Journal of Experimental and Clinical Medicine
https://dergipark.org.tr/omujecm

Case Report

J Exp Clin Med
2021; 38(3): 389-392
doi: 10.52142/omujecm.38.3.36

Skin reaction related to povidone iodine use

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Received: 24.11.2020 • **Accepted/Published Online:** 04.02.2021 • **Final Version:** 23.02.2021

Abstract

Nowadays, 10% povidone-iodine is a topical antiseptic solution that is commonly used in surgical areas' sterilization, wound cleaning and daily wound dressing. Severe complications may arise from povidone-iodine when it is not used carefully and in adequate proportion. Povidone-iodine-induced chemical skin reactions is one of the severe complications. Given the widespread use of povidone-iodine, clinicians need to be aware of this possible adverse drug reaction and of preventive cautions. This report presents two cases about povidone-iodine related skin reaction (these reactions are also called as chemical burns or chemical skin reactions) which are encountered in our hospital (Ondokuz Mayıs University, Samsun, Turkey) to point this important issue.

Keywords: antiseptics, povidone-iodine, contact dermatitis, skin reactions

1. Introduction

Povidone-iodine (PI) is frequently used during surgical preparation, postoperative wound cleaning and dressing. It was described by Shelaski about seventy years ago (Shelanski and Shelanski, 1956). PI consists of the complex structure of povidone, a polymer that is structurally similar to plasma proteins, and the iodine element, which has antimicrobial properties. The function of polyvinylpyrrolidone (PVP) used as a polymer includes increasing iodine solubility and penetration, decreasing iodine ion concentration and keeping iodine bound. However, PVP does not have antimicrobial properties. Shelanski defined this complex structure as 'iodophor' (Shelanski and Shelanski, 1956).

While 99.96% of the iodine element is bound to PVP, a small part of 0.04% is in free form. The spectrum of action of elemental iodine is very wide; it has effects on gram-positive and gram-negative bacteria, viruses, fungi, protozoa, and spores (Ameer et al., 2014). There is almost no resistance development against PVP in organisms. The iodine element separates from the complex structure at certain concentrations, penetrates the microbial cell membrane, interacts with proteins, nucleotides and fatty acids in the cytoplasm, disrupting their structure and functions. It may cause rapid death by affecting the structure of hydrogen bonds. Thus, resistance development is prevented (Ameer et al., 2014).

The Food and Drug Administration (FDA) approved the use of povidone-iodine in December 1986. The pregnancy category is D for topically and vaginally applied products and pregnancy category C for ophthalmic use. It is said that topical or vaginal use during pregnancy may cause temporary hypothyroidism in neonatal if systemic absorption occurs, and ophthalmic use may affect the fetal reproductive system (ScriptSave WellRx, 2021). There are many products, such as povidone iodine-containing solution soap, brush, cream, ointment, gels and ophthalmic drugs. Accidental oral ingestion of these products may cause metabolic acidosis, nausea, vomiting, diarrhea, gastroenteritis, hypotension, sinus tachycardia and cyanosis. Iodine related acute renal failure and renal tubular necrosis are rare but severe clinical presentations.

10% PVP solution contains 10% bound iodine and 1% free iodine molecules (100 mg poly-1-vinyl-2-prolidone with 10% iodine in 1 g) (Mete et al., 2009). It is an effective antiseptic that has fewer irritant properties due to its less amount of free form. However, it may cause irritant contact dermatitis, skin sensitization, allergic dermatitis, urticaria, anaphylaxis, irritation, maceration, necrosis and chemical burns in compression areas in individuals with hypersensitivity (Mark, 1982).

In the postoperative period, severe complications, including skin reactions, contact dermatitis, allergic dermatitis, and chemical burns, related to povidone-iodine use have been reported (Iijima and Kuramochi, 2002; Vandergriff et al., 2006; Kara et al., 2007). In this study, we aimed to present two cases that developed dermatitis after preoperative skin preparation with 10% povidone-iodine. For all photographs,

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written permission was obtained from the families for medical research and education purposes, without sharing the patient's identity information.

2. Case report

2.1. Case 1

A 9-month-old, 9 kg, boy was taken to the operating room for bilateral undescended testicle operation. He had no other disease. The child who was taken to the operating room was taken to the operating table with a heating blanket (Astopad DUO 120, Northern Ireland). The blanket, which was routinely checked and covered with a sterile surgical cover, was set to 36-39°C and the alarm sound was on. There were silicone support and green covers for the operating room on the blanket. After smooth induction and endotracheal intubation, caudal anesthesia was used to provide postoperative analgesia. After the surgical area was prepared with 10% povidone-iodine by the surgical team, the operation was started. The esophageal body temperature measured was between 36.6-36.8°C.

At the end of the operation that lasted for 50 minutes, the patient was awakened without any problem and taken to the recovery room. During the follow-up, a sharp redness was observed in the lower half of the back and the gluteal area (Fig. 1). Silver sulfadiazine 1% cream and 5% lidocaine topical treatment were initiated with the prediagnosis of a first-degree chemical burn to the patient who had no lesions in other body areas. At the visit performed on the first postoperative day, it was observed that the patient's lesions regressed (Fig. 2). The blanket was controlled by the maintenance team and it was learned that there was no problem with its settings.

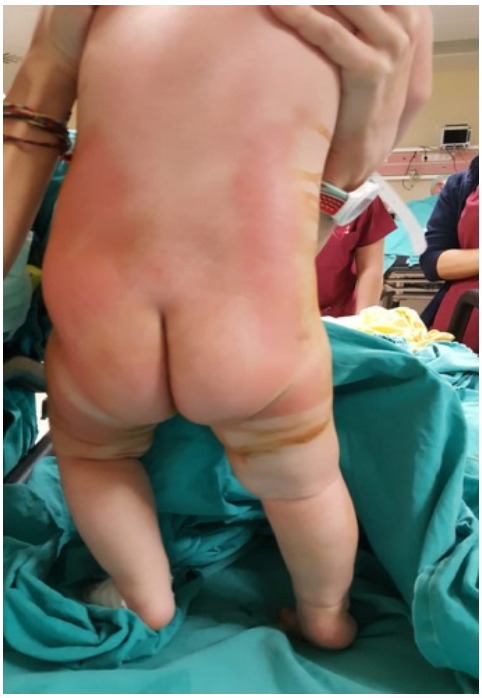

Fig. 1. Case 1, postoperative 20th-minute examination revealed a markedly demarcated rash spread around the gluteal area, especially the gluteal area

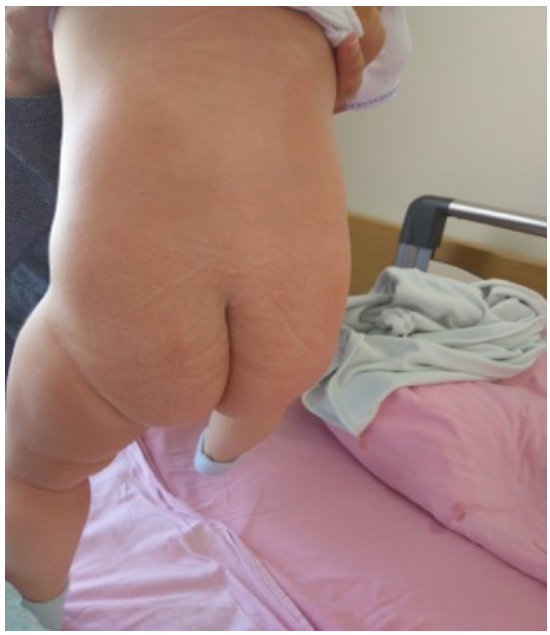

Fig. 2. Case 1, it was observed that the lesions of the patient regressed on the postoperative first day compared to the lesions in the first postoperative hours

2.2. Case 2

A 20-month-old, 14 kg boy was taken to the operating room for the second session of hypospadias. The heating blanket (Astopad DUO 120, Northern Ireland) that was set at 36-39°C and alarms turned on was used to prevent hypothermia; the sterile surgical cover was laid on the blanket to prevent direct contact of child and the blanket. After smooth induction and endotracheal intubation, a caudal block was performed for postoperative analgesia. After the operation area was wiped with 10% povidone-iodine by the surgical team, it was covered with sterile covers, and surgery was initiated. Esophageal body temperature measured was between 36.6-36.8°C. At the end of the operation, which lasted for 75 minutes, the patient was awakened without any problem and taken to the recovery room. Here, a markedly demarcated redness was observed in the gluteal areas, spreading to the perineal and intergluteal areas. Nitrofurazone 0.2% ointment, 5% lidocaine ointment, and 25% pomade for Hamamelis virginiana were initiated for the patient who had no lesions in other body areas, such as back and arms that were exposed to pressure and were in contact with the blanket.

On the postoperative first day visit, it was observed that the lesions regressed (Fig.3). It was learned that there was no problem with the blanket sent for precautionary control.

3. Discussion

Postoperative skin reactions may arise from solutions used, surgical equipment, drugs and heating furnishing. Povidone contained in povidone-iodine is an allergic agent. Contact dermatitis cases caused by some noniodine copolymers of povidone (PVP-eicosene, PVP-hexadecane) have been reported (Constance et al., 2009). The proposed mechanism in the formation of burns is maceration, pressure effect, and skin irritation due to friction (Donna et al., 2006).

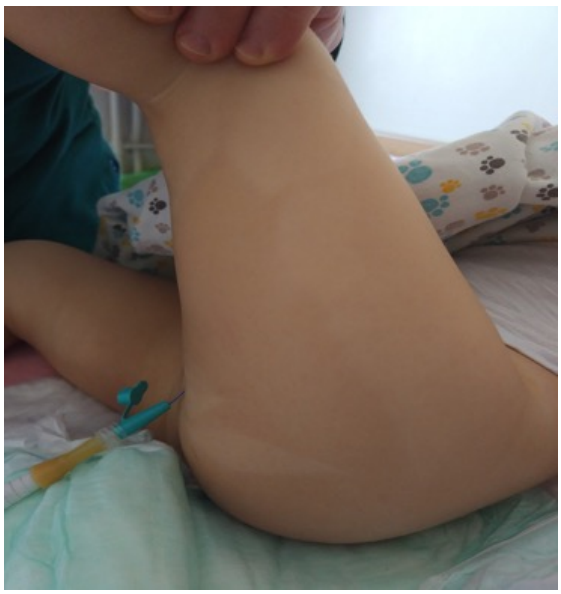

Fig. 3. Case 2, the first day of the postoperative period (It was observed that the skin lesions of the patient regressed compared to the first postoperative hour).

Risk factors for skin reactions after using povidone-iodine can be listed as follows (Donna et al., 2006; Chiang et al., 2011):

- Chemical burns caused by not drying the too much PI from the patient's skin and pooling effect due to accumulation of solution on the skin layers

- Increased skin fragility with the reduced age of the patient

- High concentration of alcohol in solution (better disinfectant properties but increased maceration effect)

- Pressure on the compression areas of the patient's body and the possibility of the pooling of the solution can be increased according to operation position (such as Lithotomy).

- High free iodine concentration in PI solution

- Prolonged operation time

To prevent any complications arising from the heating blanket, the blankets should be routinely checked, the alarm intervals should be adjusted appropriately, and alarm tones should be kept. The risk of povidone-iodine-related chemical burns is greater in areas of the body that are exposed to pressure. As a result of tissue trauma caused by the effects of pressure and damage to the protective skin barrier, PI-related chemical burn formation is facilitated (Chiang et al., 2011).

In the literature, there are cases in which the risk of PI-related chemical burns increases due to the pressure effect of the tourniquet used in orthopedic cases (Chiang et al., 2011), and there are cases with PI-related chemical burns in the skin areas exposed to pressure depending on the position in the lithotomy position (Donna et al., 2006). In a one-year-old male patient who underwent Nissen fundoplication, there is a case of contact dermatitis and burn-like lesions with excessive use of PI after four hours of operation (Kara et al., 2007).

Wet skin is also a risk factor for damage. In the operation area that remains wet, the PI solution continuously releases free iodine (it normally has a free iodine concentration of approximately 0.0001% at a stable concentration), and the released iodine molecules cause skin damage (Zamora, 1986). The patient under anesthesia does not respond to painful stimuli caused by skin damage. The local epidermal lipid layer, which is the only defense barrier, weakens with the agents used preoperatively, especially alcohol. Alcohol deesterizes the skin, thus increasing the chemical damage inflicted (Nahlieli et al., 2001).

If the PI solution is planned to be used in surgical area cleaning, the skin should be wetted with water first, and 1ml PI should be used for each 125-200 cm area. It is then recommended to allow the skin to dry (Ellenhorn et al., 2005).

In our cases, the areas cleaned using PI were the lower abdomen, upper abdomen and perineal area. Lesions were seen in areas that included these parts of the body but were more exposed to body pressure. Before the wiping process, no measures were taken to prevent povidone-iodine ponding, the amount used was not taken care of, and the skin was not allowed to dry before sterile dressing. With the adjustment of the alarms of the heaters, burns due to technical problems were ruled out, but the possibility of the lesions caused by the pooling of batticon due to the heating effect and pressure of the body may increase.

Although burns usually develop right after the operation, there are also cases detected the next day (Vandergriff et al., 2006). When conservative treatment is applied, recovery is usually observed with scar tissue after three to four weeks (Donna et al., 2006).

Postoperative skin reaction risk should always be kept in mind in patients who will be taken to the recovery unit at the end of the operation, and the patients should be checked in this regard. PI, which is widely used in operating rooms, is an effective antiseptic agent, but it has side effects, including severe skin reactions. A careful approach to the patient is required to prevent this complication, which can be avoided with simple precautions.

Conflict of interest

The authors declared no conflicts of interest concerning the authorship and/or publication of this article.

Acknowledgments

None to declare.

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