

Report

Povidone-iodine induced post-surgical irritant contact dermatitis localized outside of the surgical incision area. Report of 27 cases and a literature review

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Abstract

Background Povidone-iodine solution is an antiseptic that is used worldwide as surgical paint and is considered to have a low irritant potential. Post-surgical severe irritant dermatitis has been described after the misuse of this antiseptic in the surgical setting.

Methods Between January 2011 and June 2013, 27 consecutive patients with post-surgical contact dermatitis localized outside of the surgical incision area were evaluated. Thirteen patients were also available for patch testing.

Results All patients developed dermatitis the day after the surgical procedure. Povidone-iodine solution was the only liquid in contact with the skin of our patients. Most typical lesions were distributed in a double lumbar parallel pattern, but they were also found in a random pattern or in areas where a protective pad or an occlusive medical device was glued to the skin. The patch test results with povidone-iodine were negative.

Conclusions Povidone-iodine-induced post-surgical dermatitis may be a severe complication after prolonged surgical procedures. As stated in the literature and based on the observation that povidone-iodine-induced contact irritant dermatitis occurred in areas of pooling or occlusion, we speculate that povidone-iodine together with occlusion were the causes of the dermatitis epidemic that occurred in our surgical setting. Povidone-iodine dermatitis is a problem that is easily preventable through the implementation of minimal routine changes to adequately dry the solution in contact with the skin.

Introduction

Irritant contact dermatitis is one of the most prevalent skin diseases in hospitalized patients.¹ Povidone-iodine (PVP-I) solution is used worldwide as surgical paint because of its potent germicidal activity.² Povidone is an effective iodophor that complexes with iodine in aqueous solution. A 10% PVP-I solution contains 10% bound iodine and 1% available iodine, making it less toxic and irritating than pure iodine solutions. Although it is considered to have a low irritant potential, scattered cases of severe skin injury have been associated with the use of PVP-I in the surgical setting.^{3–33} In this series, our patients developed contact dermatitis, which was localized in areas of embedded medical devices that were painted with PVP-I as well as in areas where PVP-I was suspected to have pooled during the surgical procedure.

Materials and methods

Between January 2011 and June 2013, 27 patients were referred to the Contact Dermatitis Unit of the Hospital Universitario Insular due to acute dermatitis that developed after surgical procedures (Table 1). Twenty-four patients were evaluated as inpatients of our hospital and were referred to the dermatologic outpatient clinic, and the other three patients underwent surgery at another hospital. Of the 24 inpatients, one underwent surgery in the maternal surgical department (patient 5), and the remainder of patients underwent an operation in the general surgical department. Thirteen patients were available for patch testing. All patients were patch tested using the Spanish baseline series, plastics and glue series (Chemotechnique Diagnostics, Vellinge, Sweden), and Drugs–Antiseptics series (Marti Tor, Barcelona, Spain), which includes 10% PVP-I aqueous solution and 0.5% iodine pet. Readings of the tests were performed on D2 and D4.

Table 1 Clinical data

Patient	Age/sex	Clinical condition	Duration of procedure (h)	Area/clinical pattern	Patch test results
1	59/M	Cholecotomy Intestinal polyposis	3	Parallel lumbar pattern, electrosurgery returning terminal, 1 electrocardiogram terminal	Neg.
2	36/F	Bowel reduction	4	Parallel lumbar pattern, electrocardiogram terminals	Nickel, 4-tert-butylcatechol
3	31/M	Laparoscopic cholecystectomy. Son of patient 6	1	Left buttock	Neg.
4	37/F	Left ankle compound fracture	5	Back, back of the arms, left thigh; blisters	Neg.
5	33/F	Endometriosis. Laparoscopy	1½	Buttocks	Thimerosal, ethylenediamine dihydrochloride
6	57/F	Mastectomy. Breast cancer	4	Left shoulder, lumbar left, buttocks	Nickel, PVP-I 10% aq ROAT: Negative
7	62/M	Sigmoidectomy, colon carcinoma	2½	Parallel lumbar pattern	Nickel
8	63/F	Knee prosthesis	4½	Back, back of the arms, left thigh; blisters	Neg.
9	63/F	Bowel reconstruction, previous colon carcinoma	3	Parallel lumbar pattern; buttocks	Nickel
10	52/M	Sigmoidectomy, colon carcinoma	2	Parallel lumbar pattern	Nickel
11	53/M	Right inguinal deep lipoma	1½	Left thigh and buttock	Methyldibromo glutaronitrile Tixocortol pivalate
12	53/M	Bowel reconstruction, previous colon carcinoma	3	Parallel lumbar pattern; buttocks	Methyldibromo glutaronitrile
13	67/M	Colectomy, splenectomy colon carcinoma	4	Upper back, buttocks	Neg.
14	43/M	Right knee prosthesis	4½	Left calf, border of pneumatic tourniquet on right thigh	NP
15	60/M	Segmentectomy, lung carcinoma	3	Linear, bullous lesions on the back	NP
16	63/M	Squamous cell carcinoma of the mouth	5	Both shoulders	NP
17	50/M	Diverticulitis, bowel reconstruction	2	Right axilla, buttocks, right thigh; 1 electrocardiogram electrode, left part of the thorax	NP
18	72/M	Femur fracture	6	Buttocks, right thigh and leg; medical support devices of the surgical table	NP
19	51/M	Anal sphincterotomy and reconstruction	1½	Buttocks	NP
20	48/M	Lower back arthrodesis	3	Thorax, abdomen	NP
21	53/M	Intestinal resection, colon carcinoma	2½	Parallel lumbar pattern, buttocks	NP
22	52/F	Mastectomy, breast cancer	2	Upper back, buttocks	NP
23	64/M	Bowel reconstruction, colon carcinoma	4	Linear right lumbar area	NP
24	63/M	Bowel reconstruction, colon carcinoma,	3	Parallel lumbar pattern	NP
25	42/M	Triple cervical arthrodesis	6	Upper back, buttocks	NP
26	73/F	Bowel reconstruction, traumatic intrarectal perforation	3	Parallel lumbar pattern; erosions	NP
27	50/M	Abdominal eventration and bowel reconstruction, previous colon diverticulitis	4	Parallel lumbar pattern; specular image to grooves of clinical drapes	NP

F, female; M, male; Neg., negative patch test results; NP, patch test not performed.

Results

The clinical findings, patch test results, duration, and type of procedures are shown in Table 1. All patients developed a skin eruption within one day post-surgery. With the exception of three patients, who had the mildest eruptions, surgical procedures lasted for more than two hours. All patients presented well-demarcated erythematous plaques. Nine patients had erosions or vesicles. Of these patients, five patients also had bullae, and two patients had residual scaling. None of our patients presented with necrosis. Fourteen patients had lesions with signs of dropping figures (Fig. 1). Twenty-two patients presented lesions on the back. Ten of these patients presented lesions on both sides of the shoulders and back in a parallel distribution (Fig. 2). Three patients presented annular-



Figure 1 Patient 17. Dropping lesions located in the buttocks



Figure 2 Patient 2. Lesions located in a double lumbar parallel pattern

shaped lesions located in the area of the electrocardiogram electrode. One patient presented with lesions below the site where the return electrosurgery plate was placed, and another patient had lesions where the skin came into contact with the arm of the surgical table used by the orthopedic surgery department; one patient also had lesions at the border of the pneumatic tourniquet. One patient had lesions in a rhomboidal pattern matching the grooves of the surgical drape used during the procedure. None of the patients had dermatitis at the incision area. The only liquid that contacted the patient's skin during the surgical procedure was Betadine Sol Dermica® (Meda Pharma SAU; Meda Manufacturing, Bordeaux, France). This antiseptic is a 10% PVP-I aqueous solution with glycerin, nonoxynol-9, disodium phosphate, citric acid, and sodium hydroxide as excipients. Only patient 6 presented a positive reaction to 10% aqueous PVP-I, but the repeated open application test (ROAT) with Betadine Sol Dermica (r) and 10% aqueous PVP-I solution was negative.

Comment

In this study, we analyzed a series of patients over a 2-year period who presented with post-surgical dermatitis that was localized away from the site of the surgical incision. A meticulous and strict investigative program was performed. Pre-, intra-, and postoperative nursing procedures as well as the habits of surgeons were evaluated. The antiseptics used to clean surgical tables were also considered. Betadine Sol Dermica was considered as the only possible cause of the dermatitis. The fact that surgical incisions and postoperative daily painting with the same solution did not result in complications were confounding factors in making an initial appropriate diagnosis. Only one patient reacted to the 10% aqueous PVP-I in the patch test, but the ROAT using 10% aqueous PVP-I and Betadine Sol Dermica (r) was negative. Allergic contact dermatitis from PVP-I has been reported over the last 30 years (Table 2),^{6-16,34,35} but, in the case of patients, the lesions were located where the antiseptic had been applied. De la Cuadra-Oyanguren *et al.*⁶ presented two cases of allergic contact dermatitis in whom the incisional area, also painted with PVP-I, was free of dermatitis. In these cases, the patch test was positive to PVP-I in petrolatum, but the ROAT test was negative.^{2,3,6}

Intolerance to antiseptics can also be the result of other components in the preparations. Allergic contact dermatitis to nonoxynol-9 present in the PVP-I solutions has been previously shown,³⁶ and this substance is found in Betadine Sol Dermica (r). Unfortunately, we did not have the opportunity to perform a patch test of all of the components of the solution to exclude nonoxynol-9 sensitization. Similar to the cases of allergic contact dermatitis

Table 2 Literature review

Patient	No. of cases	Surgical procedure	Location	Incisional site affected	Allergic/irritant	Ref.
1	27	Table 1		No	Irritant	
2	2	Uterine prolapse/hand surgery	Gluteal area/tourniquet	No	Allergic and irritant	6
	5	Melanocytic nevus/bone biopsy/colon carcinoma/knee prosthesis/pneumothorax	At the site of procedure	Yes	Allergic and irritant	
3	1	Articular infiltration	Elbow	Yes	Allergic and irritant	7
4	1	Hip replacement	Hip	Yes	Allergic	8
5	1	Pelvic surgery	Genital area	Yes	Probably allergic	9
6	1	Carpal tunnel release	Left hand	Yes	Allergic	10
7	1	Right knee prosthesis	Right lower limb	Yes	Allergic	11
8	1		Abdomen	Not available	Allergic	12
9	2	Right foot/right kidney surgery	Right foot/right flank	Yes	Allergic	13
10	1	Not available	At the site, limbs and trunk	Yes	Allergic erythema multiforme	14
11	2	Achilles tendon repair/peripheral vascular disease surgery	Right ankle, artery access	Yes	Allergic	15
12	1	Cholecystectomy	Back, gluteal area, inner arm	Not available	Allergic	16
13	1	Cruciate ligament reconstruction	Left leg	No	Chemical burn	17
14	2	Left knee surgery/knee arthroplasty	Tourniquet	No	Chemical burn	18
15	1	Acute appendicitis	Buttocks	No	Irritant/burn	4
16	1	Polydactyl reparation	Tourniquet	No	Chemical burn	19
17	1	Caesarean under spinal anesthesia	Back	Yes & folds	Irritant/burn	20
18	2	Cruciate ligament repair/Achilles tendon lengthening	Tourniquet	No	Chemical burn	21
19	5	Cardiac patients	Not available	Not available	Chemical burn	22
20	1	Aortic valve and aortic aneurysm	Axillae and abdominal folds	No	Irritant NET-like	23
21	1	Ovarian cystectomy	Midback – buttocks	No	Irritant	24
22	1	Sebaceous cyst	Abdomen and low thorax	Yes	Irritant, Vasculitic-like	25
23	1	Subtotal thyroidectomy	Midback	No	Chemical burn	26
24	2	Not available	Back/abdomen and chest	Not available	Irritant	27
25	12	Surgery	Back/buttocks/ Posterior area of thighs	Not available	Irritant	3
	7	Cardioangiography				
26	3	Flexor tendon repair	Tourniquet	No	Irritant/burn	28
		Femoropopliteal bypass graft	Back. Spinal anesthesia	No	Irritant/burn	
		Right iliac endarterectomy.	Left gluteal area	No	Irritant/burn	
27	2	Kidney surgery	Opposite flank	No	Irritant	29
28	1	Nissen's fundoplication	Back	No	Irritant	30
29	1	Falot tetralogy	Back	No	Irritant	5
30	3	Syndactyly	Tourniquet	No	Chemical burn	31
31	1	Delivery/spinal anesthesia	Back	No	Chemical burn	32
32	2	Cervix carcinoma	Lower back – sacral area	No	Irritant/burn	33

due to active principles, the reported cases were located where the antiseptic had been applied.^{36,37} The absence of dermatitis at the site of incision and the patch test results support the hypothesis that irritancy is the predominant cause of the dermatitis in our cases.

PVP-I solution consists of iodine in complex with PVP in equilibrium based on the concentration. If free iodine is used, then more iodine is released, and the iodine concentration is maintained for a longer period.^{3,4} As shown by Dykes and Marks,³⁸ irritation due to PVP-I is time dependent, and most of the patients in the present study had long procedures. In addition, excipients present in

the solution, occlusion with plastic drapes, waterproof dressings, medical devices (electrosurgical returning plate in patient 1), contact with PVP-I-soaked cotton pads used to cover the pneumatic hemostat (patient 14), or contact with the arms of the surgical tables (patient 18) may increase the possible irritancy.

Notably, patient 2 reacted to p-tert-butylcatechol, which is suspected to be present in the electrocardiogram electrode. This patient exhibited dermatitis at the locations of all electrodes and had recurrent dermatitis when the electrodes were used again. Two other patients had typical annular dermatitis at the location

of one electrode but not the others (patients 1 and 17). One of these patients underwent patch testing for the same electrode as well as the Chemotechnique Diagnostics plastic and glue series. All patch tests were negative, and the patient tolerated the electrodes after surgery.

In different medical specialties, the misuse of PVP-I can lead to severe irritant reactions similar to caustic or electrical burns. In particular, it has been shown that when PVP-I solutions are not adequately dried and pool beneath a part of the body, a chemical burn-like skin reaction may result.^{5,23,24,29} Based on the literature and our own experience, four different clinical patterns can be described as a result of PVP-I misuse. The first and most distinct pattern consists of a double lumbar parallel pattern.³ This pattern is the consequence of the folding and maintenance of moist PVP-I during a surgical procedure in which the patient is maintained in the supine position (Fig. 2). A second pattern is due to embedded cotton or gauze pads used to protect some of the medical devices employed during the procedure, as has been described with the use of tourniquets.^{6,18,19,21,28,31} The third clinical pattern is observed when the lesion delineates a terminal or a device glued to the skin of the patient, as reported in dermatitis occurring after spinal anesthesia.^{28,32} The fourth clinical pattern is a random pattern that follows the folds or grooves of clinical drapes.

Because several of our patients had cancer or the diagnosis of the dermatitis was considered a minor complication, we were unable to analyze fully all patients using patch testing and different dilutions of the solution. Surgeons initially considered the dermatitis a minor problem in many cases, and therefore only severe cases were referred to our department. Most of our cases were only seen after insistence by the patients or surgical nurses. Moreover, some of the dermatitis cases were interpreted by hospital personnel as an allergy to hospital clothing or due to an increase in perspiration. The most severe cases can also be misinterpreted as electrical burns.²⁸ Therefore, when a PVP-I or iodine reaction is suspected by the referring clinician, the irritant nature of the dermatitis should be clarified to reassure patients and doctors that they do not need to avoid iodine compounds in the future.

PVD-I dermatitis is a problem that is easily preventable through the implementation of minimal routine changes to adequately dry the solution in contact with the skin.^{3,24}

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