undeveloped. His intellect was well above average; indeed, he had passed his school certificate at the age of 15 years, some three months previously. The fields of vision showed a right homonymous hemianopia which was not quite congruous. A ventriculogram showed the third ventricle grossly displaced upwards. The upward displacement included a posterior part of the third ventricle, so that there was no obvious concave impression of a globular tumour (Fig. 2).

Operation was performed under general anaesthesia together with hypothermia to 28.6° C. A left frontal craniotomy gave access to a large craniopharyngioma, which when tapped yielded 40 ml. of fluid, the last 10 of which contained typical glistening crystals of cholesterol. The cyst seemed to be firmly fixed to its surroundings, but, in view of the experience of the previous case, the same manoeuvre was attempted—namely, the pulling downwards of the part attached to the hypothalamus and dissecting it off first. This manoeuvre was again successful in separating the cyst from the thinned-out floor of the ventricle, to which it was lightly adherent. Again it was possible in the terminal stage to remove the solid portion at the base. Post-operative progress was astonishingly smooth. The patient recovered consciousness three hours after operation; the maximum elevation of temperature was 102° F. (38.9° C.) and the blood pressure was steady. The only sign the chart showed of the usual hypothalamic disturbances that punctuate the post-operative course of these patients was a persistent tachycardia running up to 160 and lasting 48 hours. The pulse was regular. The skin throughout was well coloured and showed no sign of cyanosis. Electrolytes were normal, and, though there was again a mild degree of diabetes insipidus, it was easily controlled by the administration of larger quantities of fluid than normal.

The patient was very well four to five days after his operation and his visual acuity and visual fields returned to normal within 18 days.

Summary

A preliminary note is put forward to suggest an extension of the value of hypothermia in neurosurgical cases. In addition to the accepted advantages of lowered metabolism when arterial occlusion or prolonged hypotension is employed, there would appear to be a *prima facie* case for reducing the patient's body temperature when operations on the brain stem or diencephalon are contemplated.

Two consecutive cases are described of large craniopharyngioma completely removed; they illustrate the smooth post-operative course to be expected in operations under hypothermia.

We are indebted to Dr. Gilbert Hall, under whose care the second case was admitted, and to Mr. W. H. Biffen for technical help with the hypothermia.

REFERENCES

- Botterell, E. H., Loughheed, W. M., Scott, J. W., and Vandewater, S. L. (1956). *J. Neurosurg.*, 13, 1.
Inglis, J. McN., Biffen, W. H., and d'Abreu, A. L. (1954). *Lancet*, 1, 549.
Loughheed, W. M., Sweet, W. H., White, J. C., and Brewster, W. R. (1955). *J. Neurosurg.*, 12, 240.
Lundberg, N., Nielsen, K. C., and Nilsson, E. (1956). *Ibid.*, 13, 235.
Ralston, B., Rasmussen, T., and Kennedy, T. (1955). *Ibid.*, 12, 26.
Rosomoff, H. L. (1956). *Ibid.*, 13, 332.

The industrial advisory committee of the Ross Institute has issued a bulletin (No. 11) on iron-deficiency anaemia, prepared by Dr. R. FORD TREDRE, and its bulletin on tropical ulcer (No. 4) has been rewritten. These bulletins, and all other publications of the Ross Institute, may be obtained from the secretary, Mr. L. G. PONSFORD, London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1.

IMMUNITY TO DIPHTHERIA EVALUATION OF SCHICK TEST AS A PRELIMINARY TO IMMUNIZATION

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An investigation was carried out to determine the immunity to diphtheria of R.A.F. recruits, to assess the value of Schick-testing as a routine Service procedure, and to correlate the results of Schick tests with circulating antitoxin titres.

A total of 991 recruits from five recruit centres were Schick-tested in a survey which took place in March and April, 1956. Nearly all the men were 17½ to 18½ years old and belonged to the 5–6 years age group in 1943, when most children were immunized against diphtheria by local authorities. There was no geographical selection of the recruits at the different centres, though some selection by trade. It is just possible, therefore, that there may have been a slight social selection at the different centres. It is felt that the group as a whole was a reasonable cross-section of the young men of this country. Each volunteer had 5 ml. of blood taken by venepuncture and then a Schick test. All the Schick tests were performed and read by one person (P. J. S.).

The Schick Test

The materials used were Schick test toxin and Schick control fluid (a heated diluted toxin) prepared by Evans Medical Supplies, Limited. The dose of each was 0.2 ml., and this was administered intradermally, the test dose being put into the anterior aspect of the right forearm and control into the left. The Schick tests were read after 48–72 hours (first reading) and on the fifth, sixth, or seventh day (second reading). On each occasion the reactions to both test and control were recorded in the following way: 0=no visible reaction at all or merely a tiny red spot of 1–2 mm. marking the needle puncture. 1=a faint flush, barely discernible up to 15 mm. diameter. 2=a more definite flush

TABLE I.—Interpretation of First Schick Reading

Test	Control	Result
0	0	Negative (—)
1 or 2	0	Weak positive (w+)
3 or more	0	Positive (+)
1 or more	1 or more	Pseudonegative (ps—)
(both reactions equal)		
2 or more	1 or more	Pseudopositive (ps+)
(test reaction greater than control)		

TABLE II.—Interpretation of Both Schick Readings

First Reading	Second Reading	Schick Status
—	—	Negative
+	—	"
w+	—	"
w+	+	Positive
+	w+	"
w+	w+	"
+	+	"
—	w+	"
—	+	"
Either or both ps+ or ps—		Pseudoreactor

TABLE III.—Summary of Tests Performed

Recruit Centre	No. of Recruits Schick Tested	No. of Recruits whose Antitoxin was Estimated	Degree of Selection of Specimens for Antitoxin Estimation
1	202	193	No selection—all available specimens tested
2	198	184	Slight selection—some clear negatives and frank positives not titrated
3	191	159	
4	128	84	
5	272	79	Considerable selection—clear negatives and frank positives omitted
			Entirely selected—titrations confined to weak positives, pseudo-reactions, and discrepant first and second Schick readings
Total	991	699	

into which the fluid is injected cannot be guaranteed in the absence of great care and special training (Palmer and Edwards, 1953; Guld and Rud, 1953).

On the basis of the first reading a recruit was assessed according to Table I. Each recruit was similarly assessed at the second reading and then given a final reading of Schick status according to Table II. It will be noted that by this method of final assessment the first reading is ignored except for identification of pseudoreactors. The justification for this is discussed below.

Antitoxin Estimations

Diphtheria antitoxin titres were estimated at the Wellcome Research Laboratories by a modification of the Römer and

TABLE IV.—Summary of Schick-test Results

Schick Status	Negative				Positive				Weak Pos.			Total All Pos.	Pseudo-reactors	Unsatisfactory	
1st reading ..	—	w+	+	Total	+	w+	+	—	w+	—	Total	Total	Total	Total	Total
2nd ..	—	—	—	—	+	+	+	+	w+	w+	—	Total	Total	Total	Total
	579	22	2	603 (60%)	97	81	15	25	32	22	54 (6%)	272 (28%)	103 (11%)	13 (1%)	991

but less than 10 mm. or a faint flush over 15 mm. 3 = a very definite erythema of 10 mm. or over, with or without some induration, brown pigmentation, or desquamation. 4 = 3 but larger.

It should be emphasized that the grading was a fairly quick assessment made in about 5 to 10 seconds. The exact size of reactions was not accurately measured. It was considered unnecessary to do so, since a reaction just less than the arbitrary minimum size usually required for a positive was noted as a grade 1 or 2 reaction and so not lost as a negative. Further, to attempt an exact measurement of such a reaction seems a waste of time and is apt to give results a false appearance of scientific accuracy, since the constant factors involved in the test are themselves inevitably inaccurate—for example, the size of the inoculum cannot be measured very accurately and the exact layer of dermis

Sames (1909) method (Glenny and Llewellyn-Jones, 1931). A total of 699 sera were titrated. Some of these were on bloods selected after the Schick test results were known, but many were performed on specimens chosen at random (see Table III).

The results of the Schick tests are given in Tables IV and V. It will be seen that there is little difference between the findings at the five centres and that overall there were 60% negatives, 28% positives (consisting of 22% positives by the usual standards and 6% weak positives), 11% pseudo-reactors, and 1% unsatisfactory results, the latter due to men failing to appear for one or both readings of the test.

Results of Schick tests with their corresponding titres of circulating antitoxin for Centre 1 and the collected results from all centres are shown in Tables VI and VII, respectively. A full analysis of results at each centre is not given. Those from Centres 2 and 3, where selection of specimens for antitoxin estimation was negligible, are very similar to those from Centre 1, and the Chart shows the distribution of the total results from Centres 1, 2, and 3.

TABLE V.—Summary of Schick-test Results Grouped According to Recruit Centre (Percentages are Expressed as Whole Numbers)

Centre	Neg.	Pos.	W. Pos.	Total Pos.	Pseudo-reactors	Unsatisfactory
1	60%	25%	4%	29%	9%	2%
2	59%	19%	7%	26%	12%	3%
3	61%	24%	6%	30%	8%	1%
4	55%	26%	4%	30%	15%	0%
5	65%	19%	5%	24%	10%	1%

Schick Rates and Immunity

It is of interest to note that the men we have examined were schoolchildren of 5 to 6 years of age in 1943, when the immunization programme of schoolchildren was well under way. According to Brincker (1945) the peak of the

TABLE VI.—Results of Specimens from No. 1 Recruit Centre

Schick Status	Readings 1st 2nd		No. of Men with Antitoxin Titres (units/ml.)													Total
			< 0.001	0.001-	0.002-	0.004-	0.01-	0.02-	0.04-	0.1-	0.2-	0.5-	1-	2-	5-10	
Negative	-	-	0	1	7	27	12	10	18	14	9	6	5	1		110
	w+	-	1			2							1			4
Positive	-	w+			1	1										2
	-	+	1													1
	w+	w+	2			5	1									8
	w+	+	10	2	2											14
	+	w+	3				1									4
	+	+	25	1	1	1			1							29
Pseudo-reactors	ps+	+	1													1
	ps+	w+									1					1
	ps+	ps+	1		1	1										3
	ps+	-											1			1
	ps+	ps-									1	2				3
	ps-	+								1						1
	ps-	w+									1					1
	ps-	-							1	1	1					2
Unsatisfactory	ps-	ps-														4
	-	ps-							1	1	2		1			1
	Not read	ps-					1			1						2
	No readings		1													1
	Total		45	4	12	37	15	10	21	17	12	11	8	1	0	193

immunization campaign, as judged by the immunization returns of local authorities, was in 1943, and by 1945 there was a considerable falling off in its intensity. It is generally agreed that in recent years, for various reasons, there has been a marked decrease in the numbers immunized (Gray and Cartwright, 1952). Figures are given in the *Medical Officer*

The results, which show a Schick-positive rate of 28%, excluding pseudoreactors, seem to confirm this, particularly when it is remembered that this figure includes weak positives (20% of the total positives).

Goldsworthy and Wilson (1943) reviewed the literature up to 1942 and found Schick-positive rates varying between 30 and 80%, the majority being 50 to 60%. These surveys were almost all on young adults. Their own survey gave figures of 46% Schick-positive and was made on 335 young adults who had no history of either diphtheria or immunization. It is not stated what definition of a positive reaction was used. Cheever (1948) found an average of 34% Schick-positives among 18,000 U.S. naval recruits, but an analysis of these on a geographic basis indicated considerable differences between groups from different areas, ranging from 16 to 47%. Again, no details of the definition of a positive reaction were given. Thomas *et al.* (1940) found that 70% of university students from well-to-do families but only 36% of military youths from poor families were Schick-positive.

Liao (1954) recorded that among 3,000 U.S. military recruits in 1951 35% were Schick-positive (definition of positive was 10-mm. erythema with induration and negative was "no definite response"). Fraser (1952) tested 1,000 naval recruits aged 17-20 in this country, but gave no details of the definition of positive. He found 32% positive, 51% negative, and 17% pseudoreactors.

Antitoxin Titres and Immunity

The Schick level of circulating antitoxins has been variously regarded as being about 0.002 unit/ml. (Cameron, 1941), 0.004 unit/ml. (Greenberg and Roblin, 1949), and about 0.01 unit/ml. (Barr and Cunliffe, 1954). The workers quoted were not all using the same

Distribution of total results from Centres 1, 2, and 3.

(1946a, 1946b) for the percentages of children under 15 immunized during the years to 1945, and these vary between 50% and 67%.

Our survey has therefore been made upon a group of young adults who are likely to have had as good an immunization history as any similar group in recent years or any we shall have in the next 15 years at least.

Schick-testing materials. Our series would appear to support a level at about 0.004 unit/ml., since from Table VII 90% of 231 Schick-positives had titres of less than 0.004 unit/ml. and 91% of 359 Schick-negatives had titres over 0.004 unit/ml. Therefore if it is of value to divide a group of people into those who probably have less than 0.004 unit/ml. and those who probably have more than 0.004 unit/ml.

TABLE VII.—Total Collected Results from All Stations (Not Random Sample)

Schick Status	Readings 1st 2nd	No. of Men with Antitoxin Titres (units/ml.)													Total
		<0.001	0.001-	0.002-	0.004-	0.01-	0.02-	0.04-	0.1-	0.2-	0.5-	1-	2-	5-10	
Negative	- -	9	1	17	63	43	30	46	49	40	24	13	1		336
	w+ -	4			9	1					2	4	1		21
	+ -	1					1								2
Positive	w+ w+	14	3	4	7	1			1	1					31
	w+ +	59	10	4	2										75
	+ w+	8	1	2		1		1		1					14
	+ +	61	5	2	1			1							70
	- w+	9	4	5	3							1			22
	- +	11	1	4	2	1									19
Pseudo-reactors	ps+ +	2		1											4
	ps+ w+	1					1			1			1		4
	ps+ ps+	1		1	1										3
	ps+ ps-	1			1										12
	ps+ -	1			2			2	2	7	4	2	3	1	20
	ps- +			1				1							2
	ps- w+					5	1	2	1	5	1	2	6		1
	ps- -		1	1	1	1		2	3	5	4	2			34
	ps- ps-	1										1		1	20
	- ps-	1													2
Unsatisfactory	Not read ps-					1			1						2
	ps+ Not read								1						1
	- Not read		1			1		1							3
	Not read Not read	1													1
Total		185	28	42	93	55	33	54	61	62	46	26	12	2	699

ml., then the Schick test with the material used is a good one.

The value of a test giving the dividing line at as low a level as 0.004 unit/ml. has been discussed by Barr and Glenny (1951), and they gave it as their opinion "that before artificial immunization became general, when the population relied upon natural infection to stimulate immunity, the great majority of Schick-negative persons had high titres of antitoxin and most Schick-positives had none." A test, therefore, with a dividing line at 0.004 unit/ml. was quite satisfactory. They had found during recent years many people with antitoxin titres just around the Schick level, and to-day, therefore, Schick-negative reactors may nevertheless have titres the adequacy of which is doubtful.

The Chart indicates that our results agree with Barr and Glenny's findings. There are two peaks, and one is around the Schick level. Barr and Glenny were strongly of the opinion that a good level of circulating antitoxin as well as a good immunity were necessary for complete protection against diphtheria, and Barr and Cunliffe (1954) assumed that those with less than 0.01 unit/ml. were in need of boosting. Marshall (1950) discussed these points and suggested that the strength of the Schick-test toxin might be altered with advantage to give a positive reaction at a rather higher level.

Hartley *et al.* (1950) concluded, as a result of a study of outbreaks of diphtheria in two areas of Great Britain and its occurrence in non-inoculated and inoculated persons, that the incidence, mortality, frequency, and severity of complications bore a striking relationship to previous inoculation and to circulating antitoxin, though the correlation was not complete. They considered that unless "the proportion of the immunized population is kept up to the 75% level, protection against epidemic diphtheria cannot be reasonably assured," and they showed that clinical diphtheria could occur in those with as much as 0.02 unit/ml. of circulating antitoxin. Fanning (1947) described an outbreak in a community of children in which there was a 94% history of immunization and an 80% Schick-negative rate.

It is possible that a level of immunity such as we have found in R.A.F. recruits is adequate to prevent any major outbreak of diphtheria in this country, where the disease is now rare, but it must be remembered that our sample probably represents the peak of achievement of the immunization campaign. Furthermore, many overseas areas have a high diphtheria rate among the civilian population, and we believe it is important for the armed Forces to maintain immunity at a much higher level as a necessary part of their preparation for service anywhere in the world.

While use of test toxin at the present strength followed by immunization of positive reactors will leave some individuals imperfectly protected, our figures suggest that this practice will adequately increase the level of immunity to prevent epidemics. If it is assumed that immunization will raise the antitoxin level above 0.02 unit/ml., then after immunization of all Schick-positives, excluding pseudoreactors, only 55 (28%) of the 193 recruits at Centre 1 (Table VI) would have remained with less than 0.02 unit/ml., 6% with less than 0.004 unit/ml., and only 3 (1½%) with no circulating antitoxin. If in addition one takes into account the probability that the Schick test itself would stimulate a number of the 55 whose antitoxin titres were just less than 0.02 unit/ml. to produce more antitoxin (Barr and Parish, 1950), then probably approximately 80% of the recruits would be left with high titres (over 0.02 unit/ml.) and only 2 or 3% would be left without detectable antitoxin.

Weak-positive Reactors

It is important not to neglect the weak-positive reactions—that is, those we scored as 1 or 2. In our study of 53 weak-positive reactors—that is, first reading w+, second reading w+, or first reading—, second reading w+, 39 (74%) had less than 0.004 unit/ml., and from Table IV it will be seen that weak-positive reactors are 20% of our total positives. We strongly recommend that, with the reagents we used, the usual practice of defining a positive reaction as one at

least 10 mm. in diameter should be discontinued and that any flush extending beyond the needle puncture should be recorded as positive.

Comparison of First and Second Readings

Examination of Table VII shows that the second reading is a much more reliable index of immunity than the first. Of 41 who were negative at the first reading and positive or weak positive at the second, 34 (83%) had titres less than 0.004 unit/ml., whereas of 23 who were positive or weak positive at the first reading and negative at the second, only 5 (22%) had titres less than 0.004 unit/ml. We consider that these results justify the exclusive use of the second reading for the assessment of the Schick test apart from the recognition of pseudoreactors.

Pseudoreactors

It is well recognized that immunization of adults with the various preparations in current use is attended by undesirable reactions in a considerable proportion of cases and that a preliminary screening for sensitive subjects should be made by Schick-testing (Cockburn, 1947; Scheibel *et al.*, 1948; and many others). A study of the antitoxin titres of those recruits giving various pseudoreactions indicates that 70% of those showing a pseudopositive reaction at one or both readings and 79% of those showing pseudonegative reaction at one or both readings, were highly immune—that is, more than 0.02 unit/ml. There seems little point, therefore, in distinguishing between pseudopositive and pseudonegative.

It is true that consideration of both Schick readings may indicate pseudoreactors who have low titres of antitoxin. Those who were pseudopositive on each occasion and those showing a positive pseudoreaction followed by a strong positive all had low titres. That this is generally so is well recognized (Parish, 1954). In addition, there was a suggestion from our results that a pseudonegative of grade 3 or 4 at the second reading is associated with low antitoxin titres. There were four such cases in our series and all had low antitoxin titres (three were less than 0.001 unit/ml. and one between 0.001 and 0.002 unit/ml.). Though these points are of interest, they have little practical importance. The numbers are too few to worry about with regard to herd immunity, and in the event of an epidemic such people would be given a temporary passive immunity with antitoxin.

The possibility of inducing adequate immunity by minimal doses of antigen, insufficient to cause reactions even in sensitive subjects, is to be the subject of further work and a subsequent report. In the meantime we think that when concerned with herd immunity it is best to withhold immunization from all pseudoreactors. Here lies the importance of the first reading. Omission of the first reading would have missed 65 of the 102 pseudoreactors, and 11 of these would have been immunized, since they had become uncomplicated positive reactors at the second reading. Any administrative objection to conducting two readings should therefore be firmly opposed.

Summary

A total of 991 R.A.F. recruits were Schick-tested, and on 699 of them estimations of circulating diphtheria antitoxin were performed.

The comparatively low rate of Schick-positives (28%, comprising 22% "classical" positives and 6% weak positives) was in keeping with the fact that these recruits were schoolchildren when the diphtheria immunization of schoolchildren was at its height.

An analysis suggests that the herd immunity was below the desirable level for Service men, though possibly adequate for residents in this country.

Weak-positive reactions should not be ignored, since 74% of these reactors had less than 0.004 unit/ml. of circulating antitoxin.

It is strongly recommended that, with the reagents we used, any flush extending beyond the needle puncture should be recorded as positive.

To increase herd immunity only Schick-positives should be immunized, all pseudoreactors being treated as immune.

The second reading of Schick tests showed a closer correlation with the level of circulating antitoxin than the first, but the first must not be omitted owing to the danger of missing pseudoreactors.

It is possible, though of little practical value, to detect many of the pseudoreactors who have low antitoxin titres.

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REFERENCES

- Barr, M., and Cunliffe, A. C. (1954). *Monthly Bull. Minist. Hlth (Lond.)*, 13, 98.
 — and Glenny, A. T. (1951). *J. roy. Army med. Cps.* 96, 77.
 — and Parish, H. J. (1950). *Monthly Bull. Minist. Hlth (Lond.)*, 9, 97.
 Brincker, J. A. H. (1945). *Ibid.*, 4, 214.
 Cameron, G. D. W. (1941). *Canad. publ. Hlth J.*, 32, 412.
 Cheever, F. S. (1948). *Amer. J. publ. Hlth*, 38, 374.
 Cockburn, T. A. (1947). *Monthly Bull. Minist. Hlth (Lond.)*, 6, 131.
 Fanning, J. (1947). *British Medical Journal*, 1, 371.
 Fraser, P. K. (1952). *J. roy. nav. med. Serv.*, 38, 22.
 Glenny, A. T., and Llewellyn-Jones, M. (1931). *J. Path. Bact.*, 34, 143.
 Goldsworthy, N. E., and Wilson, H. (1943). *Med. J. Aust.*, 2, 349.
 Gray, P. G., and Cartwright, A. (1952). *Monthly Bull. Minist. Hlth (Lond.)*, 11, 26.
 Greenberg, L., and Roblin, M. (1949). *Canad. J. publ. Hlth*, 40, 112.
 Guld, J., and Rud, C. (1953). *British Medical Journal*, 1, 368.
 Hartley, P., Tulloch, W. J., Anderson, M., Davidson, W. A., Grant, J., Jamieson, W. M., Neubauer, C., Norton, R., and Robertson, G. H. (1950). *Spec. Rep. Ser. med. Res. Coun. (Lond.)*, No. 272.
 Liao, S. J. (1954). *Amer. J. Hyg.*, 59, 262.
 Marshall, M. A. (1950). *J. Pediat.*, 37, 620.
Med. Offr. 1946a, 75, 225.
Ibid., 1946b, 76, 64.
 Palmer, C. E., and Edwards, P. Q. (1953). *British Medical Journal*, 1, 363.
 Parish, H. J. (1954). *Antisera, Toxoids, Vaccines and Tuberculin in Prophylaxis and Treatment*. Edinburgh.
 Römer, P. H., and Sames, Th. (1909). *Z. Immunforsch.*, 3, 344.
 Scheibel, I., Tulinusi, S., Rasch, G., Bojlen, K., and Peterson, C. B. (1948). *Acta path. microbiol. scand.*, 25, 319.
 Thomson, S., Glazebrook, A. J., and Green, C. A. (1940). *J. Hyg. (Lond.)*, 40, 115.

NEPHROTIC SYNDROME ASSOCIATED WITH RENAL VENOUS THROMBOSIS AND BRONCHIAL CARCINOMA

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The recognition of an association between long-standing renal venous thrombosis and persistent albuminuria has existed for over forty years (Rowntree *et al.*, 1913; Shattock, 1913). Blainey *et al.* (1954) describe three cases of the nephrotic syndrome, in one of which renal venous thrombosis was confirmed at necropsy. They point out that, while in many cases the aetiology of the syndrome is obscure, it may be caused by interference with venous return from the kidney. Most cases—for example, Derow *et al.* (1939), Moschowitz (1948), and Bell (1950)—have shown involvement of the inferior vena cava.

Thrombophlebitis (often of migratory type) has been known to be associated with malignant disease since

Trousseau (1877) drew attention to its occurrence in visceral carcinoma. Williams (1954) describes three cases of thrombophlebitis migrans associated with bronchial carcinoma, and points out that up to 1951 Gross *et al.* found only nine such cases so associated.

The following case presents an association of the nephrotic syndrome, renal venous thrombosis, and bronchial carcinoma. The inferior vena cava was not involved.

Case Report

A fireman aged 39 was admitted to hospital on December 28, 1954, with a history of dull backache for a fortnight, followed a week prior to admission by marked swelling of

FIG. 1.—Chest x-ray film taken on January 28, after aspiration of chylopleurothorax.

the legs and feet, and moderate swelling of the face, hands, and abdomen. There had been oliguria, headache, and tightness of the chest for a similar period. His previous medical history was limited to chronic dyspepsia of about eight years' duration. A barium-meal x-ray examination in 1949 had shown chronic gastritis. There was no significant family history.

On examination his general condition was fairly good, with slight pallor and slight puffiness of the face, and marked pitting oedema of the whole of both legs. He had moderate ascites and the liver was just palpable and tender, but the spleen was not felt. There was no cardiovascular abnormality and his B.P. was 140/90. There were signs of fluid at the base of the left lung.

The following investigations were carried out during the week immediately following admission. Urine: protein ++++, with numerous hyaline casts and a few pus and red cells, and sterile on culture. Blood urea, 90 mg. per 100 ml.; urea clearance, 4.5% normal; total plasma proteins, 4.4 g. per 100 ml. (albumin 3 g., globulin 1.4 g.), A/G ratio 2.14:1; blood cholesterol, 310 mg. per 100 ml. A blood count showed: Hb, 119%; W.B.C., 11,400 per c.mm. (neutrophil polymorphs 87%, eosinophils 1%, lymphocytes 9%, monocytes 3%); E.S.R., 11 mm. at one hour (Wintrobe); normal morphology of red and white cells. Serum sodium 139 mEq/l.; serum potassium, 6.1 mEq/l.; serum chlorides, 101 mEq/l. Blood W.R. and Kahn tests negative.

He was given 2 pints (1,140 ml.) of dextran intravenously on January 3, 1955, with no diuretic effect, but repetition of a similar transfusion on January 8 resulted in a diuresis of 76 oz. (2.16 litres). A further 2 pints (1,140 ml.) of plasma was given on January 11, but caused no diuretic effect. In spite of these transfusions his total plasma proteins