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Application of Midline Catheter in Patients with Oral Cavity Malignancies during Perioperative Period

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Abstract

Objective: The study aims to compare the application value of midline catheter and indwelling needle in patients with oral cavity malignancies during perioperative period. **Methods:** 146 patients with oral cavity malignancies admitted to our hospital from January 2019 to July 2021 were selected as the research subjects. 73 patients treated with midline catheters during the treatment were the experimental group, and another 73 patients were treated with indwelling needles as the control group. The indwelling time, total number of puncturing times, and incidence of adverse reactions of two catheterization methods were compared between the two groups. Meanwhile, each patient was investigated for treatment satisfaction. **Result:** The indwelling time was significantly longer in the experimental group than in the control group ($P < 0.0001$), and the total number of puncturing times in the experimental group was significantly lower than that in the control group ($P < 0.0001$). The incidence of adverse reactions in the experimental group ($\chi^2 = 4.960$, $P = 0.0259$) was significantly lower than that in the control group in terms of catheter occlusion ($\chi^2 = 12.56$, $P = 0.0004$), catheter detachment ($\chi^2 = 8.46$, $P = 0.0036$), drug extravasation ($\chi^2 = 3.27$, $P = 0.0011$), phlebitis ($\chi^2 = 3.62$, $P = 0.0003$), and bleeding from the puncture point ($\chi^2 = 14.98$, $P = 0.0001$). The satisfaction rate ($\chi^2 = 33.45$, $P < 0.0001$) and fundamental satisfaction rate ($\chi^2 = 16.57$, $P < 0.0001$) in the experimental group were significantly higher than those in the control group, while the dissatisfaction rate was significantly lower than that in the control group ($\chi^2 = 11.38$, $P = 0.0007$). The difference is statistically significant. **Conclusion:** Compared with indwelling needle, the application of midline catheters in patients with oral cavity malignancies during perioperative period can effectively reduce the number of puncturing times

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and the incidence of catheter-related adverse reactions, with a high satisfaction rate, which is worthy of clinical promotion and application.

Keywords

Oral Cavity Malignancy, Midline Catheter, Indwelling Needle, Adverse Reactions

1. Introduction

Oral cavity malignancy is one of the most common malignancies in the world, with high morbidity and mortality [1]. Studies have shown that oral and maxillofacial malignancies are the sixth most common malignancy, accounting for 6% of all malignancy cases and about 1% to 2% of deaths of malignancies [2]. Approximately 644,000 new cases of oral and maxillofacial malignancies are diagnosed every year, and two-thirds of them are from developing countries [3]. Treating patients with oral and maxillofacial malignancies is relatively complex. At present, surgery is still an effective treatment for oral and maxillofacial malignancies. However, surgery often causes large soft and hard tissue defects in patients, affecting the facial appearance and postoperative life quality [4]. According to studies, the forearm flaps can be used for the repair and reconstruction of defects to improve the appearance and physiological function of patients to some extent [5]. However, in such cases, infusion can only be conducted on one arm, and patients often have difficulties in chewing after surgery, resulting in poor systemic nutritional status, which in turn requires prolonged intravenous infusion therapy [6]. Therefore, it is of great importance for patients with oral cavity malignancy to choose appropriate infusion tools.

A midline catheter, also known as medial venous catheter, 20 to 30 cm in length, is inserted in a basilic vein, cephalic vein, or median cubital vein in the upper arm or anterior cubital region, with the tip positioning in the subclavian vein prior to reaching the central veins [7]. Midline catheters have been shown to be more effective when used for continuous intravenous infusion of drugs, alleviating pain from repeated punctures of peripheral veins and reducing complications [8]. Thus, midline catheters are the priority for patients requiring long-term infusion and may be a feasible alternative to peripherally inserted central catheter or short peripheral intravenous catheter [9] [10]. Therefore, this study explores and reasonably analyzes the clinical application effect of midline catheters in patients with oral cavity malignancies in the perioperative period, with the purpose to provide a theoretical basis for the application of midline catheters to patients with oral cavity malignancies as soon as possible.

2. Data and Methods

2.1. Clinical Data

146 surgical patients with oral cavity malignancies admitted to our hospital from

January 2019 to July 2021 were selected as the research subjects, the inclusion criteria is as following: 1) the patients were all diagnosed with oral cavity malignancy by pathology and underwent surgical treatment; 2) patients who voluntarily participated in the study; 3) patients with complete clinical medical records. Exclusion criteria: a) patients with unconsciousness or communication disorders; b) pregnant or lactating women; c) patients with systemic infection.

In this study, 146 patients who met the inclusion criteria were divided into experimental and control groups, with 73 patients in each group, using a random number table. The experimental group includes 58 males and 15 females, aged from 16 to 79 years old, with an average age of 55.28 ± 11.43 years old. The control group includes 60 males and 13 females, aged from 21 to 72, with the average age of 56.72 ± 10.46 years old. The general clinical data of two groups of patients did not differ significantly ($P > 0.05$) and were comparable. Informed consent was obtained from all included patients in this study.

2.2. Catheterization

2.2.1. Indwelling Needle

Patients in control group were treated with 22 to 24 G BD Safety Closed IV Catheter System (Saf-T-Intima™), straight type, with heparin cap, and infusion connector (Clivee; Model: 01C-C3300T) for infusion therapy. The thick, straight and elastic blood vessels in the patient's hand or forearm were selected for venipuncture, and the puncture point was disinfected in advance. After the puncture, the needle was fixed with a 6 cm × 7 cm transparent patch produced by 3M Company. The infusion was performed exactly as standard for infusion via indwelling venous catheter. After daily infusion, pulsed positive pressure sealing was performed with 10 mL of normal saline.

2.2.2. Midline Catheter

Patients in the experimental group were treated with disposable peripherally inserted central catheter made of silicone from Bard, with specifications of 4 to 5 Fr. Before catheterization, the patients' coagulation function, skin to be punctured, etc. were evaluated. Patients were asked to lie flat for careful observation of blood vessels in two finger-widths in the cubital region of patient's healthy limb using the ultrasound system. Then the basilic vein (first choice) or brachial vein was selected according to the vascular condition, and the puncture point was marked. The distance from the puncture point to the midpoint of ipsilateral clavicle was measured to determine the length of the catheter. 2% glucose chlorhexidine ethanol solution was used to disinfect the skin. According to the patient's subcutaneous vein depth, a suitable needle guide kit was selected to fix the needle. The operator held the ultrasound probe in his left hand and gently pressed the patient's blood vessel vertically, and punctured the needle into the blood vessel using his right hands. After blood appeared, the guide wire was sent into the blood vessel through the needle. Then the puncture needle was taken out. The skin was expanded after local anesthesia at the puncture point using li-

docaine. Insert the micro-intubation sheath through the guide wire and pull out the wire. After the inserted catheter slowly reached the predetermined length, the micro-intubation sheath was pulled out. The position of the catheter was confirmed and properly fixed after no abnormalities were found. After daily infusion, 10 mL of normal saline was used for pulse positive pressure flushing and 50 U/mL of heparin saline for sealing [11].

2.3. Observation Index

The indwelling time and total number of puncturing times in both groups were observed and recorded. At the same time, the adverse reactions that occurred in the course of catheterization treatment in the two groups were observed, such as catheter occlusion, catheter detachment, drug extravasation, phlebitis, and bleeding from the puncture point. Finally, the clinical indexes such as the indwelling time, total number of puncturing times and adverse reactions were statistically analyzed in the two groups.

2.4. Treatment Satisfaction of Patients in Both Groups

The survey in the study was conducted using a self-designed questionnaire on treatment satisfaction. The results were categorized into satisfaction, fundamental satisfaction and dissatisfaction. Satisfaction rates of patients were calculated after the survey.

2.5. Statistical Method

The software SPSS 22.0 was used for statistical analysis, and the count data was represented by (n, %), and χ^2 test was used; the measurement data was expressed by ($\overline{x} \pm s$); t test was adopted. It is statistically significant if $P < 0.05$.

3. Results

3.1. Comparison of Indwelling Time and Total Number of Puncturing Times between the Two Groups

As shown in Table 1, the indwelling time was significantly longer in the experimental group than in the control group ($P < 0.0001$), and the total number of puncturing times in the experimental group was significantly lower than that in the control group ($P < 0.0001$).

Table 1. Comparison of indwelling time and total number of puncturing times between the two groups.

Group	Control group (n = 73)	Experimental group (n = 73)	t	P value
Indwelling time (d)	3.24 ± 0.92	11.05 ± 2.48	25.23	P < 0.0001
Total number of puncturing times	4.21 ± 1.09	1.04 ± 2.72	9.24	P < 0.0001

3.2. Comparison of Adverse Reactions between the Two Groups

As shown in Table 2, the incidence of adverse reactions in the control group was significantly higher than that in the experimental group in terms of catheter occlusion (χ^2 = 12.56, P = 0.0004), catheter detachment (χ^2 = 8.46, P = 0.0036), drug extravasation (χ^2 = 3.27, P = 0.0011), phlebitis (χ^2 = 3.62, P = 0.0003), and bleeding from the puncture point (χ^2 = 14.98, P = 0.0001). It was shown that, compared with indwelling needles, midline catheters could reduce the incidence of adverse reactions in intravenous therapy.

3.3. Comparison of Satisfaction between the Two Groups

As shown in Table 3, the satisfaction rate (χ^2 = 33.45, P < 0.0001) and fundamental satisfaction rate (χ^2 = 16.57, P < 0.0001) in the experimental group were significantly higher than those in the control group, while the dissatisfaction rate was significantly lower than that in the control group (χ^2 = 11.38, P = 0.0007). The difference is statistically significant.

4. Discussion

The clinical application of intravenous indwelling needles can avoid repeated venipuncture, thereby alleviating the pain caused. However, the indwelling time of the needle is only about 3 days [12], which is still short for patients with oral cavity malignancies, who require long-term infusions. Moreover, patients receiving long-term infusion are prone to problems such as atherosclerosis and

Table 2. Comparison of adverse reactions between the two groups [n (%)].

Adverse reactions/Group	Control group (n = 73)	Experimental group (n = 73)	χ^2	P value
Catheter occlusion	14 (19.18)	1 (13.7)	12.56	0.0004
Catheter detachment	8 (10.96)	0 (0)	8.46	0.0036
Drug extravasation	10 (13.70)	0 (0)	3.27	0.0011
Phlebitis	12 (16.44)	0 (0)	3.62	0.0003
Bleeding from the puncture point	16 (21.92)	1 (13.70)	14.98	0.0001

Table 3. Comparison of satisfaction between the two groups [n (%)].

Group	Control group (n = 73)	Experimental group (n = 73)	χ^2	P value
Satisfied	32 (43.84)	65 (89.04)	33.45	P < 0.0001
Common	28 (38.36)	7 (9.60)	16.57	P < 0.0001
Dissatisfied	13 (17.81)	1 (1.40)	11.38	P = 0.0007

thinning blood vessels, further bringing difficulties to puncture. So the use of indwelling needles doesn't show an ideal clinical application effect. As a result, it is necessary to select a suitable intravenous catheter for patients requiring long-term intravenous infusion and reduce the number of venipunctures and the incidence of adverse reactions due to punctures and alleviate the pain, thus establishing a safer and more reliable intravenous access for patients with tumors undergoing intravenous therapy.

A midline catheter is a new type of intravenous indwelling catheter tool. The midline catheter applied in this study is made of imported high-quality medical grade silicone material, which is soft, good in tissue compliance and low in surface energy. Midline catheters can stay in for a relatively long time, typically up to 1 to 7 weeks [13]. The tip reaches the subclavian vein where the blood flow rate is 1000 - 1500 mL/min, to diminish the stimulation to the vascular intima by the drug, thus reducing damages to the vascular intima. In recent years, midline catheters have been used frequently in pediatrics, neurology, and emergency departments [14] [15]. It has also become another major infusion way and method in developed countries and regions in addition to peripherally inserted central catheter, providing more alternatives for medical staff [7]. However, due to the fact that midline catheters have not yet been popularized in China, the accurate analysis of their effects remains controversial. Therefore, by following strict inclusion and exclusion criteria, the study compared the application value of midline catheters and indwelling needles in patients with oral cavity malignancies, providing a new direction for future clinical treatment.

According to the regulation of Infusion Nurses Society (INS), the indwelling time of indwelling needles is generally 72 to 96 h [16]. The results showed that the indwelling time of the group using indwelling needle (3.24 ± 0.92) is significantly lower than that of the group using midline catheter (11.05 ± 2.48), and the total number of puncturing times is significantly more than that of the latter group. In other words, for patients with oral cavity malignancies, the midline catheter can stay in for a longer period of time, which reduces the number of puncturing times, thereby alleviating patients' pain. It also reduces the workload of clinical nurses and saves working hours. The results of Xu B L *et al*. in the application of transcatheter aortic valve replacement in elderly patients during perioperative period also showed that the indwelling time of indwelling needle is shorter than that of the midline catheter, and the total number of puncturing times was more than that of the midline catheter group [17], which are broadly consistent with those in this study.

The results of this study also showed that the incidence of adverse reactions in the group using indwelling needles in several aspects such as catheter occlusion, catheter detachment, drug extravasation, phlebitis, and bleeding from the puncture point was significantly higher than that in the group using midline catheter. Related studies have also shown that the incidence of adverse reactions such as phlebitis, intravenous infusion extravasation, and catheter occlusion was significantly higher in the group using indwelling needles than in the group using mid-

line catheter [17]. It can be seen that midline catheters are superior to indwelling needles in reducing the incidence of adverse reactions in patients with oral cavity malignancies during perioperative period. The tip of midline catheter is positioned in the subclavian vein, with the drug infusion rate higher than the blood flow rate in the superficial veins of the upper arm [18], and the higher blood flow rate can quickly dilute the drug entering the blood vessel, thereby diminishing the drug stimulation to the vascular endothelium and reducing the incidence of adverse reactions [19]. On the other hand, the midline catheter is soft, which causes little damage to the venous vessels, thus also reducing the incidence of adverse reactions to a certain extent.

Besides, the survey result of this study showed that the satisfaction rate of patients in the group using midline catheter was significantly higher than that in the group using indwelling needles. The use of midline catheter alleviated the pain caused by repeated punctures, ensured smooth infusion, and reduced various complications related to intravenous therapy, suggesting that it is feasible to promote midline catheters in treating patients with oral cavity malignancies to have a better treatment experience than using indwelling needles.

So, compared with indwelling needle, the application of midline catheters in patients with oral cavity malignancies during perioperative period can effectively reduce the number of puncturing times and the incidence of catheter-related adverse reactions, with a high satisfaction rate, which is worthy of clinical promotion and application. Due to limited experimental conditions, however, the study presents some limitations. 1) The sample size of this study was small which should be further expanded for research; 2) There was a lack of specific comparison with more kinds of infusion tools; 3) This study mainly compared the application of midline catheters and indwelling needles in patients with oral cavity malignancies during perioperative period, but failed to analyze the application of midline catheters in treating other tumors in detail. Therefore, we will expand the sample size of the study subjects and further explore the application of midline catheters in treating other tumors to increase the confidence of experimental results in the future.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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