of acute bronchiolitis which were a source of concern to the family doctor and the paediatrician alike. In Britain the frequency of severe infections produced by this virus may be greater in the industrial towns such as Newcastle (Andrew and Gardner, 1963), Sunderland (Crone *et al.*, 1964), Birmingham (Sandiford and Spencer, 1962), Bristol (Clarke *et al.*, 1964), and Glasgow (Ross *et al.*, 1964) than in country towns such as Cirencester (Higgins *et al.*, 1963, 1964).

The occurrence of the other virus infections may also vary in different parts of the country from year to year. In the latter part of 1962 parainfluenza type 1 was frequent in the North-west and in Cambridge (Banatvala *et al.*, 1964), but not in Cirencester, where type 2 was the commonest virus isolated during this period. But an accurate analysis of the relative importance of these agents in different parts of the country cannot be determined until standard methods of virus isolation are used, as isolation rates are difficult to interpret owing to the variety of techniques employed.

Respiratory viruses were rarely isolated in the absence of respiratory symptoms or from healthy people. Although the types of upper respiratory infection caused by the different viruses could not be readily distinguished, some agents were associated with definite clinical syndromes. R.S. virus was the main agent of bronchiolitis, the parainfluenza viruses of croup, and the adenoviruses of non-bacterial tonsillitis.

Although R.S. virus appears to encourage the proliferation of haemophilic bacteria in the respiratory tract, the interplay between viruses and bacteria in producing the clinical syndromes was far from clear, but it would appear that in infants and young children viruses can often produce severe clinical disease, and perhaps death, without involvement by larger micro-organisms.

Summary

During a two-year period from April 1962 to March 1964 396 viruses were found in the throats of 1,219 children with respiratory disease, and 87 viruses in the throats of 1,333 children with other diseases, admitted to Booth Hall Children's Hospital. Viruses were isolated from throat swabs by the direct inoculation of cell cultures kept in an incubator in the

admission-room. Respiratory syncytial virus and influenza and parainfluenza viruses were rarely found in cases of non-respiratory disease, while the majority of adenoviruses and picornaviruses isolated were also associated with respiratory diseases. Respiratory syncytial virus was isolated most often, being the cause of the large annual epidemics of bronchiolitis in infants in the Manchester area. This virus was the only one isolated which appeared to alter the respiratory bacterial flora appreciably. The necropsy findings in two fatal cases associated with this virus infection are also described.

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Cardiovascular, Metabolic, and Thermoregulatory Disturbances in Patients with Erythrodermic Skin Diseases

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Patients with generalized psoriasis, exfoliative dermatitis, and other widespread erythrodermic skin diseases often exhibit clinical signs of increased peripheral blood-flow, and Shuster (1963) drew attention to cardiac failure in such patients. Excessive heat loss from erythrodermic skin might be anticipated and hypothermia has been reported (Krook, 1960; Magnusson, 1960). It was felt that the nature of these serious complications merited further investigation, and this report presents measurements of cardiac output, peripheral blood-flow, basal metabolic rate, thyroid function, and pressor amine

excretion in patients with widespread erythrodermic skin conditions.

Patients and Methods

All 11 patients had been admitted to hospital with exfoliative dermatitis or generalized psoriasis (see Table III). The haemodynamic and thermoregulatory disturbances were studied in six patients; in three of these and in a further five patients the mechanism of the raised B.M.R. was investigated in greater detail.

Cardiac Output, Venous Pressure, and Plasma Volume.—The cardiac output was measured in the basal fasting state by a dye-dilution technique using an ear oximeter and a

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Cambridge recorder (Taylor and Shillingford, 1959). The dye, Coomassie blue (sodium anoxynaphthionate), was injected rapidly through a polyethylene catheter placed in the superior vena cava. To calibrate the inscribed dye curve an arterial blood sample was taken three minutes after the injection. Three to five measurements of cardiac output were done in each patient and the mean was calculated. Plasma volume was calculated from the concentration of dye in the three-minute sample and the known dose of dye injected. In four patients the catheter was then advanced into the right atrium and the pressure recorded using an Elema-Schonander electro-manometer with zero reference point situated 5 cm. below the sternal angle. The mean pressure was calculated to the nearest 0.5 mm. Hg from an electrically damped tracing. Finally, in cases 4, 5, and 6 the manometer was then connected to the arterial catheter and a Valsalva manoeuvre performed.

Peripheral Blood-flow.—The blood-flow through the hand and forearm was measured by venous-occlusion plethysmography (Fox, Goldsmith, Kidd, and Lewis, 1963). Water-filled plethysmographs were maintained at 32° C. for the hand and 34° C. for the forearm. Each blood-flow measurement was the mean of eight inflow records. Body temperature was measured with an aural thermistor. The patients rested for at least 45 minutes before the first blood-flow reading, and great care was taken to allay any possible anxiety. They reclined on a canvas seat with the lower part of the body immersed in a well-stirred water-bath at 34° C. In these conditions the body temperature of normal subjects is maintained without either marked vasoconstriction or vasodilatation. The bath temperature was then slowly raised until the patient's body temperature had risen by 1–15° C. Finally the bath temperature was quickly lowered to cool the patient. Blood-flow measurements were recorded at five-minute intervals throughout the test period. The results are compared with the corresponding values for 20 healthy adult males treated in a similar manner (Fox *et al.*, 1963). During heating, sweating was observed, using quina-zarine-starch powder.

Basal Metabolic Rate.—The B.M.R. was measured in the basal fasting state; the patients were sedated the night before. The result given in Table II is the lowest of either two or three readings obtained on consecutive days compared with the standards of Robertson and Reid (1952). In Case 1 the result was obtained on a readmission. In three patients the B.M.R. was measured again when the skin condition had improved.

Urinary Vanillyl Mandelic Acid (V.M.A.).—Urinary metabolites of adrenaline and noradrenaline were measured as V.M.A. by the method of Pisano, Crout, and Abraham (1962). Each analysis was done twice and duplicates agreed to within $\pm 4.0\%$. The results are the means of two 24-hour collections. V.M.A. excretion in nine adult patients with localized skin diseases ranged from 4.3 to 6.7 mg./24 hours with a mean of 5 mg. This agrees well with the normal range of 3.9–7.5 mg./24 hours (Georges and Whitby, 1964).

Urinary ^{131}I Excretion.—Thyroid function was measured by following the urinary excretion of an oral dose of 7.8–15 μC of ^{131}I . Urine collections were made 0–8 (a), 8–24 (b) and 24–48 (c) hours after the dose had been administered. The "T" ratio (Fraser, Hobson, Arnott, and Emery, 1953) for the diagnosis of hyperthyroidism was calculated from the ^{131}I excretion in the three collection periods from the formula:

$$T = \frac{a \times 100}{b \times (a + b + c)}$$

Results

Cardiovascular Findings

On admission all the six patients studied in detail had a raised jugular venous pressure with pitting oedema (Table I).

Cases 1, 5, and 6 had an increased cardiothoracic ratio, but the E.C.G. was normal in all cases. Right atrial pressure was increased in all five patients measured. Plasma volume was greatly increased in four of the six patients as compared with that predicted on a weight basis (42.1 ml./kg. body weight). The absolute cardiac outputs ranged from 4.5 to 8.7 l./min., which is the upper limit of the normal range (Wade and Bishop, 1962). The response to the Valsalva manoeuvre was normal in the three patients examined (Cases 4, 5, and 6). One patient (Case 1) developed a minor infection of the upper respiratory tract during her stay in hospital and concomitantly became orthopnoeic, with basal rales; there were increases in oedema and J.V.P., the heart enlarged to the anterior axillary line, and there was a loud diastolic gallop.

TABLE I.—Cardiovascular Findings on Admission

Case No.	J.V.P. (cm.)	Pitting Oedema	Cardiothoracic Ratio		Mean Right Atrial Pressure (mm. Hg)	Plasma Volume (litres)		Cardiac Output	
			Admission	Discharge		Observed	Predicted	L./min.	L./min./Sq.m.
1	3	+	0.60	0.54	—	3.9	3.4	6.7	3.6
2	6	+	0.48	0.44	—	4.4	3.3	5.0	2.6
3	4	+	—	—	4	3.6	3.1	4.5	2.4
4	3	+	0.48	0.42	5	5.4	2.8	8.2	4.7
5	3	+	0.64	0.51	3	3.5	2.5	8.7	5.3
6	4	+	0.58	0.48	5	5.3	2.3	6.4	4.2

Peripheral Blood-flow and Thermoregulation

Hand and forearm flows measured before body-heating and when body temperatures had been raised to 38° C. and 38.5° C. are compared in Table II with the corresponding values for the 20 normal subjects. Hand flows before body-heating were, with one exception, within the normal range, whereas forearm flows were always raised. Vasodilatation was delayed in Cases 2, 3, and 4, as shown by the small increase on warming to 38° C. compared with the marked response on raising body temperature a further 0.5° C. The forearm flows at 38.5° C. were larger in the patients than in the normal subjects. During heating visible sweating was absent or grossly diminished.

TABLE II.—Peripheral Blood-flow Measurements (ml./100 ml. Tissue per min.) and Body Temperature (°C.) Recorded Before Heating

Case No.	Before Body-heating			During Body-heating			
	Body Temp.	Hand	Forearm	at 38° C.		at 38.5° C.	
				Hand	Forearm	Hand	Forearm
1	37.7	35.2	14.9	48.3	20.7	—	—
2	36.7	7.3	7.6	9.5	15.0	13.5	20.3
3	37.6	1.6	10.5	5.3	10.7	18.5	21.9
4	37.0	12.3	13.0	19.2	22.1	46.6	35.4
6	37.2	9.2	13.3	28.2	22.0	39.6	33.0
Normal subjects	37.0	10.5	4.0	31.9	16.0	35.0	18.0
S.E.	± 0.04	± 1.2	± 0.3	± 1.3	± 1.0	± 1.2	± 1.1

One patient (Case 4) was examined during the acute phase (Fig. 1) and again during recovery (Fig. 2). During the first test he shivered until body temperature was raised, and shivering recommenced on cooling. The movements were not marked, did not involve either arm, and therefore did not affect the measurements. The delayed vasodilatation and increased forearm flow compared with normal subjects are shown in Fig. 1. During recovery there was no shivering and the vasodilatation corresponded more closely to the normal pattern (Fig. 2). Routine temperature recordings taken in the ward also showed evidence of thermoregulatory instability; six patients had temperatures of 36° C. or less for periods of at least 4 to 12 hours, and three patients had episodes of unexplained pyrexia. Case 4 had an oral temperature of 36.1° C. and was shivering on admission; he was put to bed and in 20 hours his temperature had risen to 38.1° C. The pyrexia lasted four to five days, but on three occasions when

he was allowed up body temperature fell rapidly and shivering restarted at temperatures above 37° C.

FIG. 1.—Case 4. Peripheral blood-flow test shortly after admission. There was no visible sweating. Shivering: ~~~~~ = present, ——— = absent. The inset graph gives the average response of the normal subjects for comparison.

FIG. 2.—Case 4.—Peripheral blood-flow test during recovery. There was no shivering. The onset of sweating is shown. The inset graph gives the average response of the normal subjects for comparison.

Metabolic Studies

The B.M.R. was raised in 9 of the 11 patients (Table III). At the time none of these patients had a pyrexia and none

TABLE III.—B.M.R., and ^{131}I and V.M.A. Excretion

Case No.	Age and Sex	Diagnosis	B.M.R. ($\pm$ % of Normal)	^{131}I Excretion (% of Dose)		V.M.A. Excretion (mg./day)
				0-48 hr.	"T"	
1	54 F	Erythrodermic psoriasis	+119	—	—	—
2	61 M	Exfoliative dermatitis..	+8	—	—	—
3	75 M	Erythrodermic psoriasis	+44	—	—	—
4	66 M	Exfoliative dermatitis..	+48	58.7	1.1	15.3
5	54 M	" "	+54	59.7	2.9	7.3
6	62 M	" "	+94	56.3	5.5	8.4
7	27 M	Erythrodermic psoriasis	+7	60.3	0.9	6.2
8	64 M	Exfoliative dermatitis..	+24	—	—	7.0
9	67 F	Erythrodermic psoriasis	+53	61.1	1.8	4.5
10	61 F	" "	+60	82.7	1.8	7.2
11	68 M	Exfoliative dermatitis..	+24	—	—	5.2
Normal values			± 13	37.6-68.7	2.7-10.0	3.9-7.5

was shivering. In Cases 4, 5, and 6 it was measured again during recovery and had fallen to -11%, +13%, and +36% respectively.

The 0-48-hour urinary excretion of ^{131}I and the "T" index of Fraser *et al.* (1953) excludes hyperthyroidism.

In five of the eight cases V.M.A. excretion was above normal or at the upper limit of normal on admission. Cases 4 and 6 were pyrexial during the collection period, and this may have influenced the results. With improvement of the skin condition in Case 4 the urinary V.M.A. fell to normal (4.5 mg./24 hours).

Discussion

Forearm blood-flows were much higher in the patients than in the normal subjects. It seems unlikely that this can be explained by any difference between the two groups such as age (Hellon and Clarke, 1959), and must be attributed to the skin condition. Despite the substantial increase in peripheral blood-flow, cardiac output was raised in only two out of six cases. It is possible to estimate roughly the effect of an increase in skin blood-flow on cardiac output if we assume that the flow through the forearm is representative of the average body skin flow (Fox and Edholm, 1963) and that the flow through other tissues and organs is the same in these patients as in the normal subjects. On this basis, for the normal subjects the total skin flow before heating would have been 1.4 l./min. whereas for Case 4 the corresponding value is 4.1 l./min., giving a difference of only 2.7 l. However, this calculation applies to the basal state, and when the demands of activity and thermoregulation are added the cardiac load may become excessive. Thus the calculated total skin flow of the normal subjects at 38.5° C. is 5.6 l./min., and that for Case 4 is 11.2 l./min. Although one patient had an acute episode of cardiac failure associated with an intercurrent infection, in most cases it was difficult to decide whether or not the patients had heart failure.

Inflammation of the skin can produce pitting oedema, and a raised venous pressure and slight cardiomegaly are not in themselves sufficient to distinguish heart failure from a high output state with hypervolaemia. Hypervolaemia has been previously reported (Shuster and Wilkinson, 1963), and some increase in plasma volume is to be expected in these patients as part of the physiological adjustment to an increase in peripheral blood-flow (Robinson, 1949). An abnormal Valsalva response, which is thought by some to be essential for the diagnosis of heart failure (Sharpey-Schafer, 1955), was not present in the patients tested.

Most of the patients had subnormal body temperatures at one time or another, and some had periods with a raised temperature. The results indicate a complex pattern of thermoregulatory disturbances. The main factors are: heat conservation is impaired by the inability to vasoconstrict the affected skin fully, and possibly also by a reduced sensitivity of the shivering reflex; heat elimination is impaired because of defective sweating, while the requirement for heat elimination is raised by the hypermetabolism. In short, the thermoregulatory reserve required to avoid both hypothermia and hyperthermia is reduced in these patients. The peripheral blood-flow studies also indicate that four of the five patients had their central "set point" for temperature regulation raised as in fever; body temperature was below the fever level, or, in other words, they were relatively hypothermic.

The B.M.R. was raised in most of the patients even at a time when their body temperatures were normal and they were not shivering. The ^{131}I excretion showed no evidence of hyperthyroidism, which is in agreement with a previous study (Krook, 1960). Hypermetabolism could result directly from the inflammatory reaction in the skin or indirectly as a result of repeated minor episodes of body-cooling, since Davis (1963)

has shown that this can stimulate non-shivering thermogenesis in man. Cold-adapted subjects also showed an increased calorogenic action of noradrenaline (Joy, 1962; Davis, 1963), so that the slightly raised V.M.A. excretions found in this study may be important. Shivering tends to disappear in the cold-adapted subject, and this may explain why all except one of our patients with a relative hypothermia failed to shiver.

These observations emphasize certain aspects of the management of these patients. Because of the reduced capacity to thermoregulate, with its attendant dangers of hypothermia or hyperthermia, body temperature must be accurately observed, using a low-temperature thermometer when indicated. Patients usually require more clothes and a warmer room than the average person, and the risk of hypothermia is obviously greatest during winter months and when they are treated at home, but even in hospital care is needed during treatment periods. If the patient develops a high body temperature steps should be taken to reduce it in order to avoid an excessive increase in the cardiac load. The aim should be to steer a course between the two extremes and keep body temperature close to normal. If the patient is seen to be shivering, complains of the cold, or has a subnormal temperature, the room temperature or his clothing should be promptly increased. The temperature at which he becomes comfortable and shivering ceases should be recorded and used as a guide to adjust his environment. Prompt treatment of the skin condition, usually with corticosteroids, is the best way of avoiding heart failure. The unexplained high mortality of patients with erythrodermic skin diseases may in large part be due to the haemodynamic and thermoregulatory problems we have discussed.

Summary

Haemodynamic studies on six patients with widespread erythrodermic skin conditions have shown marked increases in skin blood-flow equivalent to up to two-thirds of that seen in normal subjects when fully vasodilated by heat; there was a

considerable further increase in skin blood-flow when the body temperature was raised. All had a raised venous pressure with hypervolaemia, and in two patients the cardiac output was moderately increased.

Body-temperature regulation was grossly disturbed. Four out of five patients had either a fever or an elevation of the set point for temperature regulation with body temperatures below the fever level. The capacity to thermoregulate is greatly diminished in these patients, and hypothermia, which is an important risk, is related to the high skin blood-flow and inability of the skin blood-vessels to constrict fully.

The basal metabolic rate was raised considerably in 9 out of 11 patients. Radioactive iodine studies showed no evidence of hyperthyroidism, but there was a slight increase in vanillyl mandelic acid excretion. The hypermetabolism is probably mainly due to the abnormal skin metabolism, but the development of non-shivering thermogenesis may also play a part.

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Acute Infections of the Urinary Tract and the Urethral Syndrome in General Practice

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What is the significance of single or repeated attacks of infection of the urinary tract? Our knowledge of these infections comes mainly from studies of patients in hospitals (Wharton *et al.*, 1937; Jackson *et al.*, 1957; Winberg and Barr, 1960) and from post-mortem studies (Weiss and Parker, 1939; MacDonald *et al.*, 1957). In contrast, most infections of the urinary tract are diagnosed and treated at home by the general practitioner. It is therefore important to examine the natural history of these infections. We report a prospective study planned to investigate the type of infection occurring in general practice, the response to treatment with sulphafurazole (Gantrisin), and the incidence of recurrent infections.

Urologists often see patients who complain of frequency and dysuria without evidence of infection in the urine. The aetio-

logy of this urethral syndrome is obscure and has been attributed to an anxiety neurosis (Gray and Pingelton, 1956; Zufall, 1963). In this study we found that the urethral syndrome was common in general practice; many patients presenting with symptoms of infection had sterile urine. To assess the urethral syndrome these patients have been compared with the remaining patients with definite infection in the urine seen in the survey.

Methods

In New Zealand patients with acute infections in the urinary tract are often treated with a sulphonamide by general practitioners who do not have facilities for bacteriological examination of the urine. This study was designed to determine the deficiencies of treating patients in this way.

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