

Povidone-iodine

Povidone-iodine (PVP-I) is a stable chemical complex of polyvinylpyrrolidone (povidone, PVP) and elemental iodine, is less toxic, and had been used in infected wounds and treatment of burn injuries (Fleischer, 1997).

From: [Advanced Wound Repair Therapies, 2011](#)

Related terms:

[Peroxide](#), [Stimulant](#),
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[Implant](#)

Wound Cleansing and Irrigation

Alexander T. Trott MD, in [Wounds and Lacerations \(Fourth Edition\)](#), 2012

Povidone-Iodine

Povidone-iodine (Betadine) is a complex of the potent bactericidal agent iodine and the carrier molecule povidone. On contact with tissues, the carrier complex slowly releases free iodine. Gradual release decreases tissue irritation and reduces potential toxicity while preserving the agent's germicidal activity. **Povidone-iodine** is effective against gram-positive and gram-negative bacteria, fungi, and viruses.⁸ In contrast to chlorhexidine, **povidone-iodine** has a shorter protective effect against bacterial buildup on the skin after hand washing and seems to be less effective than these agents for that purpose.⁹

Povidone-iodine is manufactured as a solution by itself (**povidone-iodine** solution) or in conjunction with an ionic detergent (**povidone-iodine** scrub preparation). The detergent in the scrub preparation seems to be toxic to several normal tissues and to components of an open wound.^{1,10} Excessive exposure of open wounds to scrub solutions by wound scrubbing or soaking is not recommended. Scrub solutions were designed for preoperative preparation of intact skin before operative incisions.

Povidone-iodine, without the detergent, is distributed most commonly as a 10% solution. When diluted to a 1% concentration or lower, it can be applied safely to wounds, and it retains its bactericidal activity.¹¹ It has no inherent negative effect on wound healing.¹² The lack of clinical toxicity of **povidone-iodine** without detergent was shown with 225 patients undergoing ophthalmologic surgery.¹³ **Povidone-iodine** 10% solution, diluted with saline, was used to prepare the eye and its surrounding structures for surgery. There was no reported corneal, conjunctival, or skin toxicity. Adverse and allergic reactions are extremely rare, even when the solution is used in known iodine-allergic patients.¹⁴

Side Effects of Drugs Annual 32

Pam Magee, in [Side Effects of Drugs Annual](#), 2010

Observational studies

Povidone-iodine solution has been used as an effective broad-spectrum antiseptic and disinfectant since the 1950s. In the early 1980s, a tumoricidal effect was reported. In colorectal operations, povidone-iodine has generally been used for the purpose of minimizing postoperative septic complications and reducing cancer recurrence, although there is little evidence to support its use.

In a review of the literature on the use of povidone-iodine in colorectal surgery, few prospective randomized controlled trials were identified (20^R). The authors found no conclusive evidence of benefits but were able to comment on adverse

effects. Serious adverse effects of povidone–iodine were not common; *metabolic acidosis*, *acute renal failure*, *hyperthyroidism* and toxic reactions to iodine or iodide had been reported. The authors recommended that in general povidone–iodine should be avoided in patients with a history of allergic reactions to iodine-containing compounds, thyroid disease, renal insufficiency and established systemic sepsis.

Analytical Profiles of Drug Substances and Excipients

Eugene S. Barabas, Harry G. Brittain, in [Analytical Profiles of Drug Substances and Excipients](#), 1998

4.5 Stability of the Complex

Povidone-iodine can be stored as a solid-state powder without significant loss of iodine. Samples stored at 65°C in glass-stoppered bottles for as long as three years showed only 0.5% loss of available iodine. Because povidone-iodine exhibits only negligible vapor pressure (0.01 torr as compared to 3.3 torr for elemental iodine at 56°C), the iodine does not sublime even at elevated temperatures. However, the material is hygroscopic and should be protected from moisture [8].

The stability of povidone-iodine solutions is much higher than that of iodine tincture or of Lugol's solution. Aqueous solutions of the complex containing 2% available iodine were found to remain unchanged when stored for one year at room temperature. Experimental data relating the relative loss of available iodine from povidone-iodine solutions and other iodine preparations are given in Table 3.

Influence of Iodine-Containing Pharmaceuticals on Iodine Status and Thyroid Function

Keigo Nobukuni, in [Comprehensive Handbook of Iodine](#), 2009

VVP-I and thyroid dysfunction

VVP-I is used frequently in various fields as a broad-spectrum topical disinfectant for bacteria, fungi, viruses and protozoa. It is a powder containing 10% iodine (Figures 96.1 and 96.2). The available iodine content in the preparation varies from 0.05 to 1%. VVP-I solutions used for disinfection of the skin or wounds have a 1% iodine content.

Little iodine is absorbed by healthy skin in a short period (Moody *et al.*, 1988), so there is no concern about potential absorption of iodine after washing the hands with VVP-I (Nobukuni and Kawahara, 2002). However, iodine absorption from sites of topical treatment with VVP-I is enhanced if it is applied to injured skin or mucosal surfaces, or even to extensive areas of intact skin (Dela Cruz *et al.*, 1987). High permeability of the skin of neonates allows the absorption of large amounts of iodine.

Vaginal douching with VVP-I by women can cause transient hypothyroidism in their neonates and increased the false-positive rate of screening for congenital hypothyroidism in an iodine-deficient region of Germany (Grüters *et al.*, 1983), and even in iodine-sufficient areas of Japan (Koga *et al.*, 1995). It has been suggested that iodine-rich breast milk may play an important role in this increased recall rate (Chanoine *et al.*, 1988; Koga *et al.*, 1995).

Iodine is readily absorbed when VVP-I is applied to the skin of a newborn infant, because of high cutaneous permeability, and neonates are very sensitive to iodine overload, as described previously. Topical VVP-I therapy is associated with a significant risk of hypothyroidism in neonates, especially very-low-weight babies (Smerdely *et al.*, 1989). Many cases of hypothyroidism induced by topical use of VVP-I have been reported in newborn infants, mainly from iodine-deficient regions (Markou *et al.*, 2001). However, a case of severe hypothyroidism in a neonate was also reported from North America, an iodine-sufficient region (Khashu *et al.* 2005). A premature infant developed severe hypothyroidism that required l-thyroxine replacement therapy after application of VVP-I for 20 days.

The serum iodine concentration is extremely elevated in patients who have severe burns and are treated with VVP-I. Rath *et al.* (1988) reported two cases of hyperthyroidism in burn patients. Both patients had no history of thyroid disease and follow-up examination after recovery from injury revealed normal thyroid function. After topical treatment with VVP-I was

discontinued, the thyroid function of these patients returned to normal within a few weeks. In one patient, PVP-I treatment was repeated and this led to hyperthyroidism, which was also readily reversible.

There have been many reports of a decrease in thyroxine (T_4) and triiodothyronine (T_3), as well as an increase in TSH, in burns patients receiving PVP-I treatment. However, these changes in thyroid hormones may represent part of general stress response (Becker *et al.*, 1980).

Iodine is readily absorbed from mucosal surfaces. Peritoneal lavage with PVP-I was reported to frequently induce transient thyroid dysfunction in patients from Germany where dietary iodine ingestion is relatively low (Gortz *et al.*, 1984). In Japan (an iodine-sufficient region), however, intraoperative bowel irrigation with PVP-I does not cause thyroid dysfunction (Tsunoda *et al.*, 2000).

Long-term treatment with PVP-I, even at a relatively low dose, can result in thyroid dysfunction. Out of 27 patients in whom PVP-I was applied on the tracheotomy site, the gastrostomy site, the external urethral meatus, or an ulcerated skin for 3–133 months (mean \pm standard deviation 48.0 ± 33.2), subclinical hypothyroidism was seen in 3 patients, mild hyperthyroidism was seen in 1 patient, and subclinical hyperthyroidism was suspected in 7 patients (Nobukuni *et al.*, 1997). Sato *et al.* (2007) reported two cases of hypothyroidism induced by prolonged habitual gargling with PVP-I for 4 and 10 years, respectively. Shetty and Duthie (1990) and Valayer-Chaleat *et al.* (1998) reported cases of hyperthyroidism in patients who received topical application of PVP-I for 6 months to treat decubitus ulcers.

Surgery

Timothy J. King, Edward M. Sullivan, in [Physician Assistant \(Fourth Edition\)](#), 2008

Agents Commonly Used for Operative Site Skin Preparation and Surgical Hand Washing

Povidone-iodine or iodophor products are supplied in two distinct liquid versions. For the operative site preparation, a detergent *scrub* is first applied with sponges to mechanically remove gross dirt and oils from the skin. After the skin has been blotted with a sterile towel, a nondetergent *solution* is “painted” onto the area. This thin film of **povidone-iodine** continues to have bactericidal action for up to 8 hours after application. The solution's brown color also effectively outlines the borders of the surgical scrub, allowing accurate placement of the towels and drapes before incision. Patients and OR staff who have a history of sensitivity or allergic reaction to iodine should refrain from the use of either of these preparations for surgical scrubs.

Chlorhexidine gluconate, when used in a 4% concentration, is bactericidal and has persistent antimicrobial activity after application. Repeated scrubbing throughout the day enhances its activity. Because this agent is nonirritating for a majority of the patient population, it is commonly used for hand washing and preparation of the operative site. Chlorhexidine gluconate scrub soap adequately prepares the skin, and no solution is required after the scrub.

Parachlorometaxylenol (PCMX) is a useful skin preparation agent, particularly for those allergic to iodine-containing preparations. This agent is often combined with an emollient to reduce skin drying.

Hexachlorophene, although used infrequently, is an effective skin preparation solution for those patients and staff allergic to **povidone-iodine** and chlorhexidine gluconate. It accumulates on the skin after several days of use, causing an overall decrease in skin flora.

Ocular clinical pharmacology

Robin G Stanley, in [Small Animal Clinical Pharmacology \(Second Edition\)](#), 2008

OTHER ANTIFUNGALS

Povidone-iodine

Povidone-iodine diluted to a 1% concentration normal saline has been used in the treatment of equine keratomycosis. No data regarding its clinical efficacy are available.

Silver sulfadiazine

The author has found silver sulfadiazine to be extremely effective in the treatment of keratomycosis. It is available as a skin preparation usually used in the treatment of skin burns. It is usually well tolerated. Studies have shown that the silver is concentrated well in the cornea.

Directions for use involve applying a generous amount onto the affected cornea 4–6 times daily. Clinically the author has found this preparation to be useful in treating fungal keratitis.

A worldwide yearly survey of new data in adverse drug reactions and interactions

Pam Magee, in [Side Effects of Drugs Annual](#), 2012

Polyvinylpyrrolidone (povidone) and povidone-iodine

Immunologic Povidone-iodine has been associated with a wide range of allergic reactions from minutes to hours after exposure. However *delayed allergic reactions* can also occur [27^A].

- A 57-year-old woman who had had multiple pelvic operations for urinary incontinence underwent further surgery for stress incontinence. An irrigation of povidone-iodine mixed with sterile saline was used to clear the operative field. She tolerated the procedure well with no intraoperative complications. The vagina was packed with iodoform. On day 2 the vaginal packing was removed but 24 hours later she developed vulvar swelling, severe pain, and inability to void. The vulvar edema improved significantly with diphenhydramine and the use of ice packs.

A worldwide yearly survey of new data in adverse drug reactions

Pam Magee, in [Side Effects of Drugs Annual](#), 2011

Iodophors [*SEDA-15, 1896; SEDA-30, 279; SEDA-31, 411; SEDA-32, 440*]

Iodine

Although povidone iodine is now more commonly used as an antiseptic, iodine has traditionally been used as a powerful bactericidal agent. Owing to the problems associated with the emergence of drug-resistant pathogens, new strategies in the design of antimicrobial agents are investigating the properties of iodine in novel ways.

An ideal antimicrobial agent should be non-toxic and possess broad-spectrum antiviral, antibacterial, and antifungal activity and exclude resistance. This has led to the design of a combination agent, iodine–lithium–alpha-dextran [66^R]. This uses the non-specific antimicrobial action of molecular and ionized iodine and the systemic immunomodulatory effects of the polysaccharide complex of iodine and lithium. This new agent has been assessed by parenteral administration in HIV-infected patients. The adverse effects of *phlebitis* of punctured small veins and subfebrile *fever*, transient *headache*, *malaise*, and *sweating* did not lead to withdrawal of therapy. *Hepatitis* was a serious adverse effect and occurred in 0.11% of subjects with viral hepatitis.

Polyvinylpyrrolidone (povidone) and povidone-iodine

Endocrine

Hypothyroidism and *altered metabolism of thyroid hormones* have been reported as adverse events in neonates and children, resulting from the use of antiseptics containing povidone-iodine [SED-15, 1896; SEDA-30, 279; SEDA-31, 411; SEDA-32, 440]. Because of concerns about possible iodine excess, chlorhexidine-based antiseptics have replaced povidone-iodine in some clinical settings. However, this may not be advantageous for infants and children who are

receiving total parenteral nutrition (TPN) as iodine is not routinely added to TPN solutions. Previously, iodine deficiency was considered unlikely in patients receiving TPN, because of adsorption from iodine-containing skin disinfectants and other adventitious sources [67^r, 68^R].

Immunologic

Severe systemic reactions to povidone-iodine are rare [SEDA-32, 441] and are more often reported with lavage or instillation into wounds or body cavities, although there are individual case reports of anaphylaxis when povidone-iodine has been applied vaginally [SEDA-20, 226] and rectally [69^A].

Gnotobiotic Fish as Models to Study Host–Microbe Interactions

Torunn Forberg, Kathryn Milligan-Myhre, in [Gnotobiotics](#), 2017

5.1 Polyvinylpyrrolidone–Iodine

Polyvinylpyrrolidone–iodine (PVP-I) disinfection varies on concentration and duration depending on the ability of the chorion to withstand exposure. PVP-I can be purchased as a solid powder or as a dilute liquid (also known as povidone–iodine). PVP-I stock solutions should be maintained at 10% or higher in a dark container, and dilutions of PVP-I should be made the day of germfree egg derivation in a fish-safe medium and filter sterilized. Due to possible lot-to-lot variability, several concentrations within fourfold dilutions of the established protocols should be tested when using commercially obtained diluted liquid PVP-I to determine the appropriate concentration to sterilize eggs while maintaining fish viability. Because of the instability of the chemical, dilute liquid PVP-I should not be used in a gnotobiotic protocol more than 6 months after opening, and very dilute (less than 10%) PVP-I solutions should be not be used more than a day after dilution.

For some fish, such as zebrafish, the concentration of PVP-I is very low (0.1%), whereas for other fish, such as stickleback, the concentration may be up to four times higher. Similarly, the strength of the chorion will determine how long an egg may soak in PVP-I. For example, zebrafish can only withstand a 2-min soak in 0.1% PVP-I, whereas stickleback can be exposed to 0.4% PVP-I for up to 8 min without long-term effects on survival or development. Prolonged exposure to PVP-I may inhibit the development of fish. Therefore, fish should be rinsed several times with sterile fish medium following a soak in PVP-I.

Prosthetic Vascular Graft Infection

Linda M. Reilly MD, in [Comprehensive Vascular and Endovascular Surgery \(Second Edition\)](#), 2009

Antimicrobial Wound Irrigation

Wound irrigation with povidone-iodine or wound soaking with mafenide have both been used to sterilize infected or contaminated wounds.^{170,179} Unfortunately, the recommended 10% povidone-iodine strength also impairs wound healing and inhibits fibroblasts.¹⁹⁸ This has led to the use of dilute solutions, which are more likely to be ineffective in local bacterial control.^{198,199} Some authors recommend combining 10% povidone-iodine with antibiotic irrigation for optimal wound sterilization.¹⁹⁹ Mafenide is at least as effective as undiluted povidone-iodine²⁰⁰⁻²⁰² but does not have adverse effects on wound healing and is actually helpful to fibroblast proliferation.¹⁹⁸

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