rate (Westergren) was 9 mm in first hour. Serological tests showed strongly positive precipitins to "humidifier fever" antigens (baffle plate material, humidifier water, and the amoeba *Naegleria gruberi*). Pulmonary function tests showed peak expiratory flow rate (PEFR) 470 l/min; forced expiratory volume in one second (FEV_1) 3·00 l; forced vital capacity (FVC) 3·30 l; total lung capacity (TLC) 5·39 l; vital capacity (VC) 3·41 l; residual volume (RV) 1·98 l; functional residual capacity (FRC) 3·41 l; and carbon monoxide transfer factor (T_{LCO}) 6·4 mmol/min/kPa (19·1 ml/min/torr). All these were within her predicted normal range. On the evening of her first day back at work she experienced symptoms as described above. Her WBC rose to $17·1 \times 10^9$/l (17 100/mm³) with 94% neutrophils and no eosinophils, and the ESR was 39 mm in 1st h. PEFR fell to 335 l/min, with an FEV_1 of 2·75 l, FVC 3·35 l, TLC 4·54 l, VC 3·14 l, RV 1·40 l, FRC 2·83 l, and T_{LCO} 5·8 mmol/min/kPa (17·4 ml/min/torr). After the next weekend off duty tests before work showed PEFR 480 l/min, FEV_1 3·25 l, FVC 3·70 l, TLC 5·12 l, VC 3·52 l, RV 1·60 l, FRC 3·36 l, and T_{LCO} 6·9 mmol/min/kPa (20·7 ml/min/torr).

The humidifier was of the static spray type where mains water was chilled and recycled under pressure through sprays that humidified filtered external air. Baffle plates eliminated large droplets, and the outgoing air was warmed to the appropriate temperature by steam coils. Gel diffusion testing of samples of the water concentrated $\times 1000$ by air dialysis revealed antigens associated with humidifier fever using sera from previous outbreaks of the disease. There was a high degree of cross-reactivity between the sera and antigens from three outbreaks, suggesting a common source of allergenic material.

Sixty other theatre staff were interviewed, examined, and their sera tested by double gel diffusion against material derived from the humidifier water. The physician sought symptoms of humidifier fever, particularly in relation to the first working day, without knowing the results of serological tests. Chest radiographs were taken and pulmonary function tested, but not on any particular working day. Symptoms compatible with humidifier fever were reported in 10 cases. There was a highly significant relationship ($P < 0·001$ by χ^2) between symptoms and results of serological tests (table). Chest radiographs and pulmonary function were normal in all those with suggestive symptoms or serological findings, or both. Six of the remaining subjects had abnormalities related to pre-existing chest diseases.

Humidifier fever: symptoms in relation to results of serological tests

Symptoms	Serological tests		
	Negative/weakly positive	Positive	Strongly positive
Negative	34	12	4
Positive	1		9

Comment

Humidifier fever has been described in offices and factories.[2-5] We report the first recorded instance of humidifier fever associated with an operating-theatre humidifier. As in previous outbreaks,[1] the humidifier had a recirculating water system that allowed the build-up of allergenic material. Fungi, bacteria, and amoebae were isolated from the humidifier, and their characterisation is in progress. Since the humidifier is of a common design and used in other operating theatres the problems we have described could well be present in other hospitals and be contributing to morbidity among theatre staff. We recommend that such humidifiers be inspected and tested for the presence of humidifier-fever antigens. We have found it difficult to keep our humidifier free of antigens and a different type may have to be installed.

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Drug-induced haemolysis and fast haemoglobin A_1 in diabetes mellitus

Measurement of the fast components of haemoglobin A_1 (HbA_1) has created a new dimension in the assessment of blood glucose control in diabetic patients, because abnormally high values reflect either intermittent or more constant hyperglycaemia during the life of the red cell.[1 2] Although haemolytic anaemia is known to cause falsely low HbA_1 values as a result of increased red cell turnover,[3] it is perhaps not appreciated that even minor degrees of drug-induced haemolysis may have similar effects. We report the case of a chronically hyperglycaemic diabetic who had normal HbA_1 values associated with haemolysis induced by dapsone.

Case report

A 48-year-old diabetic man, whose disorder was well controlled by diet and glibenclamide 10 mg daily, attended the dermatology clinic in 1973 on account of dermatitis herpetiformis. Treatment with dapsone 100 mg three times a day was started. The haematological findings a month later and at subsequent visits are shown in the table. The patient returned to the diabetic clinic in 1978 because symptoms of uncontrolled diabetes had recurred while taking glibenclamide 10 mg daily and dapsone 100 mg twice daily. The blood glucose concentration two hours after breakfast was significantly raised at 21·8 mmol/l (392·4 mg/100 ml) yet a normal fast HbA_1 of 4·2% was recorded (upper limit of normal 8·5%; Isolab microcolumn method).

Haematological findings in diabetic with drug-induced haemolysis

Date	Drug treatment (mg/day)	Haemoglobin concentration (g/dl)	Reticulocyte count (%)	Heinz bodies	Plasma glucose concentration 2 h after breakfast (mmol/l)	Fast haemoglobin A_1 (%)
25 Sept 1973	Glibenclamide 10, dapsone 300	14·7	5	Absent	10·5	Not estimated
12 March 1974	Glibenclamide 10, dapsone 200	14·7	3	Absent	2·5	Not estimated
31 Aug 1978	Glibenclamide 10, dapsone 200	13·7	3	Absent	21·8	4·2
13 Dec 1978	Glibenclamide 20, dapsone 200	14·6	4	Present	23·8	3·7

Conversion: SI to traditional units—Glucose: 1 mmol/l ≈ 18 mg/100 ml.

Despite increasing the glibenclamide to 20 mg daily, one month later the postprandial blood glucose concentration remained raised at 23·8 mmol/l (428·4 mg/100 ml) and the fast HbA_1 was only 3·7%. Although the reticulocyte count was raised on each occasion Heinz bodies were found only once and the patient was never anaemic (table).

Comment

Although dermatitis herpetiformis is associated with thyroid disease, villous atrophy, and an increased prevalence of parietal cell antibodies haemolysis is not a feature.[4] In a series of 42 cases given oral glucose tolerance tests only one patient was diabetic. Dapsone, sulphasalazine, phenacetin, and many other drugs in high enough doses shorten red cell life by overwhelming the intracellular mechanism for maintaining haemoglobin in the reduced state with consequent methaemoglobin or Heinz body formation. Damaged cells will be preferentially removed from the circulation, particularly by the spleen. Older red cells have a lower enzyme content and are more susceptible to chemical damage. Increasing glycosylation of haemoglobin proceeds throughout red cell life,[3] thus premature destruction of older red cells removes an undue proportion of glycosylated haemoglobin (HbA_1) as well as inducing a compensating increase in the output of young cells with low HbA_1 content. Both these factors tend to produce false low HbA_1 measurements in diabetics treated with such a drug or in people with congenital haemolytic states such as congenital spherocytosis. On the other hand, in acquired haemolytic states such as autoimmunity red cells are randomly destroyed so that only the second factor operates and a lesser reduction in HbA_1 values is to be expected.

The findings in this patient, who was never anaemic, show that altered red cell turnover profoundly influences HbA_1 values. Recent doubts about the reliability of this test in assessing diabetic control[5] indicate that further methodological and clinical evaluation of its

usefulness is necessary. Clearly, even minor degrees of haemolysis should not be overlooked.

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Oral mannitol: a simple and effective bowel preparation for barium enema

Bowel preparation for a barium enema usually includes inconvenient restriction of diet and unpleasant nights of diarrhoea and abdominal pain after taking cathartics. The subsequent radiographs are not always of the highest quality and sometimes have to be repeated. Since the osmotic diarrhoea induced by oral manitol affords excellent preparation for colonoscopy[1] and is usually well tolerated we thought it might also be a convenient and effective method of preparing the bowel for barium enema. We therefore carried out a trial comparing mannitol with our routine preparation.

Patients, methods, and results

Forty consecutive patients referred from medical and surgical outpatient departments and general practitioners entered the trial. They received routine preparation (preparation A) or mannitol (preparation B) according to whether they had their barium enema on odd or even number days of the trial. They were all examined during afternoon sessions by the same radiologist (ANK) using an identical technique. Preparation A comprised a low-residue diet for three days before examination with instructions to drink an extra pint (0·6 l) of fluid each day. At 9 pm on the evening before the enema 20 g magnesium sulphate dissolved in water was taken by mouth, followed at 11 pm by 45 ml castor oil and at 8 am the next morning by the insertion of a 10-mg bisacodyl suppository. With preparation B diet was unrestricted. Patients were instructed to drink at 7.30 am on the day of the examination one litre of 10% mannitol solution (BP), iced and mixed with fruit juice, within 30 minutes, and subsequently to drink as much fluid as they wished. On arrival at the radiology department each patient completed a questionnaire about bowel action and side effects associated with their preparation. A conventional barium enema followed by drainage of barium and replacement with air was performed and seven similar views taken in each case. The radiographs were then seen by a consultant radiologist who had no knowledge of the preparation employed and assessed as follows: grade I, no visible faeces; grade II, minimal faecal matter coating the bowel wall; grade III, small amount of material within the lumen but not affecting the diagnostic value of the examination; grade IV, gross faecal matter such that the films were not diagnostic—for example, small polyps could not be excluded. The mucosal coating was then graded as good, adequate, or poor and the films scrutinised for lesions.

The table shows that the quality of the radiographs obtained after mannitol preparation were significantly better than those after routine techniques ($P < 0.01$ by the χ^2 test with Yates modification for small frequencies). All patients had diarrhoea of about equal frequency in the two groups. Though the numbers were small, there were more side effects associated with preparation A. No patients had incontinence but more preparation A patients had considerable urgency. Nausea and vomiting were also more common after routine preparation, though equal numbers had abdominal pain.

Quality of bowel preparation for barium enema

Preparation	No of patients						
	Clearance grade				Coating		
	I	II	III	IV	Good	Adequate	Poor
A	3	7	6	7	14	7	2
B	14	2	1	0	16	2	0

Comment

Although rectal washouts and enemas can be given to outpatients,[2] the lack of any clearcut benefit[3 4] and the inconvenience and discomfort to the patient has prompted many radiology departments to prepare the colon by methods similar to our conventional method. Preparation with mannitol is quick and sodium loss is only moderate.[5] We therefore think it the preparation of choice for both quality of radiograph and comfort of the patient.

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Bacteroides infection in fibroids during the puerperium

Infection in fibroids is unusual but when it occurs it tends to be in the early puerperium.[1] We report two puerperal cases of fibroid infection with *Bacteroides fragilis*, a well-established causative agent of post-delivery endometritis.[2]

Case reports

Case 1—A 37-year-old primigravida first attended hospital on 17 December 1971 complaining of vaginal bleeding after three months' amenorrhoea. The uterine fundus reached the umbilicus and there were several small fibroids. A pregnancy test was positive. During her pregnancy the fibroids grew rapidly. On 28 June 1972 the fetus died in utero owing to placental insufficiency. Two days later a macerated female infant weighing 2·9 kg was spontaneously delivered. On manual removal of the retained placenta a huge fibroid mass was found communicating with the uterine cavity along the full length of its left wall. Three days after delivery the patient developed a persistent fever of 38-38·5°C. Ampicillin was given but she developed vomiting and diarrhoea with weight loss and cachectic appearance. Subacute obstruction supervened, and at laparotomy on 22 July a huge sloughing cystic mass was found densely adherent to the peritoneum and the colon. The mass contained 4·5 l of brown, faecal-smelling fluid. It was identified as a degenerating fibroid and a hysterectomy was performed. Subsequent recovery was uneventful. Anaerobic culture of the fluid gave a pure growth of *B fragilis*.

Case 2—A 35-year-old para 1+0 first attended hospital on 17 July 1978 at 11 weeks' gestation. An ultrasonic scan showed a normal gestation sac but the isthmus of the uterus was expanded by a fibroid 8 cm in diameter. Her further antenatal care was uneventful except that the fibroid grew to cause an unstable lie of the fetus. Spontaneous labour began at 38 weeks' gestation on 29 January 1979. At caesarean section a fibroid about 18 cm in diameter was found on the left side of the lower segment. A lower segment operation was possible and a healthy baby girl weighing 2·9 kg was delivered. Eight days after delivery the patient developed a fever of 37·8°C rising to 38·6°C. A scan showed cavitation in the fibroid mass. The next day she passed a large quantity of necrotic fibroid tissue which produced on anaerobic culture a pure growth of *B fragilis*. The patient was treated with metronidazole. Recovery was uneventful apart from the passage of further pieces of necrotic fibroid tissue over several days. On 2 May 1979 the patient was asymptomatic but the uterus was the size of a 14-week gestation owing to multiple small fibroids.

Comment

After delivery fibroids have a greatly diminished blood supply and tend to undergo ischaemic degeneration. This offers an ideal culture