

Asthma and hairdressers

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Purpose of review

Hairdressers have an increased prevalence of respiratory diseases and are at high risk of occupational asthma. In this paper we aim to review the most recent findings in respiratory diseases related to the occupation of hairdressing to provide a background for management and prevention.

Recent findings

Recent studies have described several cases of occupational asthma and occupational rhinitis in hairdressers. Persulphate salts are the major causal agents. Sensitization to persulphate salts seems more related to an individual hypersusceptibility than to environmental factors. An underlying immunologic mechanism is strongly suggested but not definitively demonstrated. The diagnosis of persulphate asthma is based on the specific challenge, for which standardized methods have been described. Some data show the presence of respiratory disorders in an early stage in apprentices and demonstrate that after diagnosis a proportion of hairdressers with occupational asthma remain symptomatic despite cessation of exposure.

Summary

Careful medical surveillance is recommended for hairdressers and for hairdressing apprentices. Further studies are needed to evaluate the mechanism of persulphate asthma and to determine the relative role of individual risk factors compared with environmental factors in the development of the disease.

Keywords

diagnosis, epidemiology, hairdressers, occupational asthma, prevention

Introduction

Hairdressers are exposed to several reactive agents with potentially irritant and sensitizing effects on the airways and on the skin. Data from population and clinical studies have shown that these workers are at high risk of asthma and of occupational asthma and rhinitis.

The purpose of this paper is to review the most recent findings on epidemiology, risk factors, etiologic agents, mechanisms, diagnostic methods and prevention of respiratory diseases related to the occupation of hairdressing, in order to provide a background for management and prevention.

Epidemiology and etiology

After the first report by Pepys *et al.* [1], several studies have addressed the epidemiology of asthma and occupational asthma in hairdressers. The most recent papers report data from Europe [2[•],3–5,6[•],7[•],8^{••}] and from Turkey [9]. These studies differ considerably in sample populations, methods, diagnostic criteria, and epidemiologic variables.

In Sweden, a retrospective nationwide study based on self-reported symptoms collected by a postal questionnaire evaluated the incidence of asthma among all female hairdressers certified from vocational schools from 1970 to 1995 [2[•]]. The crude incidences of asthma among hairdressers was 3.5/1000 person-years; a higher incidence was found during active years as a hairdresser (3.9/1000 person-years) compared with the referents – women randomly selected from the general Swedish population (3.1/1000 person-years; incidence rate ratio (IRR) = 1.3; 95% confidence interval 1.0–1.6).

In Turkey, a questionnaire-based study in which occupational asthma was defined on the basis of self-reporting of work-related symptoms of asthma estimated a prevalence of the condition among hairdressers of 14.6% in 1996 [9].

In France, Iwatsubo *et al.* [5] assessed respiratory symptoms collected by questionnaire and lung function values in a sample of hairdressing apprentices evaluated at the beginning and during the last month of apprenticeship, and compared them to a control group of office apprentices. The incidence of respiratory symptoms was not significantly different between the two groups, while a significant deterioration of forced expiratory volume in 1 s (FEV₁) and FEF_{25–75} in hairdressing apprentices

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Abbreviations

HSA	human serum albumin
IRR	incidence rate ratio
SIC	specific inhalation challenge
SPT	skin prick test

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compared with office apprentices was observed. The authors suspected a healthy worker effect, more likely in apprentices exposed to sensitizing materials with irritant properties (such as persulphates in hairdressing apprentices).

In France, a national surveillance program based on voluntary reporting of occupational asthma from physicians (mainly occupational and chest physicians), known as Observatoire National des Asthmes Professionnels (ONAP), was started in 1996 to monitor the incidence of occupational asthma. Two recent papers have reported new cases of occupational asthma collected in the period 1996–99. In the first full year of sampling (1997) 5.2% of reported cases of occupational asthma were hairdressers [3]; in the period 1996–99 hairdressers made up 149 (6.8%) of the individuals with occupational asthma, with an incidence rate of 308/million [4]. These data show that in France hairdressers represented the third category of workers with the highest risk of occupational asthma, following bakers and pastry makers (683/million), and car painters (326/million).

In Belgium, a self-administered questionnaire distributed to pupils attending the last training year of their hairdressing school showed that 14.1% of future hairdressers reported having already suffered from asthma and 26.7% reported having had wheezing over the last 12 months. Thus, pupils were showing preliminary signs of asthma before entering into an active work life [10^{••}].

Baur and Latza [6[•]] reviewed the published statistics on nonmalignant occupational respiratory diseases in Germany; the source of the data was statistics of the Ministry of Labour and Social Affairs and of the federation of statutory accident insurance institutions for the industrial sector for the year 2003. The collected data showed 922 cases of obstructive airway diseases (including rhinitis) due to allergens, 59 of which were hairdressers, and 181 obstructive airway diseases caused by irritants or toxic agents, including a large percentage of hairdressers ($n = 27$).

In Norway, data obtained from the registry of the notifications of occupational respiratory diseases to the Labor Inspection Authority during the period 1995–99 showed an incidence of occupational asthma in hairdressers of 0.26/1000 person-years in females and 0.20 in males, but the authors suggest that the notification of occupational asthma by Norwegian physicians may underestimate the true incidence considerably [7[•]].

In the largest group of exposed hairdressers with work-related respiratory symptoms published to date, Moscato *et al.* [8^{••}] found that half of them suffered from occupational asthma, confirmed by specific inhalation

challenge (SIC), and that occupational asthma was associated with occupational rhinitis in 54.2% of cases.

Most recent studies agree that bleaching agents should be the first suspected cause of occupational asthma in hairdressers [4,8^{••}]. Persulphate salts are the most common components of hair bleaching. These compounds were the fifth most frequently suspected causal agents of all cases of occupational asthma reported to the ONAP (5.8% of total cases) [4], and the etiologic agent in 21/24 (87.5%) cases of occupational asthma in the sample of hairdressers evaluated by Moscato *et al.* [8^{••}]. In Sweden, hairdressers performing hair bleaching treatments or using hair spray more often had a slightly although not significantly higher incidence of asthma compared with more infrequent users [2[•]].

Hairdressers may also be exposed to several other substances able to produce respiratory symptoms (Table 1). Baur and Latza [6[•]] reported hair dyes as the second main trigger of the total cases of obstructive airway diseases caused by irritants or toxic agents. In the study by Moscato *et al.* [8^{••}], two out of 24 cases of occupational asthma were due to hair dyes, and one to latex.

Risk factors

Risk factors for asthma/occupational asthma in hairdressers have been considered in some recent studies [2[•],5,8^{••},9].

Atopy

An increased risk of occupational asthma was found by Akpınar-Elci *et al.* [9] in hairdressers with atopy and in those with symptoms of allergic rhinitis and conjunctivitis, and the incidence of several respiratory symptoms of asthma. In contrast, Albin *et al.* [2[•]] found that respiratory atopy had no effect on the risk of asthma in hairdressers, and atopy was not associated with persulphate asthma in the individuals studied by Moscato *et al.* [8^{••}] or by Munoz *et al.* [11^{••}].

Smoking

Albin *et al.* [2[•]] found a moderately increased asthma risk among nonsmoking versus smoking female hairdressers and Iwatsubo *et al.* [5] reported a link between smoking and the incidence of bronchial hyperreactivity in hair-

Table 1 Risk factors for allergic symptoms in hairdressers

Persulphate salts ^a
Reactive dyes ^a
Henna ^a
Latex ^a
Hair creams and gels
Hair sprays
Perfumes
Shampoos

^aEtiologic agents of occupational asthma.

dressers and office apprentices. By contrast, no effect of smoking on the risk of occupational asthma was observed by Akpinar-Elci *et al.* [9] or by Moscato *et al.* [8^{••}].

Work exposure

Albin *et al.* [2[•]] showed a slightly but not significantly higher incidence of asthma in hairdressers most often performing hair bleaching treatments or using hair spray compared with more infrequent users, and Akpinar-Elci *et al.* [9] found a higher risk of occupational asthma in high work intensity hairdressers. In the study by Iwatsubo *et al.* [5] no specific hairdressing activity was clearly related to the observed deterioration of lung function in hairdressing apprentices during the 3-year follow up. Moscato *et al.* [8^{••}] found no difference in the duration of exposure to bleaching agents before onset of symptoms in the two groups studies (sensitized versus non-sensitized), suggesting that sensitization to persulphate salts could be more related to an individual hypersusceptibility than to environmental factors, on the assumption that a similar duration of exposure had resulted in similar levels of exposure.

Mechanisms

Bleaching agents and particularly persulphate salts are the major cause of respiratory symptoms and of occupational asthma among hairdressers, as confirmed by SIC [12–17]. The mechanism of inducing asthma is not understood. Some studies suggest an immunologic mechanism, immunoglobulin (Ig)E dependent [17,18] or non-IgE dependent [19], while others report a nonimmunologic mechanism [12]. An underlying immunologic mechanism is strongly suggested but not definitively demonstrated.

The possible mechanism of persulphate salts in inducing occupational asthma is discussed in some recent papers. Munoz *et al.* [17] studied eight individuals with occupational asthma due to persulphate salts. The latent period between onset of exposure and the onset of symptoms as well as the type of response observed in the SIC (early in one patient, late in five, and dual in one) suggest an immunologic mechanism. Positive skin prick tests (SPTs) for persulphate salts in five (62%) patients with occupational asthma and negative SPTs in three nonexposed patients with asthma and in three healthy controls suggested that the mechanism might be IgE mediated. Furthermore, one patient experienced an anaphylactic reaction after SPT to persulphates. This event, along with a recent report of anaphylactic reactions following hair bleaching and patch testing with the hairdresser battery [20], as well as previous findings by our group of an anaphylactoid reaction to patch testing with ammonium persulphate [21] support the hypothesis of the involvement of an IgE-mediated mechanism.

By contrast, the findings by Moscato *et al.* [8^{••}] of negative SPT with persulphate salts in 14 patients with occupational asthma due to persulphate salts, confirmed by a positive SIC, cannot confirm an IgE mechanism in persulphate asthma.

Aalto-Korte and Makinen-Kiljunen [22] tried to demonstrate specific binding of IgE with RAST and immunospot techniques in five hairdressers with positive SPT to persulphate, with skin symptoms from contact with hair bleaches, and with respiratory symptoms (one case only). On using the immunospot technique, specific binding of IgE to human serum albumin (HAS)-conjugated ammonium and potassium persulphates was found in two patients. Specific binding of IgE to nonconjugated persulphates or pure HSA could not be demonstrated in these five patients. On RAST, specific binding of IgE to HSA-conjugated ammonium persulphate (0.5 PRU/ml, class 1) was demonstrated in one patient. No specific binding was demonstrated from the control sera.

Diagnosis of occupational asthma

Three recent papers [8^{••},11^{••},17] have focused on the diagnostic pathway of occupational asthma in hairdressers. Clinical history has been found to be highly suggestive in patients with persulphate asthma, however it is not sufficient for a definitive diagnosis, similar to other fields of occupational asthma [23]. Immunologic tests, such as SPT or assessment of serum-specific IgE, are of little use in the diagnosis of persulphate asthma, due to the lack of an evident underlying IgE-mediated mechanism [8^{••}] and lack of sensitivity and specificity [17]. The diagnosis of persulphate asthma is based on the SIC, which has been carried out with different methods, both occupational [1,12,13,24,25] and nonoccupational [15,16], most suffering from a lack of standardization.

Two recent papers have described more standardized methods. Munoz *et al.* [11^{••}] performed the test on consecutive days with increasing quantity of potassium persulphate mixed with lactose. The patient tipped the mixture from one tray to another in a 7 m³ challenge booth. The estimated concentration of persulphate in the air was between 1 and 6 mg/m³ [11^{••}]. The test proved specific, useful and safe in diagnosing occupational asthma due to persulphate.

In a recent study we described a new method of exposure to ammonium persulphate which consists of nebulizing a solution of ammonium persulphate in an inhalation chamber [8^{••}]. The method was designed and standardized in order to overcome two major pitfalls in currently used methods, for example lack of reproducibility, related to tipping substances from one shelf to the other by the patients themselves (occupational

methods), and costly and prolonged investigations, related to progressively increasing exposure over several consecutive days. The method was proved effective in distinguishing responders and nonresponders with the cutoff of a FEV₁ decrease of 20%. It was also proved devoid of any irritative effects in all patients (responders and nonresponders, with or without bronchial hyperreactivity) and safe, all bronchial responses, including the most severe, being progressive in their onset and promptly reversed after inhaled bronchodilator.

Management and follow-up

Complete cessation from exposure is the most effective treatment for occupational asthma [26]. Despite this measure, however, a proportion of patients with occupational asthma have persistent symptoms and nonspecific bronchial hyperreactivity [26,27[•]]. Munoz *et al.* [17] followed up eight patients with persulphate asthma (mean duration 38 months, range 3–120) for a mean duration of 18 months after diagnosis (range 6–36 months). All patients were advised to avoid exposure to persulphate salts, but only five had complete avoidance while three patients adopted protective measures. Except for one patient, all continued to have asthma symptoms and required medical treatment, confirming that in this category of workers a proportion remain symptomatic despite removal from exposure [26,27[•]].

Prevention

The results of the two interesting papers [5,10^{••}], which have shown the presence of respiratory disorders in hairdressing apprentices, focus on the topic of prevention of respiratory diseases in this field. Coppieters and Piette [10^{••}] concluded that it is necessary to inform young people during training years about potential occupational risks and that the search for allergic disease must be carried out as early as possible. Similarly, Iwatsubo *et al.* [5] highlighted the need for specific respiratory surveillance of these apprentices.

In occupational asthma an early recognition of the disease followed by prompt cessation of exposure increases the likelihood of recovery [26,27[•]]. In the series of hairdressers described by Munoz *et al.* [17] the latency time between the onset of symptoms and diagnosis was prolonged [mean months 38 (3–120)], and this could account for the observed unfavorable outcome of the disease. By contrast, in the paper by Moscato *et al.* [8^{••}] patients were seen in an early phase of their disease [median months 12 (6–24)] and this finding may explain the observed absence of impairment in respiratory function. These findings strongly suggest the importance of continuous medical surveillance in hairdressers, in order to detect any functional variation at an early stage and carry out appropriate intervention.

Conclusion

In the last 2 years hairdressers have received particular attention as a category of workers at risk for occupational respiratory diseases.

Studies published have demonstrated that hairdressers are at high risk of occupational asthma and that persulphate salts are the major causal agents. An underlying immunologic mechanism for occupational asthma due to persulphates is strongly suggested but not definitely demonstrated. The diagnosis of persulphate asthma is based on a specific challenge, for which standardized methods have been described. Published data show the presence of respiratory disorders at an early stage in hairdressing apprentices and follow-up data demonstrate that despite cessation of exposure a proportion of hairdressers with occupational asthma remain symptomatic after diagnosis. These findings highlight the need for medical surveillance for both these categories.

Further studies are necessary to determine the relative role of individual versus environmental risk factors in the development of the disease and to identify the mechanism of persulphate asthma.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 129).

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This paper shows that hairdressers represent a large percentage of cases of obstructive airway diseases due to irritants or toxic agents and stresses the importance of primary and secondary prevention in these workers.

- 7 Leira HL, Bratt U, Slastad S. Notified cases of occupational asthma in Norway: exposure and consequences for health and income. *Am J Ind Med* 2005; 48:359–364.

The authors underline the importance of early recognition of occupational asthma and of the reduction or cessation of exposure after the diagnosis.

- 8 Moscato G, Pignatti P, Yacoub MR, Perfetti L. Occupational asthma and occupational rhinitis in hairdressers. *Chest* 2005; 128:3590–3598.

In the largest group of exposed hairdressers with work-related respiratory symptoms published to date, the authors found that half of them suffered from occupational asthma, confirming that hairdressers are particularly at risk from developing occupational asthma and that persulphate salts are the major agents involved.

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