. The modified Seldinger technique under ultrasonic guidance was used for catheterization. The guidewire was reserved at least 15 cm outside the body to prevent it from sliding into the body. The skin was stretched in the direction of the guidewire to prevent damage to the guidewire and blood vessels. The guidewire was removed gently to prevent damage to the integrity of the catheter and the guidewire.

2.2.5. Catheter care

At each shift, the skin at the puncture site was examined for redness, swelling, tenderness, and bleeding; the film was examined to determine if it was wet, contaminated, or fringed; and the catheter was observed for any obstruction, damage, protrusion, displacement, *etc.* The tube was flushed with 15–20 mL of normal

saline before and after infusion, especially after infusing drugs with high viscosity, irritants, and blood products, as well as between infusions of incompatible drugs. When flushing the tube, there should be no blood return or resistance. The tube was sealed by positive pressure sealing. A special maintenance kit was used twice a week. A wet, contaminated, or fringed film was replaced immediately. During maintenance, there was strict adherence to aseptic techniques.

2.2.6. Health education

The patients and their families were educated so that they understood the precautions for catheter maintenance and the preventive measures for complications. The patients were instructed to drink more water and alternatively squeeze a grip ball to the maximum and relax after 5 s using the limb of the catheterization side 24 hours after catheterization. They were also encouraged to do elbow flexion and extension exercises, along with internal and external wrist rotation exercises, 10 min each time.

2.2.7. Catheter removal

The catheter was removed by qualified members of the static therapy team. Strict aseptic technique was adhered to. The catheter was not removed by force if there were difficulties in removal. After removal of the catheter, the puncture site was covered for protection, and the film was removed 24 hours later; the length of the catheter was measured, the integrity of the catheter was assessed, and the fibrin sheath adhesion of the tube wall was carefully observed. The tip of the catheter, with a length of 2–3 cm, was taken for bacterial culture. The length and removal time were recorded.

3. Results

The placement of catheter was successful for all 102 patients. The retention time of the catheter was 10–31 days. After the completion of the treatment plan, the catheter was removed. During the indwelling period, high osmotic pressure fluid, intravenous vasoactive drugs, blood products, and parenteral nutrition were administered to the patient via the catheter. The patients did not experience any adverse reaction, and no tubes were blocked, shed, or broken. However, four patients showed different degrees of bleeding at the puncture points, which was stopped within 1–2 days after changing the dressing. One patient died due to disease progression.

4. Discussion

In clinical work, it is important for nursing staff to make a thorough assessment of critically ill patients and make reasonable selections of infusion tools. Medium-length catheters can reduce the number of phlebotomies in a patient, alleviate pain, protect blood vessels, and reduce the workload among nurses. The cost of placement and maintenance of medium-length catheters and the incidence of complications are significantly lower than those of CVC and PICC [6], thereby reducing treatment costs and the economic burden on patients. The retention time of medium-length catheters meets the treatment and hospitalization needs of critically ill patients undergoing hepatobiliary surgery. In a comprehensive evaluation, medium-length catheters are significantly better than traditional infusion tools in terms of benefit; thus, they should be given priority in the selection of intravenous access for critically ill patients.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Fan X, 2016, Study on the Selection of Infusion Tools and Its Influencing Factors During Intravenous Infusion Therapy, thesis, Shanxi Medical University.
- [2] Wang J, 2009, Transfusion Therapy Nursing Practice Guidelines and Implementation Rules, People's Military Medical Press, Beijing, 16–22.
- [3] Sharp R, Esterman A, McCutcheon H, et al., 2014, The Safety and Efficacy of Midlines Compared to Peripherally Inserted Central Catheters for Adult Cystic Fibrosis Patients: A Retrospective, Observational Study. *Int Nurs Stud*, 51(5): 694–702.
- [4] Hu M, Shen X, Gu P, et al., 2015, Clinical Application of Medium Length Catheter in Peripheral Vein. *Nursing Research*, 11(29): 3045–3048.
- [5] Adams DZ, Little A, Vinsant C, et al., 2016, The Midline Catheter: A Clinical Review. *The Journal of Emergency Medicine*, 51(3): 252–258.
- [6] Zhu Y, Zhao Y, Zhou Y, et al., 2021, Application of Peripheral Medium Length Catheter in Neurosurgery Patients. *Journal of Practical Clinical Medicine*, 25(2): 40–42.

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