Viscosity patterns (poise) for sputum from patient (1), saliva from patient (2), and sputum from "normal" chronic bronchitic (3), tested from low to high shear rates (S-I).

on the expectorated material confirmed that it had the physical properties expected of sputum. Saliva produced by the patient was shown to have different rheological properties (see Chart).

Comment

It is unusual for patients with bronchitis or asthma to produce more than 25 ml of sputum in 24 hours (Ashcroft, 1965; Miller *et al.*, 1965). In 1948 Rey and Rubinstein described a case of "gelatinous cancer of the lung of bronchorrhoeic form," the dominant symptom being the steady production of a seromucous sputum of 1 litre a day. Two years later Bourgeois *et al.* (1950) described a case of uncontrollable bronchorrhoea, death resulting from "hydromucous inundation of the whole bronchopulmonary system." Rubinstein and Pilheu (1954) reported on three patients who presented with bronchorrhoea; two died within months from "bronchial carcinoma" and the third was still alive 15 years later. Also from Paris, Turiaf *et al.* (1958) thought that bronchorrhoea was a "manifestation of asthma without dyspnoea," bronchial mucosa biopsy findings and associated sputum eosinophilia accounting for this suggestion. Storey *et al.* (1953) reviewed

205 cases of alveolar cell carcinoma. Reference to the sputum was sufficiently precise to permit analysis in 100 patients, 27% of whom raised more than 90 ml of mucoid sputum a day as a late symptom. Indeed, in four cases more than 750 ml was expectorated daily. An association with pulmonary adenomatosis has also been recognized (Marner and Roin, 1966). Kourilsky (1960) claimed that the chief aetiological factors were infection, irritant agents, and allergy.

In investigating bronchorrhoea the aim is to distinguish sputum from saliva. This can be done at the bedside by using the clot test described above, but this should be supplemented by determining the rheological properties of the material. Assay of the neuraminic acid content is also helpful, sputum containing more than saliva (Reid, 1971).

The references cited indicate that bronchorrhoea may be a presenting feature of a pulmonary neoplasm. Apart from this association the major disabilities of the condition are the social difficulties of disposing of large quantities of sputum, increased risk of lower respiratory tract infection due to sputum retention, and the hazard of drowning in one's own bronchial secretion should the cough reflex be depressed. Sulphur crenotherapy had its advocates (Lageze and Passa, 1963) but now corticosteroid therapy is thought to be effective (Israel *et al.*, 1957). A prolonged low dose may be necessary to control the bronchorrhoea. Keal (1971) suggested that the sputum neuraminic acid level may be a guide to treatment, lower levels being associated with a better response. In the case reported here it was felt that steroid therapy was not indicated.

I would like to thank Dr. M. Abrams for his help, and for allowing me to report this case, and Dr. P. Mitchell-Heggs for his advice, helpful comments, and rheological studies.

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Cutaneous Lesions in Multiple Myeloma

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British Medical Journal, 1972, 4, 275-276

Extraskelatal spread from multiple myeloma, particularly with involvement of the spleen, liver, breasts, and kidneys, is relatively common, and has been reported in up to 70% of cases (Hayes *et al.*, 1952). Cutaneous involvement is unusual, and

when present is normally due to extension from an underlying bony lesion. Isolated skin nodules in myeloma are rare, and no examples are reported in the British literature.

Case Report

An 81-year-old woman presented with a two-month history of a tender, 2-in (5-cm) diameter tumour in the right breast, a smaller lump in the left breast, and multiple subcutaneous lumps in both upper arms. Six years previously she had undergone a sigmoid colectomy for carcinoma. Histology showed a tubular columnar cell carcinoma of the colon which had broken through the full thickness of the bowel wall, but sections of mesenteric lymph nodes showed no metastatic involvement. Thereafter she had no intestinal symptoms. The right breast lump was excised and histological examination showed an undifferentiated malignant tumour of fairly uniform spheroidal cells, which were suggestive of a poorly-differentiated myeloma. Serum immunoelectrophoresis

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showed an abnormal IgG which reacted with Bence Jones lambda antiserum only, an IgG monoclonal gammopathy. The serum total protein was 7.9 g/100 ml (globulin 4.1 g/100 ml), and urine electrophoresis showed a protein which reacted with Bence Jones lambda antiserum only. Other investigations were: haemoglobin 13.8 g/100 ml, W.B.C. 8,800/mm³, platelets 221,000/mm³, E.S.R. 31 mm in the first hour, blood urea 47 mg/100 ml, serum calcium 9.8 mg/100 ml, and serum alkaline phosphatase 9 K.A. units.

Soon after the mastectomy she developed a lump over the left occiput, and skull x-ray examination showed a soft-tissue swelling overlying a destructive lesion of the left occipital bone. There was also a destructive lesion in the distal shaft of the right tibia, with a partial fracture.

She was treated with intermittent courses of melphalan and prednisone (Alexanian *et al.*, 1969) with complete regression of the soft-tissue lump on her skull and upper arms. Between the courses of treatment, however, the lump in the left breast tended to enlarge, and the right breast lump reappeared. One year after the first presentation she developed increasing generalized swelling of the left leg, which was assumed to be due to venous obstruction, and a group of raised, smooth, mobile nodules above and below the left knee (see Fig.). X-ray pictures of the femur and tibia showed no evidence of underlying bone involvement. One of the skin lesions was biopsied, and sections showed a solid dermal nodule composed of closely-packed, poorly-differentiated myeloma cells. No amyloid material could be found when using birefringence of congo red, or by metachromatic stains. While there was no recurrence of the lesions on her skull and upper arms, the mass in her left breast became increasingly large and painful, and required a simple mastectomy to relieve the pain.

On each occasion that the patient was treated with a course of melphalan or cyclophosphamide there was lessening of the pain and reduction in the size of the skin lesions of her leg, but these tended to enlarge between courses. She developed increasing bone marrow depression, preventing further chemotherapy, and required further transfusions. There was increasing infiltration of the lumbar spine, pelvis, and mid-shaft of the left tibia and fibula so she underwent local radiotherapy, but with little improvement of her symptoms. She died 18 months after presentation.

Appearance of skin lesions on leg.

Comment

The cutaneous manifestations of multiple myeloma may be classified as follows: (a) cutaneous extension from an underlying intraosseous myeloma deposit; (b) isolated cutaneous nodules with no underlying bony lesion; (c) cutaneous manifestations of an internal malignancy not specific to myeloma—pyoderma gangrenosum (Jablonska *et al.*, 1967) and erythema giratum (Thivolet *et al.*, 1970); (d) rashes consequent but not specific to malignant disease—cutaneous amyloidosis, waxy papules, or nodules sometimes associated with widespread purpura (Cohen, 1967)—there may also be thrombocytopenic purpura, and Raynaud's syndrome associated with the protein disturbance; (e) opportunistic infections—herpes zoster and fungus infections; and (f) effects of drug therapy—toxic rashes, alopecia, and pigmentation.

The commonest skin lesion in myeloma is extraosseous extension to the overlying skin. Blufarb (1955) found nine in 88 cases of myeloma studied. The present patient did develop one such lesion on the left occipital bone, which regressed with chemotherapy. Isolated cutaneous metastases are much rarer and not described in the British literature. Hayes *et al.* (1952) reported one in 38 cases of proved myeloma at the Mayo Clinic, and Wuepper and MacKenzie (1969) found two in 57 cases. Lesions have been reported on the back (Piney and Riach, 1931), face, trunk, and extremities (Walzer and Shapiro, 1967), and chest (River and Schorr, 1966), and they may be plaques, nodules, or tumours, which may be widespread or localized.

In the present case there appeared to be some relation between the size of the skin lesions and the courses of treatment. The extraosseous extension from the occipital bone and the nodules in the upper arms regressed quickly with chemotherapy and never recurred, but fresh cutaneous lesions appeared on the left leg which only partially regressed with subsequent treatment, although there was no reappearance of older lesions. Wuepper and MacKenzie (1969) reported a case where skin infiltration developed while receiving treatment with melphalan. The cutaneous manifestations of myeloma do not appear to be associated with any particular myeloma protein; cases have been reported with IgG and IgA paraproteins.

I am grateful to Dr. H.-J. B. Galbraith, consultant physician, for permission to report this case, and Dr. P. J. Feeny, consultant dermatologist, and Dr. K. A. D. Turk, consultant pathologist, for advice.

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