A Comparative Study between Topical Povidone Iodine and Normal Saline Solutions as Wet-to-Dry Dressing for Wound Lacerations/Abrasions among Adult Patients

Regidor-III Dioso
Lecturer
Department of Nursing
Lincoln University College, Malaysia

Kaluwanchikudy Judenimal
Nurse Manager
Department of Nursing
Batticaloa Teaching Hospital, Sri Lanka

Gopalasingam Arunaj
Nursing Officer
Department of Nursing
Nintavur Base Hospital, Sri Lanka

Abstract

This study investigated on the effectiveness of povidone iodine and normal saline solutions as wet-to-dry dressing in promoting granulation among adult patients with laceration and/or abrasion; and compared their healing time. Convenience sampling technique was used to select study populations. A total of 30 patients admitted to the surgical ward with diagnosis of abrasion and/or laceration of wound were used. A quasi experimental design used convenience sampling and divided the subjects to be experimented for the use of povidone iodine (n=15) and normal saline (n=15). There was no significant difference between normal saline and povidone iodine in promoting wound healing for laceration / abrasion types of wound among adult patients. However, normal saline has faster healing time (p=0.0474) as compared with povidone iodine (p=0.1489).

Keywords: Applied Science, Normal Saline, Nursing, Povidone Iodine, Quasi-Experimental, Wound Healing

I. INTRODUCTION

This study used povidone-iodine (Betadine) which is a stable chemical complex of polyvinyl pyrolidone which contains 9.0% to 12.0% elemental iodine, calculated on a dry basis and 90% (0.9) sodium chloride for the normal saline solution [1, 2, 3]. At the end of this study, it is hoped to (1) compare healing time of laceration / abrasion using topical povidone iodine and normal saline solutions and; (2) investigate its effectiveness as a wet-to-dry dressing in promoting granulation among adult patients with laceration and/or abrasion. Specifically, povidone iodine and normal saline were prepared as wet-to-dry dressing solution [1, 2, 4, 5]. It is hypothesized that there is a significant effect of topical povidone iodine compared with normal saline in increasing wound granulation among adults with lacerations and/or abrasions. The cause variables are the use of povidone iodine and normal saline as a wet-to-dry dressing on wound lacerations and/or abrasions, while the effect variable is the evidence of wound healing. Final implementation of this study will give appropriate effective solution for nurses to choose the most effective topical medication to promote wound healing.

II. METHODS

Nintavur Base hospital, in Sri Lanka – a government hospital – was the study site. Surgical ward is the most appropriate division. A quasi-experimental study design without crossovers of interventions comparatively analyzed wet-to-dry dressing between povidone iodine and normal saline solutions.

A. Sampling

Convenience sampling technique selected 30 participants and set precision at 5% margin of error and 95% confidence. This sampling technique is more likely appropriate in order for the researcher to select the population according to their convenience and availability of the equipment that will be used while the researcher demonstrates the intervention for this design. In order to eliminate subjects with non-healing wounds simple cauteries with silver nitrate or with topically applied steroid preparations [6] were performed.
B. Data Collection

Check list (appendix 1) will be used for 30 days to collect data by continuously observing the wound healing time on a daily basis. Wound dressing and application of the topical povidone iodine and normal saline uses a procedure manual (table 1). Data will be collected until patients withdraw or if the wounds healed.

Table - 1

<table>
<thead>
<tr>
<th>Procedure manual and biophysiologic apparatuses [1, 2, 3, 4, 5]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet-To-Dry Dressing Solution</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Gender</th>
<th>Age</th>
<th>Date of the demonstration</th>
<th>Biophysiologic apparatuses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
<td></td>
<td></td>
<td></td>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
</tr>
<tr>
<td>2- Chorhexidine 2% or 70% alcohol solution for cleaning excessive blood outside the perimeter of the wounds.</td>
<td></td>
<td></td>
<td></td>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
</tr>
<tr>
<td>Dressing set (e.g. Tegaderm, scissors, clamps, cotton balls, fine-mesh, kidney dish and galipot, and gauze and tape)</td>
<td></td>
<td></td>
<td></td>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
</tr>
<tr>
<td>Steri-strips and skin protectant</td>
<td></td>
<td></td>
<td></td>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
</tr>
<tr>
<td>Silicone-based adhesive remover</td>
<td></td>
<td></td>
<td></td>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
</tr>
<tr>
<td>Sterile and non-sterile gloves</td>
<td></td>
<td></td>
<td></td>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
</tr>
<tr>
<td>EITHER 9.0% to 12.0% polyvinyl pyrolidone and elemental iodine 90% or (0.9) normal saline solution</td>
<td></td>
<td></td>
<td></td>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
</tr>
<tr>
<td>Montgomery straps, or roller gauze</td>
<td></td>
<td></td>
<td></td>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
</tr>
<tr>
<td>Waste bin (infectious and non-infectious)</td>
<td></td>
<td></td>
<td></td>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
</tr>
<tr>
<td>Sterile green towel and rubber pad</td>
<td></td>
<td></td>
<td></td>
<td>Blood pressure apparatuses, stethoscope, mercurial thermometer, penlight, and face pain scale</td>
</tr>
</tbody>
</table>

Steps

1. Ensure that the vital signs were stable having systolic blood pressure of not more than 160 mm/hg, temperature of ≤37.5°C, pulse rate are in regular rhythm, and face pain score of ≤7 out of 10. It is also good to assess pupilary reactions and refer if there are episodes of anisocoria due to uncontrolled threshold of pain.
2. Gather the necessary biophysiologic apparatuses and bring to the bedside stand or overbed table.
3. Put on clean gloves. Carefully and gently remove the soiled dressings. If there is resistance, use a silicone-based adhesive remover to help remove the tape. If any part of the dressing sticks to the underlying skin, use small amounts of sterile saline to help loosen and remove.
4. Perform hand hygiene and put on gloves.
5. Close curtains around bed and close door if possible.
6. Explain the procedure to the patient and acquire written consent to enroll for the experiment.
7. Place a waste receptacle or bag at a convenient location for use during the procedure.
8. Assist the patient to a comfortable position that provides easy access to the wound area. Position the patient so the wound cleanser or irrigation solution will flow from the clean end of the wound toward the dirtier end. Use the bath blanket to cover any exposed area other than the wound. Place a waterproof pad under the wound site.
9. Put on clean gloves. Carefully and gently remove the soiled dressings. If there is resistance, use a silicone-based adhesive remover to help remove the tape. If any part of the dressing sticks to the underlying skin, use small amounts of sterile saline to help loosen and remove.
10. After removing the dressing, note the presence, amount, type, color, and odor of any drainage on the dressings. Place soiled dressings in the appropriate waste receptacle.
11. Assess the appearance of the surrounding tissue.
12. Measure the wound. Take a picture of the wound using the 12 mega pixel Sony handy digital camera, with ultra-magnifying lenses.
13. Remove your non-sterile gloves and put them in the receptacle.
14. Using sterile technique, open the supplies and dressings. Place the fine-mesh gauze into the basin and pour the ordered solution over the mesh to saturate it.
15. Put the sterile gloves to clean a chronic wound.
16. Clean the wound using either 9.0% to 12.0% polyvinyl pyrolidone and elemental iodine or 0.9 normal saline solutions.
17. Dry the surrounding skin with sterile gauze dressings and apply a skin protectant to the surrounding skin, if needed.
18. Squeeze excess fluid from the gauze dressing. Unfold and fluff the dressing.
19. Gently press to loosely pack the moistened gauze into the wound with two sterile clamps ensuring sterility. Press the gauze into all wound surfaces.
20. Apply several dry, sterile gauze pads over the wet gauze.
21. Place the pad over the gauze. Remove and discard gloves. Apply tape, Montgomery straps, or roller gauze.
22. Repeat steps 6 to 22 daily and take a picture of the wound using the 12 mega pixel Sony handy digital camera, with ultra-magnifying lenses.
23. Document the results.
A Comparative Study between Topical Povidone Iodine and Normal Saline Solutions as Wet-to-Dry Dressing for Wound Lacerations/Abrasions among Adult Patients

III. Results and Findings

Of the 30 patients enrolled, 15 were treated with povidone iodine and the other 30 with normal saline solution. Of the 30, 20 were males and 10 were females. Of the 20 males, 15 had lacerations and 5 had abrasions while all the females had abrasions. The age ranges from 18 to 50 years old.

A. Compare healing time of laceration / abrasion using normal saline and topical povidone iodine

Table 3 compares normal saline and povidone iodine with regards to their healing time. Normal saline has faster healing time (p=0.0474) as compared with povidone iodine (p=0.1489). However, this study has investigated that the effectiveness of povidone iodine and normal saline among 30 patients has no significant difference in the healing wound abrasions and/or lacerations.

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Day 07</th>
<th>Day 08</th>
<th>Day 09</th>
<th>Day 10</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Povidone iodine</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>2.5</td>
<td>1.5</td>
<td>0.1489</td>
</tr>
<tr>
<td>Normal saline</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>2.75</td>
<td>1.05</td>
<td>0.0474</td>
</tr>
</tbody>
</table>

B. Investigate effectiveness of normal saline and topical povidone iodine as wet-to-dry solution

The granulating tissues from both povidone iodine and normal saline show no significant differences with the connective tissue that is seen at the surface area of the wounds that healed. When investigating the number of tiny blood vessels that appear at the surface of new skins, the granulating tissues appear light red or pink in hue, and moist with a series of tightly-packed cells that provides one or more layers for both treatments. Presence of white or yellow shiny fibrinous tissue was not seen. Tissues of patients who both used povidone iodine and normal saline showed vascularization, epithelialization and healing wound after 7 to 10 days.

Figure 1 shows a lacerated wound where povidone iodine was used. The lacerated wound granulated after using povidone iodine and it showed that the skin was moist and intact. There are evidences of scar tissue formation after treatment; however, the scar was not too obvious since the skin remains moist. The wound remained vascular and capillaries formed back to supply the tissues with nutrients which the wound needs to maintain its integrity. Shukrimi et al [6] agreed that povidone iodine can leave evidences of scar formation after wound healing.

![Fig. 1: Povidone iodine used on laceration](image)

Figure 2 on the other hand shows the effectiveness of using normal saline, however, on abrasions. The wound maintained its vascularization and ensure that the integrity of the epithelium remained moist in 5 days. There are lesser episodes of scar formation and the tissues remain intact. The granulation looks pinker in color after treatment with normal saline and it does not lead to necrosis. Fallahil et al [5] agreed that normal saline solution as wet-to-dry dressing applied on abrasions and wound dehiscence can preserve the integrity of the skin and its surrounding epithelium thus maintains its moisture.
A Comparative Study between Topical Povidone Iodine and Normal Saline Solutions as Wet-to-Dry Dressing for Wound Lacerations/Abrasions among Adult Patients

Fig. 2: Normal saline used on abrasion

Figure 3 likewise is treated with normal saline because the laceration from exit sites shows evidences of necrosis outside the wound perimeter. Normal saline dressing solutions are more likely indicated to wounds with exit site necrosis [7] because it allows moisture and ensures that blood vessels remain intact. Daily treating the wound with normal saline religiously for more than 10 days allows skin integrity to remain intact. The wound returned to its moisture hence, nutrients again were redistributed by the blood vessels in order to re-epithelialize thus granulate and makes the skin more intact.

Fig. 3: Normal saline used on laceration

Figure 4 shows a wound abrasion treated with povidone iodine after 7 days. The wound abrasion (fig. 4) showed scar formation, however, the granulation was evident. The skin was color pink and moist even if the scar reveals a collagenous epithelialization. Abrasions can use povidone iodine [4, 6] however; it is expected to have scar tissue formations.

Fig. 4: Povidone iodine used on abrasion

IV. CONCLUSION

There were no significant differences in promoting wound healing for laceration / abrasion types of wound among adult patients. However, normal saline has faster healing time (p=0.0474) as compared with povidone iodine (p=0.1489). Evidences of necrosis require normal saline solution to ensure revascularization and granulation. Evidences of scar tissue are always expected with povidone iodine, so it is only recommended on simple wounds. Deep wounds are recommended to be treated with normal saline. Normal saline is also recommended if patients would like to avoid scar tissue formations.
A Comparative Study between Topical Povidone Iodine and Normal Saline Solutions as Wet-to-Dry Dressing for Wound Lacerations/Abrasions among Adult Patients

APPENDIX

Fig. 5: A 30-day comparative checklist between povidone iodine and normal saline

ACKNOWLEDGMENT

The authors would like to thank Edu Punay for editing this final written research. We would also like to acknowledge the Ministry of Health in the East Sri Lanka for the approval of the use of human subjects; and the government hospital for the use of their facilities and equipment to conduct the experiment.

REFERENCES