

Asthma associated with a circulating IgG antibody to *Calliphora* maggots

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Summary

The case report of an angler with delayed onset asthma, following fishing with *Calliphora* (Blue Bottle) maggots, is presented. The investigations showed that the symptoms were associated with the presence of a circulating IgG antibody to a crude water soluble maggot extract. The patient progressed to develop symptoms suggestive of immune complex disease.

Introduction

Asthma due to the inhalation of insect emanations has been recognized for many years (Stevenson & Matthews, 1967; Burge *et al.*, 1980; Menon & Das, 1977). Furthermore, there have been several reports of patients whose symptoms have been related to fishing bait (Buisseret, 1978; Frankland, 1981) and a positive skin prick test to the relevant larval extract has provided circumstantial evidence of sensitization. The time course of asthma related to fishing with maggots has suggested a delayed, rather than immediate, hypersensitivity reaction, though the mechanisms involved have yet to be determined. The present study describes the investigation of an angler whose symptoms were related to fishing with *Calliphora* (Blue Bottle) maggots.

Patients and methods

The patient was a 41-year-old, self-employed jeweller. He suffered from mild allergic rhinitis in the pollen season as a child, but had no family or previous history of asthma.

His symptoms started at the age of 38 years and were confined to the fishing season. He had experimented with several types of bait, but only developed symptoms when fishing with maggots. Symptoms usually commenced, within 1 hr, with itching of the hands which spread to the face and neck and was accompanied by urticaria. Four to six hours later, he experienced tightness in the chest with wheezing which progressively worsened until the early hours of the morning and then cleared by the following day.

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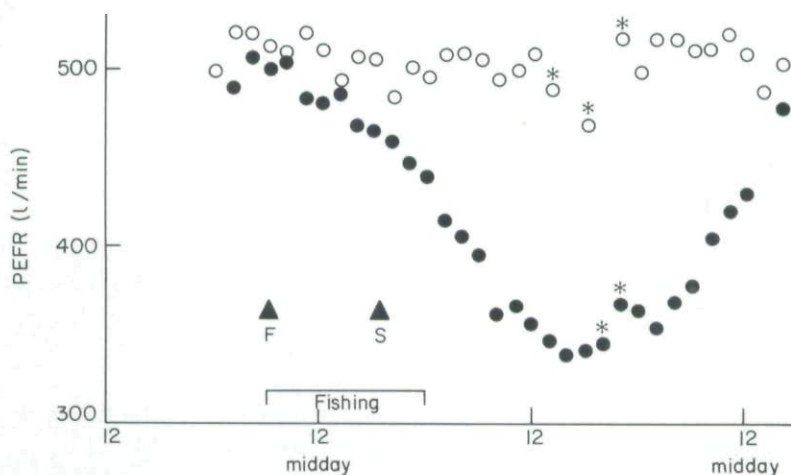


Fig. 1. Hourly peak flow rates are shown for the control days (O) and fishing days (●) for patient D.M.; F depicts the start of fishing and S the onset of respiratory symptoms. Each point is the mean of 5 days' recordings, except for the points with an asterisk which are the mean of 3 values.

The symptoms had failed to respond to a variety of antihistamines prescribed by his general practitioner.

The patient kept an hourly diary of his peak flow rate using a Wright mini peak flow meter for 24 hr prior to and after the commencement of his fishing. The average results of five consecutive records are summarized in Fig. 1. The results demonstrate a 4 hr delay before the peak flow started to fall, with the lowest values occurring during the night, 16 hr later.

The patient had normal serum immunoglobulins, including IgE. The blood eosinophil count was 918/dl. The patient had negative skin prick test to common allergens, including pollens, feathers, animal danders, house dust mite and fungi. However, a brisk immediate response was observed with an aqueous extract of crushed maggots with a 1–1.5 cm weal and 5 cm flare. However, the erythema and swelling persisted for 3 days.

Similar skin prick tests on asymptomatic anglers and control subjects proved negative for both the immediate and delayed response.

Full lung function tests were normal, but airflow obstruction was found 12 hr after the commencement of fishing. This was reversed by bronchodilators and the results are summarized in Table 1.

Identification of circulating antibody to aqueous maggot extract

Venous blood was taken from the patient prior to the skin prick tests and the serum stored at -70°C . The serum was then tested for a precipitating antibody using a series of passive haemagglutination assays.

Sensitization of human red blood cells. The method was a modification of that described by Jondl & Simmons (1957). The supernatant of the maggot extract was initially dialysed extensively against 0.15 M NaCl. Equal volumes of the extract (0.1 ml), $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ (0.1% w/v) and washed human O rhesus positive red blood cells were mixed with constant agitation and left for 15 min at room temperature. The reaction was then stopped by washing the cells three times with phosphate-buffered saline (pH

Table 1. Lung function tests. Values for forced expiratory volume in 1 s (FEV₁), forced vital capacity (FVC), total lung capacity (TLC) and residual volume (RV) are shown with the carbon monoxide transfer factor (T_LCO) before and after fishing; all values are corrected to BTPS and the response to bronchodilator is shown

	Before fishing	After fishing	After broncho- dilator
FEV ₁ (l)	3.95 3.80*	2.24	3.22
FVC (l)	4.82 4.83*	4.15	4.58
TLC (l)	6.04 6.95*	5.55	—
RV (l)	1.22 2.12*	1.19	—
T _L CO (mmol/min/kPa)	8.57 10.75*	8.28	—

* Figures predicted for the patient's age and height.

7.3). A 2% suspension of the sensitized cells was then made in 5 ml of 1% bovine serum albumin in phosphate-buffered saline.

Direct haemagglutination test. The sensitized cells were mixed in microtitre trays with varying dilutions of the patient's serum (heat inactivated at 56°C for 10 min). The results were compared with serum from an asymptomatic angler and are shown in Fig. 2. This confirmed the presence of a high titre antibody to the maggot extract in the patient's serum.

Indirect test. Equal volumes of the maggot sensitized cells and a subagglutinating amount of the test serum were mixed and incubated at 37°C for 30 min. The resultant 'Coombs' cells were then washed five times with the diluent and a 2% suspension made in the diluent.

Sheep antiserum to human IgG, IgA, IgM total immunoglobulin and the IgG subclasses (1, 3, 4) were obtained from the Immunodiagnostic Research Laboratory, University of Birmingham. A monospecific antibody to IgG₂ was not available.

The 'Coombs' cells were mixed with equal volumes of 1/10 dilutions of the antiserum in microtitre plates. The results are summarized in Figs 2 and 3, confirming that agglutination was due to an IgG antibody of the type 1 subclass.

Discussion

Although allergic symptoms are known to be associated with emanations from a variety of insects and their larvae, the exact mechanisms remain undetermined. The patient described here showed features of both immediate and delayed hypersensitivity and this was confirmed with a dual response to skin prick testing. It has been suggested that the delayed asthmatic response to antigen may be due to the presence of

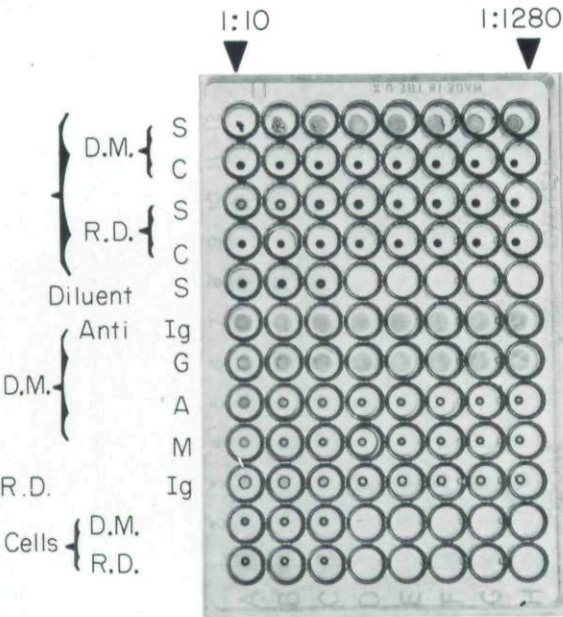


Fig. 2. Haemagglutination studies of maggot sensitized cells: the top four lines are the results for the addition of serum to maggot sensitized (S) and unsensitized (C) O rhesus positive cells for the patient reported here (D.M.) and an asymptomatic maggot fisherman (R.D.). The top line (D.M., S) shows haemagglutination to high serum dilutions for the patient; line 'diluent S' confirms that the diluent had no effect. The bottom half shows the effect of anti-immunoglobulin antibody on the sensitized cells with addition of a subagglutinating amount of the patient's serum ('Coombs' cells—control with no antibody for both subjects shown in the bottom two lines). Agglutination occurs only with the patient's 'Coombs' cells and anti-total-immunoglobulin (D.M. Ig) and anti-IgG (D.M. G).

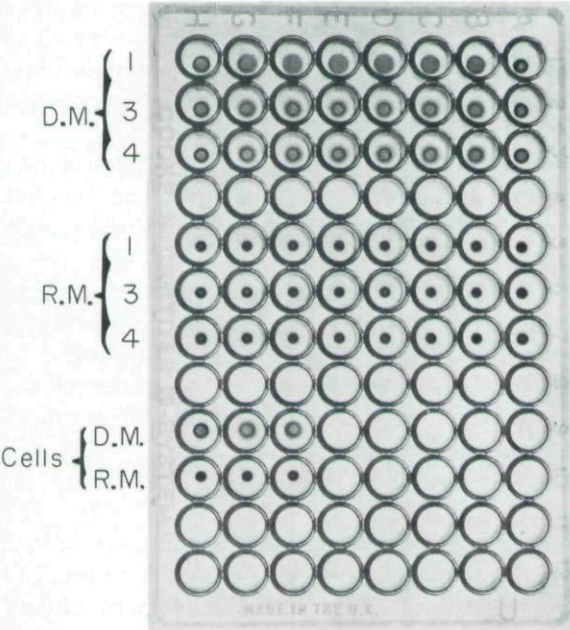


Fig. 3. Haemagglutination study (Ig subclass): the control 'Coombs' cells for each subject are shown in the bottom two rows. Only D.M. 1 showed a change from the control pattern with the occurrence of agglutination.

circulating antibody and the development of circulating immune complexes (Pepys, 1973), though evidence of such a mechanism is generally lacking.

However, the current study shows the presence of a delayed asthmatic response to a maggot antigen that is associated with a circulating IgG antibody. Such an association would be consistent with circulating immune complex disease. Other features of immune complex disease were absent in the patient described here, at his initial presentation. However, at the start of the current fishing season his symptoms changed and he developed features more suggestive of immune complex disease with fever (39°C), joint pains, loin pain and haematuria 48–72 hr after fishing. The asthma symptoms persisted for 3 days on this subsequent fishing trip. Unfortunately, it was not felt justified to risk another exposure to maggots in order to carefully monitor the process.

It is possible that many fishermen have antibodies of the IgE or IgG class to maggot protein. If so, the severity and persistence of symptoms in our patient suggest that a few subjects may develop a heightened immune response that could progress to the onset of more typical immune complex disease.

Acknowledgments

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