

# Modified fixation of indwelling intravenous catheter in management of exudate

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**Abstract. – OBJECTIVE:** To analyze the clinical efficacy of modified fixation of the indwelling intravenous catheter in the management of exudate.

**PATIENTS AND METHODS:** From January 2015 to January 2016, 110 patients who underwent surgery and management of exudate were enrolled in this study. They were divided into two groups using a random number table with 55 patients in each group. Routine intravenous catheter fixation was used in the treatment group and modified intravenous catheter fixation was used in the control group. General condition and complications between 2 groups were compared.

**RESULTS:** Our results showed that the off-bed time and nursing frequency in the treatment group were significantly shorter and lower than the control group while the indwelling time in the treatment group was significantly longer than the control group. The prevalence of redness, rash, erosion, and drainage tube infection in the treatment group was significantly lower than the control group.

**CONCLUSIONS:** We concluded that modified fixation of the indwelling intravenous catheter could effectively prolong indwelling time while reducing the significantly the off-bed time, nursing frequency and occurrence of post-operative complications. We suggest that this method is valuable in clinical applications.

Key Words:

Indwelling intravenous catheter, Management of exudate, Modified fixation.

## Introduction

Exudate refers that the fluid exudes from wounds, and plays an essential role in the wound healing process. The chemical components of exudate include water, electrolyte, inflammatory factors and growth factors. Additionally, leukocytes, phagocytes, and platelets are present in exudate<sup>1</sup>. The classification of exudate is associ-

ated with the tissue where the wound is located. The exudate in normal tissue is typically colorless and transparent, the exudate in necrotic tissue is brown or gray, and the exudate in bacteria-infected tissue is usually dark green<sup>2</sup>. If the exudate is not managed correctly, it may result in wound abscess or even necrosis. If this happens, the patient's condition may deteriorate and the patient is at a risk of physical and psychological complications<sup>3</sup>. In this study, we managed patients' exudate by modifying fixation of the indwelling intravenous catheter and achieved good results.

## Patients and Methods

### General Information

From January 2015 to January 2016, 110 patients who received surgery and management of exudate were enrolled in this study. They were divided into two groups using the random number table with 55 patients in each group. Routine intravenous catheter fixation was used in the treatment group and modified intravenous catheter fixation was used in the control group. *In the treatment group*, there were 32 males and 23 females (mean age=43.4±10.9 years). There were 27 cases of indwelling intravenous catheter in the upper limb, 13 cases of indwelling intravenous catheter in the chest and abdomen and 15 cases of indwelling intravenous catheter in the lower limb. *In the control group*, there were 30 males and 25 females (mean age= 42.9±11.1 years). There were 25 cases of indwelling intravenous catheter in the upper limb, 12 cases of indwelling intravenous catheter in the chest and abdomen and 18 cases of indwelling intravenous catheter in the lower limb. Patients in both groups were not significantly different with respect to the data of gender, age and the location of the indwelling intravenous catheter ( $p>0.05$ ). This study had been approved by the Ethic Committee of Xuzhou Children's Hospital,

**Table I.** General condition of the patients in treatment group and control group ( $\bar{x}\pm s$ ).

Group	N	Indwelling time (day)	Off-bed time (day)	Nursing frequency (n)
Treatment group	55	7.44±1.42	6.89±0.57	6.58±0.55
Control group	55	5.05±1.07	8.59±1.35	8.24±1.72
<i>t</i>		2.969	2.603	2.817
<i>p</i>		0.034	0.033	0.036

and all enrolled patients signed the written informed consent.

### Procedures

Routine intravenous catheter fixation was used in the treatment group while modified intravenous catheter fixation was used in the control group. Materials used included indwelling intravenous catheter (Bonny Medical Materials Co, Ltd., Taizhou, Shandong, China), skin disinfectant An'er dian (Shanghai Likang Disinfection Hi-Tech Co, Ltd., Shanghai, China), sterile transparent film (sterilized by ethylene oxide), and sterile medical tape. The patient was in supine position, and an appropriate vein puncture site was chosen according to the location of wound's exudate. Disinfection and bandage tourniquet were sequentially performed. We tightened the skin on needle puncturing site in the left arm and punctured the vein in an angle of 20°. Subsequently, we removed the tourniquet, covered the puncture site with sterile medical tape and recorded the time. The rate and dose of intravenous infusion were adjusted according to the physician's instructions.

### Observational Indexes

Necessary nursing was provided according to patient's condition and the management of exudate. General condition, wound exudate and complications were compared between the two groups.

### Statistical Analysis

SPSS 17.0 software (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Measurement data were presented by mean  $\pm$  standard deviation ( $\bar{x}\pm s$ ) and compared by *t*-test. Categorical

data were presented by [n (%)] and compared by chi-square test. Differences were considered statistically significant at  $p<0.05$ .

## Results

### Comparison of General Condition Between the two Groups

As shown in Table I, the off-bed time and nursing frequency in the treatment group were significantly shorter and lower than the control group. The indwelling time in the treatment group was significantly longer than the control group ( $p<0.05$ ).

### Comparison of Complications Between the two Groups

As shown in Table II, the occurrences of redness, rash, erosion, and drainage tube infection in the treatment group were significantly lower than the control group ( $p<0.05$ ).

## Discussion

Exudate facilitates the movement and dissemination of growth factors as well as immune factors around the wound, providing a moist environment that is perfect for wound healing<sup>4</sup>. Besides, exudate provides necessary nutrients for cell proliferation and metabolism, promoting autolysis in lesion tissues<sup>5</sup>. Exudate is transparent and odorless in normal tissues, but the color, odor, concentration of exudate in wound may alter with the alterations in wound. For example, in addition

**Table II.** Complications in treatment group and control group [n (%)].

Group	N	Redness	Rash	Abscess	Drainage tube infection	Total incidence
Treatment group	55	1 (1.82)	3 (5.45)	1 (1.82)	1 (1.82)	6 (10.91)
Control group	55	5 (9.09)	6 (10.91)	4 (7.27)	3 (5.45)	18 (32.73)
$\chi^2$		3.465	3.940	3.407	3.044	4.257
<i>p</i>		<0.001	<0.001	<0.001	<0.001	<0.001

to the water, growth factors and electrolytes, abnormal increases are also observed in the content of inflammatory mediator and the activity of metalloproteinase. This gives rise to a slow growth rate of the cell, and a decreased healing rate of the wound, and enlarged lesion of the wound, resulting in a series of complications<sup>6</sup>. Generally, as the wound heals, the volume of exudate will gradually decrease. In the case of inflammation and bacterial infection, the permeability of capillary may increase, leading to dehydration, ischemic ulcers and capillary lesion, which may decrease the volume of exudate<sup>7</sup>. Therefore, the wound must be re-assessed if the properties of exudate change<sup>8</sup>.

Although exudate could provide a moist environment, inappropriate management of exudate may slow down the wound healing process or even aggravate the condition. The protocol for exudate management must be changed in following cases: (1) exudate contamination<sup>9</sup>; (2) changes in the color and property of skin in wound, such as skin erosion<sup>10</sup>; (3) the time for wound healing significantly longer than expected time<sup>11</sup>; (4) presence of special odor; (5) Intensified pains in the wound; (6) a noticeable reduction in the levels of proteins and electrolytes; (7) frequent change of dressing.

The conventional indwelling intravenous catheter may lead to indwelling failure and catheter slipping out, thus prolonging the puncture time and increasing the risk of infection and other complications<sup>12</sup>. When the conventional indwelling intravenous catheter is used, the affected limb is required to be in pendulous position. This may increase the volume of local blood reflux and exudate, decrease patient's compliance and clinical efficacy<sup>13</sup>. Besides, the conventional indwelling intravenous catheter not only increases medical staffs' work load, but also aggravate physiological and economic burden, which decreases patient's satisfaction on treatment. For modified fixation, the skin on affected limb was tightened by left hand, insertion and withdrawal are performed by thumb and index finger of right hand. The dressing is covered, and a sterile medical tape is applied. The patient is in the supine position, reducing the discomfort caused by position for conventional indwelling intravenous catheter<sup>14</sup>. In modified fixation, two reversed medical tapes are used to fix puncture site, increasing the stability of indwelling intravenous catheter and reducing puncture times. The sterile medical tape has the characteristics, such as good permeability, and could reduce the occurrence of skin redness and rash<sup>15</sup>. The dressing type used in the modified fixation

is also different. The major effect of dressing on exudate is to absorb exudate or enable exudate to volatilize<sup>16</sup>. Conventional indwelling intravenous catheter uses cotton, simple polyurethane or silicone foam as dressing, which can only absorb fluid, but cannot fix fluid when the local tissue is compressed. Modified fixation uses hydrocolloid or CMC fiber as dressing, which can transform the absorbed exudate into jelly-shape, thus keeping a relatively high proportion of water despite the local tissue is compressed. Alginate dressing could also fix exudate in some degree<sup>17</sup> while hydrocolloid dressing could absorb exudate and release water to increase moisture in the wound to balance the moisture<sup>18</sup>. Some study reported that free radicals, the products of inflammatory mediators, can hamper the wound recovery<sup>19</sup>. The dressing made of collagen and CMC, oxidized regenerated cellulose and hyaluronic acid can significantly reduce free radical activity, and accelerate wound healing.

## Conclusions

The modified fixation of the indwelling intravenous catheter could increase indwelling time, shorten the off-bed time, and reduce the nursing frequency and the occurrences of redness, rash, erosion and drainage tube infection. We suggest that this method is valuable for clinical application.

## Conflict of interest

The authors declare no conflicts of interest.

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