Effectiveness of transparent film dressing for peripheral intravenous catheter

Selma Atay and Fatma Yılmaz Kurt

Abstract
Background: The intravenous applications are the most common type of such interventions. It is underlined that in cases where the peripheral intravenous catheter is not properly secured in place, even a minor movement inside the vein would result in injury of vein.

Objective: The insertion of peripheral intravenous catheter is a common practice. This is a randomized controlled prospective study aiming at investigating the effectiveness of use of transparent film dressing for peripheral intravenous catheter.

Methods: The universe of this study included inpatients in the Internal Diseases clinic of a University Hospital, and the sample included a total of 110 peripheral intravenous catheters that were calculated by power analysis. The patient identification form, the peripheral venous catheter and treatment information form, and the visual infusion phlebitis identification scale were used to collect data. The forms were completed by the investigators on the basis of daily observations. The data were assessed by the percentage, chi-square test, and logistic regression analysis via the software SPSS 20.00.

Results: The individuals in the study group and the control group included in the sample are comparable in terms of gender, having/not having a chronic disease, the site of peripheral intravenous catheter, use of antibiotics, intravenous fluid therapy, and mean age. There were no statistically significant differences between the groups. There was a significant relationship between the dwell time for the catheter and development of any complications and the groups.

Conclusion: The use of transparent film dressing for insertion of peripheral intravenous catheter can be recommended as it increases the dwell time for the catheter and reduces incidence of complications.

Keywords
Peripheral venous catheter, transparent film dressing, complication

Introduction
The hospitalized individuals undergo many interventions for diagnostic and therapeutic purposes. The intravenous (IV) applications are the most common type of such interventions. Over 80% of hospitalized individuals receive IV therapy. The interventions using IV techniques are performed through peripheral intravenous catheters (PIVCs). The studies indicate that 33%–69% of PIVCs result in failure or are replaced in unscheduled manner before the treatment is completed. The adverse events such as phlebitis, infiltration, blockage, leakage, and rare infections may be reported. The site where the PIVC is inserted is considered a wound; therefore, it is important that dressing is clean and dry as well as protected against the external contaminations. There are many factors that cause development of PIVC-related complications. It is underlined that

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in cases where the PIVC is not properly secured in place, even a minor movement inside the vein would result in injury of vein, which is the main cause of phlebitis. The other complications of inadequately secured PIVC include infiltration, leakage from the insertion site, pain, infection, and unscheduled insertion of other catheter. The unscheduled insertion would result in delay in treatment of patients, patient dissatisfaction, safety hazards, nursing interruption, and additional costs. The inadequately secured PIVC has negative effects on the quality of patient care. In the clinics, the PIVC is usually secured with sterile gauze with non-sterile tape or bandage, non-sterile plaster, or transparent dressing. Several studies underline the benefits of using a transparent cover for securing the PIVC, whereas the other studies indicate that there is no relationship between the securing material and the development of complications. The security devices for PIVC and the transparent cover prevent development of complications by preventing catheter from moving. The Infusion Nurses Society states that durability, ease of use, and cost efficiency of security devices are important. The Infusion Nurses Society (2016) also states that the dressing of PIVC has no adequate evidence (i.e. non-bordered transparent semipermeable membrane (TSM), gauze, and tape dressing). The security of PIVC and the dressing management are not enough alone to prevent complications, but they may improve the quality of patient care.

It is emphasized that relevant studies in the field are insufficient and it is recommended to carry out well-designed randomized controlled studies. To meet such requirement, this study was carried out to investigate the effectiveness of use of transparent film dressing for insertion of PIVCs.

**Material and methods**

**The objective and type of this study**

This is a randomized controlled prospective study performed to investigate the effectiveness of use of transparent film dressing for PIVC.

**Hypotheses of study**

- **H1.** There are differences between the PIVC secured by a transparent cover film dressing and the PIVC secured by a non-sterile tape.
- **H0.** There are no differences between the PIVC secured by a transparent cover film dressing and the PIVC secured by a non-sterile tape.

**Universe and sample of study**

The universe of this study included the catheters inserted into individuals in the Internal Diseases clinic of a university hospital between March and October 2017. The sample included the catheters inserted into 110 individuals (55 subjects and 55 controls) who met the inclusion criteria. The inclusion criteria include the individuals who

- received IV therapy through PIVC during hospitalization,
- were willing to participate in this study,
- were cooperative and communicative,
- were over 18 years old.

The exclusion criteria include patients receiving immunosuppressive therapy.

**Calculation of sample group**

The minimum number of participants required to reduce the infection rate from 25% to 5% was 55 in each group (α = 0.05, 1 – β = 0.80). The software G power 3.1.9 was used for the power analysis.

In the initial phase of the study, the individuals who met the inclusion criteria in the study group were assigned to the treatment group using simple randomization method. The individuals were randomized by their bed number: the individuals whose bed number ended with an odd number were assigned to the treatment group, and the individuals whose bed number ended with an even number were assigned to the control group.

**Procedure**

The investigators inserted a PIVC into the individuals indicated for PIVC by the doctor. The skin was prepared using 70% alcohol solution (INS, 2016) as an antiseptic prior to insertion. A transparent film dressing with border (Tegaderm) was used to secure the catheter inserted into the individuals in the study group, whereas a non-sterile tape was used to fix the catheter inserted into individuals in the control group. The catheter was monitored after insertion by the investigators in each shift.

**Data collection**

The patient identification form, the peripheral venous catheter and treatment information form, and the visual infusion phlebitis identification scale were used to collect data between March and October 2017. The removal of catheter prior to end of treatment due to pain, leakage, blockage, inadvertent removal, infiltration, and phlebitis is considered the main failure of PIVCs. The phlebitis was assessed by the visual infusion phlebitis identification scale, and the infiltration was assessed by the infiltration assessment scale. The scale is scored 1 to 5: 1 indicates no signs of phlebitis and 5 indicates advanced stage of thrombophlebitis. The infiltration assessment scale is scored 0 to 4: 0 indicates no infiltration in the site and 4 indicates
advanced level of infiltration. The forms were completed by the investigators on the basis of observations in each shift.

**Ethical considerations**

An official approval of the institution’s ethical committee was obtained to perform this study (Decision No: 21-02), and the individuals who agreed to participate in this study provided an informed consent in writing.

**Evaluation of data**

The data from this study were evaluated by Statistical Package for Social Sciences (SPSS) for Windows 20.00 (SPSS 2011). The data were evaluated using percentage, chi-square test, and logistic regression analysis.

**Results**

The findings from this study are provided below:

Table 1 shows the distribution of individuals’ characteristics. In Table 1, the study group and the control group were similar in gender, having/not having a chronic disease, the site of PIVC, use of antibiotics, IV fluid therapy, and mean age. There were no statistically significant differences between the groups ($p > 0.05$).

Table 2 shows the comparison of data for dwell time. In this table, 54.5% of catheters in the study group had a dwell time of 73 h or over, whereas 56.4% of catheters in the control group had a dwell time of 24–48 h. The analysis showed that dwell time varied by the groups, which was statistically significant ($\chi^2 = 48.3, SD = 2, p = 0.00$). A logistic regression analysis was carried out to find the reason for such difference. Accordingly, a dwell time equal to or more than 73 h was 15 times (odds ratio (OR) = 2.72, confidence interval (CI) = 4.855–48.213) higher than that for catheters in the study group as compared with the control group.

Table 3 shows the comparison of data for development/non-development of complications. In this table, some complications were developed for 52.7% of catheters in the study group, and this rate was 63.6% for the catheters in the control group. There was a statistically significant difference in the rate of incidence for complications between the groups. A logistic regression analysis was carried out to find the reason for this difference. So, the rate of incidence for complications was 8 times (OR = 2.19, CI = 3.104–25.899) higher for the individuals in the control group as compared with the study group.

**Discussion**

A vascular access device dressing is required to generate a sterile environment in the catheter site and provide security, and should be easy to remove, comfortable for patients and convenient for health care professionals to monitor the catheter site.\(^{18}\) A transparent cover is reported to provide stabilization and reduce complications.\(^{17}\) The permeability to water vapor and $O_2$ and impermeability to microorganisms are two major characteristics of transparent dressing.\(^{23}\) The transparent cover is reported to provide an

<table>
<thead>
<tr>
<th>Individuals’ characteristics</th>
<th>Study group (transparent film dressing)</th>
<th>Control group (non-sterile tape)</th>
<th>Statistical significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$N$</td>
<td>%</td>
<td>$N$</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>36</td>
<td>65.5</td>
<td>33</td>
</tr>
<tr>
<td>Male</td>
<td>19</td>
<td>34.5</td>
<td>22</td>
</tr>
<tr>
<td>Having a chronic disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>44</td>
<td>80.0</td>
<td>48</td>
</tr>
<tr>
<td>No</td>
<td>11</td>
<td>20.0</td>
<td>7</td>
</tr>
<tr>
<td>The site of PIVC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above hand</td>
<td>27</td>
<td>49.1</td>
<td>26</td>
</tr>
<tr>
<td>Forearm</td>
<td>14</td>
<td>25.5</td>
<td>10</td>
</tr>
<tr>
<td>Elbow</td>
<td>13</td>
<td>23.6</td>
<td>17</td>
</tr>
<tr>
<td>Upper arm</td>
<td>1</td>
<td>1.8</td>
<td>2</td>
</tr>
<tr>
<td>Use of antibiotics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using</td>
<td>39</td>
<td>70.9</td>
<td>39</td>
</tr>
<tr>
<td>Not in use</td>
<td>16</td>
<td>29.1</td>
<td>16</td>
</tr>
<tr>
<td>Use of fluid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using</td>
<td>42</td>
<td>76.4</td>
<td>42</td>
</tr>
<tr>
<td>Not in use</td>
<td>13</td>
<td>23.6</td>
<td>14</td>
</tr>
<tr>
<td>Age</td>
<td>$x \pm S$</td>
<td></td>
<td>$x \pm S$</td>
</tr>
<tr>
<td></td>
<td>61.8 ± 13.4</td>
<td></td>
<td>64.6 ± 13.4</td>
</tr>
</tbody>
</table>

PIVC: peripheral intravenous catheter.
opportunity for daily observation without removal of cover and to form a barrier to external factors air contamination. The cover reduces the risk for trauma and infections because it reduces the frequency of replacement. Moreover, it eliminates the need for preparing the skin for each replacement of dressing and would reduce the irritation of skin caused by repeated use of prepping solutions as well as additional time and cost. The comfort would be improved by reduction in the frequency of cover replacement. It is recommended to replace the dressing every 24 h if gauze strip or tape is used for the peripheral or central catheters. If a transparent cover is used for the central catheters antral, it may be retained for around 7 days. However, we could not find any information on the replacement frequency of transparent covers used for the peripheral catheters in the literature.

We found no statistically significant differences in the characteristics of individuals in the control group and study group. This is a significant finding to show that groups were homogeneous.

In this study, 54.5% of catheters in the group had a dwell time of 73 h or over, whereas 56.4% of catheters in the control group had a dwell time of 24–48 h. The analysis showed that the difference between the groups was statistically different ($\chi^2 = 48.3, SD = 2, p = 0.00$). A logistic regression analysis was carried out to find the reason for such difference. Accordingly, a dwell time equal to or more than 73 h was 15 times (OR = 2.72, CI = 4.855–48.213) higher than that for catheters in the study group as compared with the control group.

Routine replacement of PIVCs is a matter of debate and remains uncertain. The Centers for Disease Control and Prevention (CDC) recommends that routine replacement of PIVCs is not necessary in a period shorter than 72–96 h, and that a functional catheter can be used more than 72–96 h. A number of studies suggested replacement in case of clinical indication, and a number of studies suggested that it can be used more than 72–96 h.

In our study, some complications were developed for 52.7% of catheters in the study group, and this rate was 63.6% for the catheters in the control group. There was a statistically significant difference in the rate of incidence for complications between the groups. A logistic regression analysis was carried out to find the reason for this difference. So, the rate of incidence for complications was 8 times (OR = 2.19, CI = 3.104–25.899) higher for the individuals in the control group as compared with the study group.

In a randomized controlled study, a transparent film dressing was used for securing in one group and the gauze was used in the other group. The results of this study show that there was a statistically significant difference between the group receiving transparent film dressing and the group receiving gauze dressing.

In a non-randomized prospective study performed in the pediatric service, a transparent dressing was used for the treatment group and an adhesive tape was used for the control group. The results of this study show that there was a minor difference in the phlebitis and extravasation between the study and control groups.

### Table 2. Comparison of data for dwell time.

<table>
<thead>
<tr>
<th>Length of stay with catheter</th>
<th>Study group (transparent Film dressing)</th>
<th>Control group (non-sterile tape)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>24–48 h</td>
<td>1</td>
<td>1.8</td>
</tr>
<tr>
<td>49–72 h</td>
<td>24</td>
<td>43.6</td>
</tr>
<tr>
<td>73+ h</td>
<td>30</td>
<td>54.5</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100.0</td>
</tr>
</tbody>
</table>

$\chi^2 = 48.3, SD = 2, p = 0.00$

### Table 3. Comparison of data for development/non-development of complications.

<table>
<thead>
<tr>
<th>Complications</th>
<th>Study group (transparent film dressing)</th>
<th>Control group (non-sterile tape)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Yes</td>
<td>29</td>
<td>52.7</td>
</tr>
<tr>
<td>No</td>
<td>26</td>
<td>47.3</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>100.0</td>
</tr>
</tbody>
</table>

$\chi^2 = 19.8, SD = 1, p = 0.00$
In another study, 29 patients received transparent dressing and 21 patients received gauze and dressing in the general surgery and coronary intensive care unit. There were no differences in the complications (phlebitis, infiltration, and dislodgement/accidental removal) between the study and control groups.20

In a randomized controlled study including 703 adult and pediatric patients, one group received a transparent dressing and the other group received dressing with plaster. The results of this study showed that non-sterile plaster had no influence on the rate of phlebitis and provided a good fix of the PIVC as compared with the transparent sterile dressing.31

Rickard et al.32 aimed to compare the efficacy and costs of three alternative approaches with standard non-bordered polyurethane dressings and they found that total costs of the trial interventions did not differ significantly between groups. In a prospective study, one group received a microporous dressing, and the other group received a transparent film dressing, and the results showed that there was no difference between two covers in terms of complications.33 The same study reported that the use of transparent film dressing could be cost-effective for the long-term use of catheters and suggested that microporous dressing was cheaper than transparent film dressing for securing and protecting the peripheral catheter insertion sites; however, it was found that adherence of transparent film dressing was higher. The cost-effectiveness is found to be related to dressing adherence by a pharmaco-economic analysis. The results demonstrate that conventional dressings may be used for short-term catheter care (around 3 days) and film dressings may be more cost-effective for long-term use.18

**Limitations of study**

The sample of this study included only one clinic of a hospital, which limited the generalizability of study.

**Conclusion**

The results of this study suggest that the use of transparent film dressing for peripheral venous catheters had a significant influence on the dwell time for catheter and development of complications. It may be recommended to carry out similar studies with larger sample in different clinics.

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**Author contributions**

S.A. provided statistical advice. S.A. and F.Y.K. provided advice about the study design.

**Declaration of conflicting interests**

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**References**


