FOCUS ON TOMORROW

RESEARCH FUNDED BY WORKSAFEBC

British Columbia Fails to Meet the North American Screening Standards: What are the Implications for Workers with Allergic Contact Dermatitis?

April 2013

Principal Investigator/Applicant
Gillian de Gannes

RS2009-OG10

WORK SAFE BC

WORKING TO MAKE A DIFFERENCE

British Columbia fails to meet the North American screening standards:

What are the implications for workers with allergic contact dermatitis?

Gillian de Gannes MD FRCPC FAAD
Clinical Instructor, UBC Department of Dermatology & Skin Science
Director, UBC Contact Dermatitis Clinic

Sayali Tadwalkar MD CCFP
Family Physician

Aaron Wong MD
Dermatology Resident

Nino Mebuke
Patch Test Technician

Project Number: RS2009-OG10

Date: 22 April 2013

ACKNOWLEDGEMENTS

This research is supported with funds from WorkSafeBC through the FOCUS ON TOMORROW program.

TABLE OF CONTENTS

SUMMARY

- A comprehensive assessment of workers suspected of having allergic contact dermatitis is an essential component of the return-to-work strategy for cases of occupational skin disease, which includes investigational patch testing for the diagnosis of allergic contact dermatitis.
- Hands were the most common site of involvement (78%) in workers with suspected occupational contact dermatitis.
- Using a 45 allergen series alone missed 27% of study participants with a positive patch test reaction compared to the 70 allergen series.
- Similarly, supplemental allergen testing yielded at least one positive patch test reaction in an additional 23% of study participants.
- In summary, 50% of those with positive patch test reactions would have been missed using the 45 allergen series and no supplemental allergen testing.
- This study represents a prospective trial to demonstrate that an expanded series of screening allergens in addition to supplemental allergen testing improves the likelihood of detecting occupational allergic contact dermatitis.

EXECUTIVE SUMMARY

Allergic contact dermatitis (ACD) is a common allergic condition affecting the skin. The diagnosis of ACD is based on the patient's history of chemical exposures, physical examination and patch testing to indentify causative allergens. Patch testing, when used properly, often provides support for the diagnosis of allergic contact dermatitis.[1]

Occupational skin disease (OSD) is the most commonly reported category of work-related illnesses not resulting from acute or cumulative trauma in the United States.[3] OSD now accounts for 10-15% of all occupational disease.[4,5] Estimates from the literature suggest that occupational contact dermatitis (OCD) accounts for over 90% of all OSD cases.[4] In many countries, OCD ranks first among all notified occupational diseases, accounting for up to 30% of all compensation costs.[6] Irritant contact dermatitis accounts for most cases of OCD. Patch testing is the only reliable method of identifying ACD.

From 1982 to 2010, WorkSafeBC accepted 4,581 dermatitis claims for disability or survivor benefits.[7] Recognizing that compensation for health care costs alone consists of up to 88% of total OSD claims,[8] the total number of accepted claims for time loss and health care costs is expected to be much higher. As of 2010, each dermatitis claim cost an average of 25 days time loss and 4.3 thousand dollars in British Columbia,[7] comparable to the costs per compensated claim in other jurisdictions.[9]

Proper assessment of workers suspected of having allergic contact dermatitis is an essential component of the return-to-work strategy for cases of occupational skin disease. It is necessary for university affiliated academic dermatology centres to have the capacity to patch test to many allergens based on suspicion of chemical exposures as obtained by a history and physical examination.[10] Workers in British Columbia with

occupational skin disease suspected to be contact dermatitis can be referred for assessment at the University of British Columbia (UBC) Contact Dermatitis Clinic. For the past 15 years, the UBC clinic has used a 45 allergen screening series when evaluating a patient with suspected ACD, in both non-occupational and occupational cases. This screening series has not been updated in over a decade. British Columbia fails to meet the North American screening standards for patch testing. What then are the implications for workers with allergic contact dermatitis?

This prospective trial of 100 participants compared the use of a 45 allergen series with the North American Contact Dermatitis Group (NACDG) 70 allergen series. The primary outcome was to identify the number of patients with at least one positive patch test reaction to the NACDG 70 allergen series that would have been missed with the 45 allergen series. Secondary outcomes included identifying the percentage of participants who reacted to supplemental allergen testing and those with any allergen identified, irrespective of the allergen series. After ethical review board approval, patch testing with the NACDG 70 allergen series and relevant supplement trays was carried out on patients referred to the UBC Contact Dermatitis Clinic for suspected occupational ACD.

Patch test results from the NACDG 70 allergen series were compared to the 45 allergen series. Results showed that using the 45 allergen series alone missed 27% of participants with a positive patch test reaction compared to the 70 allergen series. Similarly, supplemental allergen testing yielded at least one positive test in 23% of participants, with no other positive reactions identified on the screening series tested. In summary, 50% of the positive patch test reactions would have been missed with the 45 allergen series and no supplemental allergen testing.

Even though the inclusion criteria for this study was possible occupational contact dermatitis, only 13 study participants were seen at the request of WorkSafeBC (i.e. referred by a case manager or medical advisor). At least one positive patch test reaction was identified in all of these workers except for one mechanic with a history of atopic dermatitis and workplace related irritant contact dermatitis of the hands. After requesting the dermatology consultation and patch test results, WorkSafeBC accepted the claim for occupational contact dermatitis in 5 additional study participants. Unfortunately, 2 study participants' claims for compensation were refused despite identification of possible workplace allergens (i.e. rubber accelerators in gloves, preservatives in automotive fluids and hand cleansers).

This prospective study demonstrates that an expanded series of screening allergens in addition to supplemental testing improves the likelihood of detecting occupational allergic contact dermatitis. Without an expanded and supplemental allergen series, up to 50% of the positive patch test reactions may have been missed. Local contact dermatitis expertise and patch testing resources are underutilized. Therefore, workers in British Columbia may be at increased risk of prolonged allergen exposure and additional morbidity.

Keywords: occupational skin disease, allergic contact dermatitis, screening allergens

i. METHODOLOGY

Throughout the past 25 years, clinical advances have been demonstrated in a few main areas in the field of contact dermatitis: patch test techniques, new allergen recognition and improved health and safety through dermatotoxicologic and epidemiologic-based interventions.[11] The most prominent advancement was the recognition and description of new allergens. This is clearly exemplified by the dynamic changes in the content of “standard series” allergens developed by local and international groups worldwide.[11]

Most cases of OCD are due to irritant contact dermatitis. Patch testing aims to detect the allergens responsible for contact sensitivities in patient with ACD.[12] The usefulness of patch testing has been confirmed in many studies,[13,14,15] and the validity of using an “expanded” series such as the NACDG screening allergen series has been examined as well.[16]

Several retrospective studies have shown that using a screening series of 20 allergens completely evaluated only approximately 16% of patients with allergic contact dermatitis.[10] Even with expansion of the screening series to 49 allergens, only 32% of individuals were adequately evaluated.[1] These studies showed that the more allergens one investigated, the more one found and furthermore the more relevant information one found. A recent study assessed the usefulness of the NACDG screening allergen series of 65 allergens as an exclusive screening method in the diagnosis of allergic contact dermatitis.[12] They found that 90% of the patients with a positive patch test reaction were positive for at least one NACDG test allergen. They concluded that as a screening tool, the NACDG screening allergen series is substantially more efficacious

than are more limited screening series when used in the evaluation of patients with suspected allergic contact dermatitis.

The hypothesis is that the 45 allergen “Full North American Standard” allergen series used at the UBC Contact Dermatitis Clinic is limited as a screening tool for the detection of allergens in patients being evaluated for occupational contact dermatitis.

The objective of this study is to examine the number of positive patch test reactions detected by the 2009-2010 NACDG 70 allergen screening series as compared to the 45 allergen series in the evaluation of patients with suspected contact dermatitis.

This is a prospective study. Ethical approval from the UBC Providence Health Care Research Institute was granted prior to initiating the study. Informed consent was obtained in all cases. One hundred subjects were recruited from referrals to the UBC Contact Dermatitis Clinic over a period of 2 years. Study participants were not paid an honorarium. Informed consent was obtained in all cases. An initial dermatology consultation, including history and physical exam, was done at baseline. The NACDG 70 allergen screening series was used in all subjects. Supplemental allergens were included based on occupation and personal care product information obtained during the initial history. All subjects were 19 years of age or older. They were excluded from participating if they were pregnant, unable to provide informed consent, or had developed anaphylactic reactions during previous patch testing.

After the initial history and physical exam, patch testing with the NACDG 70 allergen series and supplemental allergens (Chemotechnique Diagnostics, Vellinge, Sweden; SmartPractice Canada, Calgary, Alberta, Canada) was carried out using the IQ-Ultra® chambers (Chemotechnique Diagnostics, Vellinge, Sweden) applied to the upper back

with Scanpor® tape (Actavis Group, Norgesplaster Facility, Vennesla, Norway). At 48 hours, the patches were removed and skin reactions read. Delayed readings were taken at 96-120 hours. Reactions were graded according to the International Contact Dermatitis Research Group (ICDRG) criteria: negative reaction (-), weak reaction (+), strong reaction (++) and extreme reaction (+++) (Table 1)[17]. A patch test reaction was scored as positive if the grading was +, ++ or +++.

All statistical analyses were conducted with *Stata 12* (StataCorp. 2011. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP). Prior to conducting the study we determined the number of patients required to estimate the incremental yield (IY) with reasonable precision. A sample size of 100 patients would provide a maximum 95% confidence intervals (CI) half-width of 0.10. The IY is equal to the number of subjects who were identified using the additional screening allergens (25 new allergens on the NACDG 70 allergen series) who were not identified with the 45 allergen series divided by the total number of subjects identified with a positive patch test reaction to any of the NACDG 70 allergens (expressed as a percentage). To calculate the IY (%), we defined the denominator as all subjects with a positive patch test reaction to any NACDG 70 allergen. For the yield of the 45 allergen screening series, the numerator was all subjects with a positive patch test to any of the 45 screening allergens. For the IY of the additional (new) allergens found on the NACDG 70 allergen screening series, the numerator was all subjects who were negative on the 45 allergen screening series but tested positive to any of the 25 new allergens. Exact, 95% confidence intervals (CI) were calculated.

ii. PROJECT FINDINGS/OUTCOMES

One hundred individuals of various professions participated in the study after obtaining informed consent (Table 2). The hands were the most common site of involvement (78%) in patients with suspected occupational contact dermatitis.

The most common occupations by category were trades (33%), health care (21%), cosmetology (20%), and the restaurant and food industry (7%). Nurses were the most common occupation (10%), followed by mechanics (7%), estheticians (6%) and hairdressers (5%).

The mean age of subjects was 42.5 years (SD $\pm$ 12.2 years). Of the total 100 participants, there were an equal number of men (50) and women (50). Subjects were all screened with the NACDG 70 allergen series. Personal products and other supplemental allergens for various occupations were added based on exposure history. The mean number of allergens tested was 107 (SD $\pm$ 29).

Of the 100 participants, 72 developed at least one positive patch test reaction (+, ++, +++). Using the NACDG 70 allergen screening series, 27% of study participants showed at least one positive patch test reaction to a new allergen that would not have been identified using the 45 allergen series alone (IY 55 CI 40-69). Supplemental allergens alone were identified in 23 additional participants. Altogether, new and supplemental allergens were identified in 50% of participants that would not have been identified using the 45 allergen series alone. There were 28% participants who did not develop a positive patch test reaction to any of the allergens screened.

The most common allergens which resulted in a positive patch test reaction from the NACDG 70 screening series are metals (nickel, cobalt), fragrances (balsam of Peru,

fragrance mix I and II), rubber accelerators (thiuram mix, carba mix), preservatives (methylchloroisothiazolinone/methylisothiozolinone, quarternium-15) and dyes (4-phenylenediamine) (Table 3).

The frequency of positive patch test reactions to a new allergen are shown in Table 4. The new allergens are mostly found in personal care products and include fragrances (fragrance mix II, *Compositae* mix, tea tree oil, ylang ylang oil, carvone, majantole, lavender oil, jasmine oil), preservatives (iodopropynyl butyl carbamate), botanical additives (propolis), foaming agents (coconut diethanolamide, decylglucoside) and topical anaesthetics (lidocaine, dibucaine). Occupational allergens including 2-mercaptobenzothiazole (rubber accelerator and biocide) and 2-hydroxyethyl methacrylate (acrylic used in dentistry, orthopedic surgery and nail cosmetics) were also commonly identified new allergens.

Only 13 study participants were seen at the request of WorkSafeBC (i.e. referred by a case manager or medical advisor) (Table 5). A positive patch test reaction was identified in all of these workers except for one mechanic with a history of atopic dermatitis and workplace related irritant contact dermatitis of the hands. WorkSafeBC requested the medical records (dermatology consultation letter) and patch testing results of 5 additional study participants whose claims for occupational contact dermatitis were then accepted for compensation based on the findings of allergic contact dermatitis to a workplace allergen. Unfortunately, despite the finding of allergic contact dermatitis to workplace allergens identified through patch testing (i.e. rubber accelerators in gloves, preservatives in automotive fluids and hand cleansers), 2 study participants' claims for compensation were still denied.

ii. IMPLICATIONS FOR FUTURE OCCUPATIONAL HEALTH RESEARCH

This prospective trial shows that increasing the number of allergens tested improves the likelihood of detecting allergic contact dermatitis. If the 45 allergen series had been used alone, positive patch test reactions would have been missed in 50% of participants. Specifically, the 45 allergen series would have missed 27% of participants compared to the NACDG 70 allergen series, while supplemental testing yielded at least one positive result in an additional 23% of participants. This stresses the importance of using an expanded screening series of allergens in addition to supplemental allergens based on occupational exposure and personal care product use. These findings are consistent with multiple, previous retrospective studies which support the use of both expanded and supplemental allergens to enhance detection of allergic contact dermatitis.[1,10,12]

The finding of greatest concern from this observational study is the limited use of local contact dermatitis expertise and patch testing resources by WorkSafeBC. All participants in the study met the inclusion criteria of a diagnosis of contact dermatitis and a possible workplace exposure. It is well accepted that rritant contact dermatitis is the most common cause of occupational contact dermatitis. The diagnosis of irritant versus allergic contact dermatitis is best achieved with a focused dermatology assessment including physical examination (there are some morphologic features of a dermatitis that may help to differentiate allergic from irritant contact dermatitis) and a thorough chemical exposure history, including both workplace substances and personal care products. The only way to accurately diagnose allergic contact dermatitis is by identifying an allergen through patch testing. Repeat open application tests (i.e.

applying a personal care product such as a moisturizer on the inner forearm twice daily for 10-14 days and observing whether dermatitis occurs at the test site) will identify the product the worker is allergic to, but does not identify the individual ingredient(s) in that product which are causing the allergic reaction . Unfortunately, if a worker is suspected of having allergic contact dermatitis to a workplace allergen and is not referred for patch testing, there may be unnecessary morbidity due to continued exposure and prolonged skin injured due to the dermatitis. This may result in delayed healing, increased days time lost from work and possible permanent impairment due to repeated skin injury.

These observations identify a need for educating WorkSafeBC case managers and medical advisors, occupational health offices and primary care physicians about the diagnosis and management of occupational skin disease, including the usefulness of comprehensive investigational patch testing to diagnose allergic contact dermatitis.

iii. APPLICATIONS FOR POLICY AND PREVENTION

The most valuable information generated from this research is that increasing the number of allergens tested in cases of suspected occupational contact dermatitis increases the likelihood of identifying workers with allergic contact dermatitis. Allergen avoidance results in resolution of the skin disease associated with allergic contact dermatitis. Workers can successfully return to productive work in a safe environment once allergen sources have been identified and removed.

The UBC Contact Dermatitis Clinic underwent significant restructuring in August 2009, including the appointment of a new Director (Dr. Gillian de Gannes), the expansion of the screening series of allergens from 45 to 70 allergens and the addition of expanded supplemental allergen series, including specific occupational allergens (e.g. mechanic series, orthopedic series for both patients and surgeons). One of the achievements of this restructuring was the implementation of a new WorkSafeBC expedited dermatology assessment [Occupational Disease Services – Dermatology Assessment (ODS-DA), WorkSafeBC Code 19207], which includes comprehensive patch testing and allergen avoidance counseling for return-to-work planning. Appendix A outlines the UBC Department of Dermatology and Skin Science Occupational Contact Dermatitis Standards for Comprehensive Assessment. Workers suspected of occupational contact dermatitis must be referred for this assessment through a WorkSafeBC case manager or medical advisor.

Unfortunately, all referrals received from WorkSafeBC for an ODS-DA since August 2009, including those received for the 13 study participants, have not meet the standard requirements outlined in Appendix A. In particular, an occupational hygienist's report, including documentation of a site visit to identify any potential contact allergens, was

absent from all referrals. Since testing to as many allergens as possible will yield the best results, identifing potential sources of contact allergens in the workplace is essential to complete a comprehensive contact dermatitis assessment.

In several ODS-DA cases managed at the UBC Contact Dermatitis Clinic (including 1 of the study participants), potential workplace allergens were identified on patch testing, but the worker returned to the workplace without it being assessed by an occupational hygienist. As such, the worker continued to experience disabling contact dermatitis of the hands and was not able to perform his job to his full capacity.

The Senior Occupational Hygienist at WorkSafeBC was recently provided with the document in Appendix A. The recommendation has also been made to present these research findings and additional ODS-DA case management issues to WorkSafeBC, including an audience of case managers, medical advisors and regulatory and economic policy makers, so that all personnel involved in decisions regarding workers affected by occupational contact dermatitis can be better prepared to offer the best outcome for the worker – a safe and productive work environment.

iv. KNOWLEDGE TRANSLATION AND EXCHANGE

The findings of this study have been presented locally, nationally and internationally at dermatology meetings:

1. UBC Department of Dermatology & Skin Science, Resident Research Day, Vancouver, British Columbia (March 2012)
2. 87th Annual Conference of the Canadian Dermatology Association, Canadian Contact Dermatitis Society Subspecialty Session, Ottawa, Ontario (June 2012)
3. 23rd Annual Meeting of the American Contact Dermatitis Society (Dr. Aaron Wong was the winner of the Alexander A. Fisher Resident Bronze Medal Award), San Diego, California (March 2012)

The response from the audience in each of the three venues was positive with respect to the study design, results and conclusions. Other dermatologists involved in managing workers with occupational skin disease also commented on the lack of training and disease awareness amongst workplace insurance companies' case managers, occupational hygienists and medical advisors. There is a general lack of knowledge with regards to the dermatologic manifestations of contact dermatitis and the unique methods required to adequately assess and counsel a worker with occupational skin disease.

Dr. Aaron Wong is preparing a scientific publication based on the findings of this research project for submission to the scholarly journal *Dermatitis*, the official journal of the American Contact Dermatitis Society.

References

1. Marks JG, Belsito DV, De Leo VA, Fowler JF, Fransway AF, Maibach HI, et al. North American Contact Dermatitis Group patch test results for the detection of delayed-type hypersensitivity to topical allergens. J Am Acad Dermatol 1998 Jun;38(6):911-8.
2. Rajagopalan R, Anderson RT, Sarma S, Kallal J, Retchin C, Jones J, et al. An economic evaluation of patch testing in the diagnosis and management of allergic contact dermatitis. Am J Contact Dermatitis 1998 Sep;9(3):149-154.
3. US Bureau of Labor Statistics, 1997. Nonfatal occupational illnesses by category of illness, private industry 1992-1995. Washington, DC:US Department of Labor.
4. Schalock PC, Zug KA. Protection from occupational allergens. Curr Probl Dermatol 2007;34:58-75.
5. Emmett EA. Occupational contact dermatitis I: Incidence and return to work pressures. Am J Contact Dermat 2002 Mar;13(1):30-34.
6. Diepgen TL. Occupational skin-disease data in Europe. Int Arch Occup Environ Health 2003 Jun;76(5):331-338.
7. WorkSafeBC Report, Occupational Diseases in British Columbia, 1982-2010.
8. Kaufman JD, Cohen MA, Sama SR, Sheilds JW, Kalat J. Occupational skin diseases in Washington State, 1989 through 1993: Using workers' compensation data to identify cutaneous hazards. Am J Public Health 1998 July;88(7):1047-1051.
9. McCall BP, Horwitz IB, Feldman SR, Balkrishnan R. Incidence rates, costs, severity and work-related factors of occupational dermatitis: A workers' compensation analysis of Oregon, 1990-1997. Arch Dermatol 2005 Jun;141(6):713-718.
10. Cohen DE, Branaccio RR, Andersen D, Belsito DV. Utility of a standard allergen series alone in the evaluation of allergic contact dermatitis: A retrospective study of 732 patients. J Am Acad Dermatol 1997 Jun;36(6):914-8.
11. Cohen DE. Contact dermatitis: A quarter century perspective. J Am Acad Dermatol 2004 Jul;51(1):S60-S63.
12. Cohen DE, Rao S, Brancaccio RR. Use of the North American Contact Dermatitis Group standard 65-allergen series alone in the evaluation of allergic contact dermatitis: A series of 794 patients. Dermatitis 2008 Jun;19(3):137-141.
13. Menne T, Booms-Goossens A, Whalberg JE, et al. How large a proportion of contact sensitivities are diagnosed with the European standard series. Contact Dermatitis 1992;26:201-2.
14. Sheretz EF, Swantz SM. Is the screening patch test tray still worth using [letter]? J Am Acad Dermatol 1993;29:1057-1058.
15. James WD, Rosenthal LE, Brancaccio RR, et al. American Academy of Dermatology Patch Testing Survey: Use and effectiveness of this procedure. J Am Acad Dermatol 1992;26:991-4.
16. Nethercott JR, Holness DL. Validity of patch test screening trays in the evaluation of patients with allergic contact dermatitis. J Am Acad Dermatol 1989;21:558.
17. Marks JG, Elsner P, DeLeo V. Contact & Occupational Dermatology 3rd Ed. Mosby, Inc. 2002.

Table 1. Patch test reading: Morphology Codes[17]

+	Weak (non-vesicular) reaction: erythema, infiltration, possibly papules
++	Strong (edematous or vesicular) reaction
+++	Extreme (spreading, bullous or ulcerative) reaction
-	Negative reaction

Table 2. Study participant characteristics (n=100)

Mean age	42.5 years (SD ± 12.2 years)
Gender	Male 50%, female 50%
Number of allergens tested	107 (SD ± 29.0 allergens)
Professions (by category)	Trades (33%) Health care (21%) Cosmetology (20%) Restaurant and Food Industry (7%) **Other (all less than 5%)** Office Work Drivers Arts & Entertainment Plants and Forestry
Individual professions	Nurse 10% Mechanic 9%

	Esthetician 8% Hair stylist 8% Construction worker 4% **3%** Carpenter Dental assistant Driver Machinist Millwright **2%** Custodian / Janitor Dentist Laboratory technician Make up artist Massage therapist Office worker Server Welder Film industry

	1% Cabinentmaker, Wheel manufacturing plant, Window installer, Sprinkler fitter, Printing industry, Labourer sewage worker, Antique restorer, Bus spray painter, Caregiver, Dietician, Metalworker , Occupational therapist, Veterinary assistant, Chef, Coffee shop worker, Deli counter food handler, Pastry Chef, Butcher, Florist, Forester, Gardener, Computer technician, Quality assurance technician, Shoe salesman, Music teacher, Cashier, Actor, Musician

Table 3. Most common positive patch test reaction to a NACDG screening allergen

Allergen	**Frequency (%)**
Nickel sulfate	23
Fragrance mix I	14
Cobalt chloride	13
Thiuram mix	12
Methylchloroisothiazolinone/Methylisothiozolinone	8
Quarternium-15	8
Balsam of Peru	7
Fragrance mix II	7
Carba mix	6
4-Phenylenediamine	6

Table 4. Most common positive patch test reaction to a new screening allergen

Allergen	**Frequency (%)**
Fragrance mix II	7
2-Hydroxyethyl methacrylate	4
Compositae Mix	4
Tea Tree Oil Ylang Ylang Oil Carvone	3 3 3
2-Mercaptobenzothiazole Propolis Lidocaine Decyl glucoside	2 2 2 2
Iodopropynyl butyl carbamate Dibucaine Majantole Coconut diethanolamide Lavender oil Jasmine oil	1 1 1 1 1 1

Table 5. Occupation of participants included in the study referred for a WorkSafeBC Occupational Disease Service – Dermatology Assessment

Occupation	**Number of Referrals**
Mechanic	5
Machinist-Millwright	2
Esthetician	1
Dental Assistant	1
Chef	1
Printing Industry	1
Construction	1
Window Installer	1

Appendix A

Occupational Disease Services – Dermatology Assessment (WorkSafeBC Code 19207)

Occupational Contact Dermatitis
Standards for Comprehensive Assessment

UBC Department of Dermatology and Skin Science

1. **Review of the referral letter and occupational hygienist's assessment** (this assessment should be included with each referral letter, including documentation of a site visit to identify any potential contact allergens).

2. **Review MSDS** of all substances that the worker may come into contact with plus additional research to identify possible allergens (this may include contacting the manufacturer and obtaining a list of proprietary ingredients that are not identified on the MSDS).

3. **Obtain samples of workplace materials and preparation of custom allergens** as identified through the review of the MSDS (prepare appropriate dilutions of the chemical being tested with the assistance of a chemist/compounding pharmacist).

4. **Initial consultation** which includes an intake history and physical examination.

5. **Application of the patch test allergens** during the initial visit (total number of allergens tested will be determined by the information collected during the intake history).

6. **Second visit** for removal of the allergens and a 48 hour reading.

7. **Third and final visit** for a 96 or 120 hour delayed reading and patient counseling on allergen avoidance.

8. **Preparation of a detailed report** with relevant patient history and physical exam findings, including allergens tested, positive reactions and allergen avoidance recommendations.