

Propylene Glycol Dermatitis in the Printing Industry: The Fundamental Role of a Workplace Visit

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Workers in the printing industry serve as an example of a working population that is at high risk of developing occupational skin disease. Daily exposures include both irritants and sensitizing agents. While many substances have been associated with occupational contact dermatitis in this population, no detailed cases of allergic contact dermatitis (ACD) from propylene glycol (PG) have been reported to date. We present a case of a printing tradesman who developed work-related ACD from PG and who was subsequently able to return to work after a multidisciplinary team assessment that included a comprehensive worksite visit by a clinical occupational hygienist.

OCCUPATIONAL CONTACT DERMATITIS (OCD) is a significant burden to many industries, including the printing industry.¹ Exposures in this trade have been associated with both allergic contact dermatitis (ACD) and irritant contact dermatitis (ICD); solvents, soaps, petroleum products, acrylates, aldehydes, and “wet work” have been suggested as the main causative agents.^{2,3} In a study of 21 printing tradesmen who were involved in lithographic printing operations and who had contact dermatitis, 67% were found to have ACD; 29% of these cases were associated with ultraviolet (UV)-cured ink components.⁴ ICD accounted for the remaining 33% of cases. Although a recent retrospective cross-sectional analysis by the North American Contact Dermatitis Group (NACDG) of all positive patch-test reactions to propylene glycol (PG) from 1996 to 2006 statistically noted three cases of PG dermatitis potentially related to the patients’ work as printing press operators, no specific case information was provided.⁵ Although PG has been included in the printing series on the basis of recommendations by several authors,^{6,7} we have not identified any detailed reports in the literature of ACD from PG among workers in the printing industry.^{5,8,9}

Although OCD is a potentially debilitating disease, it can be largely avoided through adequate protective measures.¹⁰ We present a case of a printer tradesman who developed contact dermatitis from PG. He was subsequently able to return to work with the assistance of a multidisciplinary clinical team that included a clinical occupational hygienist (COH) who visited the work site to observe the work processes and tasks and to discuss with the employer preventive measures taken to date. Identification of the sensitizing agent and a subsequent visit to the workplace by the COH to confirm sources of exposure resulted in a successful intervention, enabling the patient to carry on with his job. This article highlights the first individually described case of ACD from PG in the printing industry and emphasizes the usefulness of a multidisciplinary team assessment, including a comprehensive workplace visit.

Case Report

A 42-year-old press operator with an allowed workers’ compensation claim for OCD was referred to our multidisciplinary occupational health clinic after he experienced a recurrence of a work-related eruption on his hands and forearms.

He had been working as a press operator for approximately 20 years at a printing operation in which he was exposed to UV-cured inks and solvents. Three years prior to this assessment, he had developed an eruption on his hands and forearms, which spread to his back and scalp. One year after the onset of his skin eruption, he was seen and patch-tested in an occupational dermatology clinic with the North American standard series (Chemotechnique Diagnostics,

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Malmö, Sweden) and the printing acrylates series in IQ Ultra Chambers (Chemotechnique Diagnostics) affixed with Scanpor tape (Norgesplaster Alpharma A/S, Vennesla, Norway). Reactions were read at 48 and 96 hours according to International Contact Dermatitis Research Group guidelines.¹¹ The patient reacted positively to both methylchloroisothiazolinone/methylisothiazolinone (MCI/MI) and PG. After testing, he was transferred at work for 1 year to the binding area to package forms. There were no significant chemical exposures in this work area, and his condition improved during his time there.

The company substituted various chemicals in his work process, and he was transferred back to his old job 1 year prior to his assessment in our clinic. The fountain solution used to ensure proper printing, which contained PG, was substituted with a PG-free fountain solution, and an orange hand cleaner pumice lotion that had also been found to contain PG was discontinued. An MCI/MI-containing fabric softener used as an antistatic agent was substituted with an MCI/MI-free softener. The worker was vigilant in avoiding nonwork-related skin contact with PG and MCI/MI. He practiced “double gloving” when handling the fountain solution. However, approximately 6 months later, his skin flared despite the use of these gloves and the efforts of the employer to remove products containing PG and MCI/MI. The worker was referred to our multidisciplinary occupational dermatology program to determine if there were other exposures of concern and to advise about workplace restrictions as necessary.

As part of the assessment, the COH visited the workplace to determine the worker's exposure to solvents used in printing and in washup to identify any activities that could result in an aggravation of the worker's skin problem and to determine the need for further patch testing and workplace restrictions.

During the workplace visit, the press operator's job tasks were observed. The COH noted a 45-gallon plastic wastewater drum that was passed from press to press to collect the runoff from each press. Because the fountain solution used by the other presses contained PG, that substance could potentially find its way into the common wastewater drum. Because he was the end user, the worker was responsible for emptying the wastewater drum. A pump mechanism pumped the wastewater from the drum into a sink via an attached hose. The worker stated that his hands and arms would regularly be splashed with the wastewater during this process.

The worker noted that his skin condition would flare after direct contact with fluid from the drum. As a result, his workstation was outfitted with its own dedicated wastewater drum (Fig 1) so that he would be exposed only to his own

fountain solution, which did not contain PG. After this dedicated wastewater drum was provided, his skin cleared, and he experienced no further flares in his condition.

The worker was able to partially identify the persisting source of PG prior to the COH's workplace visit, but the COH was able to confirm the worker's preliminary hypothesis and offer further suggestions and recommendations to both employer and worker. Additionally, the COH was able to ensure that there were no other potential sources of PG (or MCI/MI) in the printer's workplace area.

During the workplace visit, various other tasks were observed. Figure 1, Figure 2, Figure 3, and Figure 4 provide descriptions of the work areas.

With the introduction of his own wastewater drum, the worker was able to successfully carry on with his job. Because his skin condition appeared to have resolved and the problem had been identified in the workplace, further patch testing was not recommended. The patient has not been seen for further exacerbations of his contact dermatitis since that time.

Discussion

The typical workplace in the printing industry represents one of the many workplace environments in which OCD is a frequent problem. The incidence of dermatitis in this population has been estimated to be approximately 75 cases per 10,000 workers^{2,3} and is largely a result of the many potential irritants and sensitizers encountered on a daily basis in the workplace. Although many agents have been associated with OCD in the printing industry, to the knowledge of the authors, this is the first detailed reported case of ACD secondary to PG exposure.



Figure 1. Fountain solution collection drum dedicated to the worker's press only.



Figure 2. Fountain solution reservoir.

PG has the ability to act as a wetting agent, surfactant, solvent, vehicle, or preservative and is used widely in the pharmaceutical and cosmetic industries.¹² It has been associated with both allergic and irritant reactions and is most frequently reported in the literature as associated with the use of topical agents.^{8,13–15} In the recent review of PG patch testing by the NACDG, 4.2% of reactions were found to be occupationally related; mechanical work and motor vehicle work were the most commonly associated occupational areas.⁵ Three cases were identified in relation to printing press operators; two cases were designated as likely to be occupationally associated.⁵ No descriptions of these two cases were provided; it was not reported whether the offending product was an integral part of the printing



Figure 3. Ink used in the printing process is scooped out by a worker using an ink knife and placed into an ink tray. Nitrile gloves are worn for this work task.



Figure 4. A print deck with the blanket (roller) and plate cylinders visible. Following a print run, the blanket is washed by the worker.

process or a component of hand cleaners or moisturizing creams that may have been used in the workplace.

It should be noted that PG may be difficult to identify in a workplace setting because it may not be declared on Material Safety Data Sheets.⁵ In our case, PG was found in both Loctite Orange Hand Cleaner Pumice Lotion (Loctite Corporation, Rocky Hill, CT) and HDF 50 fountain solution concentrate (Fuji Hunt Photographic Chemicals, Inc., Allendale, NJ). PG may also be present in blanket washes for UV inks; however, it was not present in the wash at this particular job site.⁴

A multidisciplinary model of assessment can offer specialized assistance to workers with persistent or relapsing OCD. If contact dermatitis persists despite the removal of all known products containing the offending agents, a workplace visit may be warranted by an occupational hygienist and/or a physician with expertise in occupational medicine. Potential sources of a sensitizer or irritant may be identified, as well as the various safety practices of the employee (including work tasks) and the proper use of personal protective equipment (PPE). In the case of this worker, a workplace assessment by a COH was able to confirm that a remaining source of a previously identified relevant contact allergen (ie, PG) was in fact the common wastewater drum.

In addition to the identification of allergens and irritants and substitution with chemicals that are less irritating or allergenic, other strategies for the prevention of OCD include the establishment of engineering controls to decrease exposure, the use of PPE such as gloves and special clothing, an emphasis on personal and workplace hygiene, and the establishment of educational programs

to increase awareness in the workplace.^{16,17} In the printing industry, protective clothing, regular use of emollient creams, and avoidance of solvents for skin cleansing have been shown to decrease the risk of cutaneous disease.^{4,18}

Conclusion

Although printing tradesmen encounter many irritants and sensitizing agents on a daily basis, allergic contact dermatitis from propylene glycol is not commonly reported. Contact dermatitis is largely preventable with appropriate protective measures; a multidisciplinary team assessment that includes a workplace visit may prove to be instrumental in dealing with cases of refractory or persistent occupational contact dermatitis.

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