

ACUTE GLOMERULONEPHRITIS IN INFANCY*

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Karsner (1908) described 'congenital nephritis' in an infant who died 45 minutes after a normal birth, and Lapage (1932) discussed acute haemorrhagic nephritis in an 11-day-old boy who died in a few days. Conrad (1938) gave a résumé of three infants with neonatal nephritis for which no cause was found. One infant died on the seventh day of life, but the others recovered. Generalized oedema, haematuria and albuminuria were common to all. The Kahn test was negative in one infant. Their births were normal and the ante-partum history of the mothers was uneventful. Acute glomerulonephritis in babies under 2 years old has been described. Smith (1946) reported acute glomerulonephritis, Wilms tumour and a horseshoe kidney in a 10-month-old boy and Blechmann (1950) described acute glomerulonephritis with uraemia in a 21-month-old baby, who made a complete recovery.

Various attempts have been made to analyse and classify nephritis in children. Wyllie and Moncrieff (1926) analysed 87 cases of juvenile nephritis in children between the ages of 2 and 10 years and divided them broadly into three groups: (1) acute haemorrhagic nephritis (22 cases with no deaths); (2) acute exudative nephritis (23 cases with six deaths); (3) chronic nephritis (42 cases with 12 deaths).

Aldrich (1930, 1931) examined 186 consecutive children with nephritis and placed them into three main groups. A subsidiary group included cases of subacute bacterial endocarditis, syphilis, tuberculosis and renal infantilism. Aldrich's groups are: (1) acute post-infective haemorrhagic nephritis (129 cases, 6.2% died); (2) chronic non-specific nephritis (24 cases, 54.2% died); (3) nephrosis (20 cases, 35% died); (4) other cases (13 cases, 4.6% died). The ages of the children were not mentioned. Rennie (1934) reviewed acute nephritis in 10 infants under 18 months old; five of them were below 1 year old, the youngest 4 months old. There were

seven deaths. No definite cause was found and syphilis was not a factor.

Guthrie (1936) studied nephritis in 46 children under 11 years of age, the youngest child being 15 weeks old. He noted that the acute types of nephritis predominated in children, in whom the renal lesion was usually mild and was rarely complicated by arterial disease. Burke and Ross (1947) reviewed 90 consecutive cases of acute glomerulonephritis in children between the ages of 4 months and 10 years. The commonest presenting symptoms were oedema (59.9%), gross haematuria (25.5%), abdominal pain (6.7%) and other symptoms, included vomiting, convulsions, dyspnoea and dysuria. Anaemia was a frequent finding.

The cause of nephritis is still not definitely known. There seems to be a relationship between acute glomerulonephritis in children and young adults and a preceding streptococcal infection. Dingle, Rammelkamp and Wannamaker (1953) and Wilmers, Cunliffe and Williams (1954) have identified most of the infections with group A haemolytic streptococcus type 12.

Yampolsky and Mullins (1945) described acute glomerulonephritis in a 2-month-old infant with congenital syphilis. This paper is a classical example of syphilis as a cause of glomerulonephritis in early infancy. Murray and Calman (1953) demonstrated that antibodies circulated in the foetal blood from birth, and these findings are important in any discussion on the cause of nephritis which is based on an antigen-antibody reaction. Brambell, Brierley, Halliday and Hemmings (1954) made several important observations on the transference of passive immunity from the mother to her young.

Bernheim and Gaillard (1951) described two important presenting features of acute nephritis in infancy: (a) the urinary syndrome, in which red cells and casts were found in the urine; and (b) the mimicry of other conditions, especially acute haemolytic anaemia, acute leukaemia and cardiac disease.

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Bernheim (1952) distinguished five main clinical types of acute nephritis in children, *viz.*, eclamptic, anuric, anaemic, cardio-pulmonary and nephritis with a neurotoxic syndrome. Ultimate prognosis should always be very guarded. These last two papers show the difficulty of diagnosis of nephritis in infancy due to its variable forms of presentation.

Doxiadis, Goldfinch and Cole (1952) have disproved some earlier work that 'proteinuria' was a normal physiological finding in infants during the first week of life.

In reviewing the literature it is clear that nephritis in children is usually a mild condition with ultimate recovery. There is often a history of an antecedent upper respiratory tract infection. No classification of the causes of nephritis in children under 1 year old could be found. The mention of a familial or hereditary factor in nephritis at any age is most uncommon. A study is presented here of two fatal cases of acute glomerulonephritis in members of the same family.

Case Reports

Case 1. The first child, a girl, was born on September 6, 1950. She was three weeks overdue and weighed 5 lb. 15 oz. at birth. The baby was normal after a spontaneous delivery following a trial labour. She was breast-fed for six weeks and then was weaned on to National dried milk due to the failure of lactation. During her last month of life, she had been having additional broths and sieved vegetables. She had never been given any teething powders and had had no previous illnesses. On February 20, 1951, she had a primary vaccination with a normal reaction.

The mother had been well throughout the antenatal period and there was no relevant family history.

On February 27, 1951, the baby was brought for examination because she had been vomiting and had passed some dark stools and urine. Ten days earlier the mother had noticed that her baby was not taking her usual quantity of feeds, *i.e.*, 3 oz. instead of 5 oz. At this time she had vomited once. Three days before examination the grandmother noticed that the baby was passing dark-coloured urine.

On examination, the infant, aged 5 months 3 weeks, weighed 17 lb. 4 oz., temperature (rectal) 100° F., pulse 200 minute, respirations 18/minute. The face and mucous membranes were strikingly pale. No oedema, petechiae or purpuric spots were present. The anterior fontanelle was slightly depressed. The examination of the sclerotics, ears, throat, neck, heart, lungs and nervous system was normal. The abdomen was not distended and the liver and spleen were not felt. No enlarged lymph nodes were palpable in the neck, axillae or groins. The urine was dark red and contained much albumin and many red blood cells.

CLINICAL COURSE AND TREATMENT. The baby was admitted to the cottage hospital on February 27 with

vomiting, and was given one-fifth normal saline by mouth.

On February 28 she was still a very pale infant, and retained no fluids given by mouth. She was given one-fifth normal saline subcutaneously.

Her blood group was ORh positive, and a blood count gave: red cells 1.82 m. per c.mm., Hb 33% (haemoglobin standard, Hb 100% = 14.8 g. %); white cells 10,600 per c.mm. (polymorphs 60%, lymphocytes 35%, monocytes 4.5%); few platelets. Urobilinogen was not increased.

On March 1 the baby was transferred to a general hospital. She was a very ill, dehydrated baby with pale grey lips. Her temperature was 101.8° F. A little 'dextrimaltose' was taken by mouth. The blood urea level was 268 mg. %. A blood transfusion of 120 ml. packed cells was given. On March 2 the blood urea was 238 mg. %, Hb 53% and the infant's colour had improved. On March 5 the red cells numbered 940,000 per c.mm., with nucleated red cells 24 normoblasts per 200 white cells. White cells numbered 10,000 per c.mm. (polymorphs 47%, lymphocytes 51%, monocytes 2%).

On March 6 the infant vomited three times, the vomit containing some altered blood, and a transfusion of 165 ml. packed cells was given. On March 8 the blood urea level was 336 mg. % and Hb 64%, the latter decreasing on March 10 to 60% and on March 13 to 42%. On March 14 the blood urea level was 392 mg. %, and a transfusion of 95 ml. packed cells was given. On March 15 the red cells numbered 3.76 m. per c.mm. Hb 76%, white cells 10,000 per c.mm. (polymorphs 68%, lymphocytes 31%, monocytes 1%), blood urea 442 mg. %, and on March 16 red cells 3.5 m. per c.mm., Hb 68%, platelets 177,000 per c.mm., blood urea 532 mg. %, and on March 19 blood urea was 650 mg. %, when a transfusion of 120 ml. packed cells was given.

On March 20 the infant was cyanotic with fixed, dilated pupils and had been vomiting altered blood. She died at 6.30 p.m.

NECROPSY. A necropsy was made on March 21, 1951. The body was that of a female infant of good physique with a pale and waxy-looking skin. No cutaneous haemorrhages were seen. There was slight oedema of the legs.

The brain was normal. The superior longitudinal sinus had not been injured by the fontanelle transfusions. The heart was normal in size, and its muscle was pale. There was no congenital abnormality. The lungs were well expanded and were a normal bright red. There was no pneumonia. A small amount of altered blood, mixed with bile, was found in the stomach. The liver showed several haemorrhagic spots on the peritoneal surface but the cut surface was normal. The spleen was firm in consistency and its cut surface appeared to be rather dark.

Both kidneys were slightly enlarged, dark red and showed some loss of definition between the cortex and the medulla. The capsule stripped easily, leaving a smooth mottled surface which was free from haemorrhage. A few small white triangular areas were present in the cortex. The renal veins were not thrombosed and

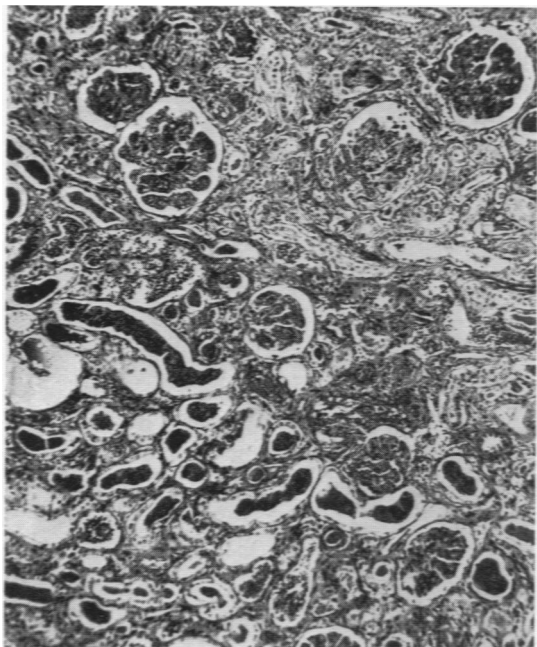


FIG. 1.—Variation in size of glomeruli; dilated convoluted tubules filled with coagulated eosinophilic material (haematoxylin and eosin $\times 60$). *Infant 1.*

the renal pelves were free from haemorrhages. No congenital abnormalities were found in the renal tract.

The bladder contained a small amount of turbid material, which gave a heavy culture of *E. coli*.

HISTOLOGY. The liver showed the presence of free iron and the sinusoids were slightly dilated. The spleen was normal except for excess free iron.

In both kidneys the renal capsule was not thickened and the aglomerular subcapsular zone was absent, though this might have been due to the age of the baby.

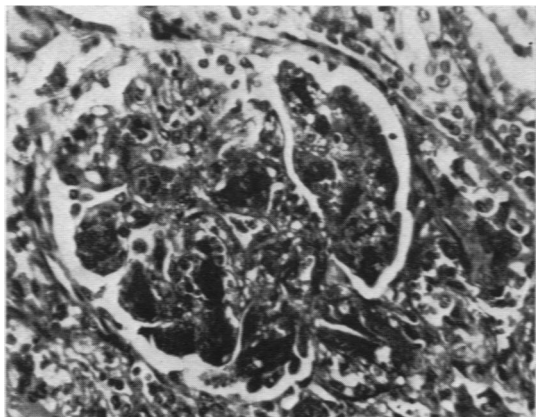


FIG. 2.—A glomerulus with hyaline thrombi and capillary dilatation (haematoxylin and eosin $\times 160$). *Infant 1.*

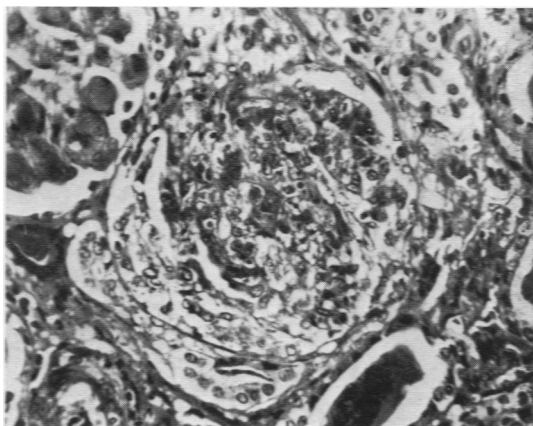


FIG. 3.—A glomerulus with early crescent formation (haematoxylin and eosin $\times 160$). *Infant 1.*

The glomeruli were variable in size (Fig. 1). Approximately half of them were normal, the others showed certain changes, which varied very much in degree. Many showed a pronounced capillary dilatation with hyaline thrombosis (Fig. 2), and in some there were small infiltrations with polymorphonuclear cells. The glomerular tufts were distorted and adhesions appeared between the tufts and Bowman's capsule. Proliferation of Bowman's capsule was seen and this had led to definite crescent formation (Fig. 3).

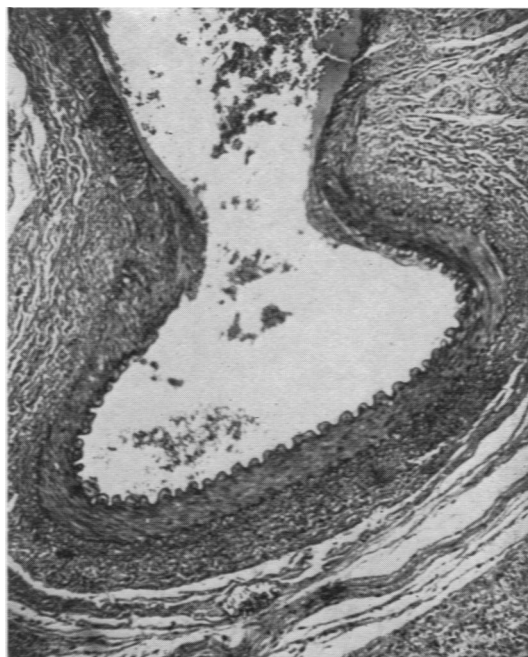


FIG. 4.—A large arteriole in which there is no pathological change (haematoxylin and eosin $\times 60$). *Infant 1.*

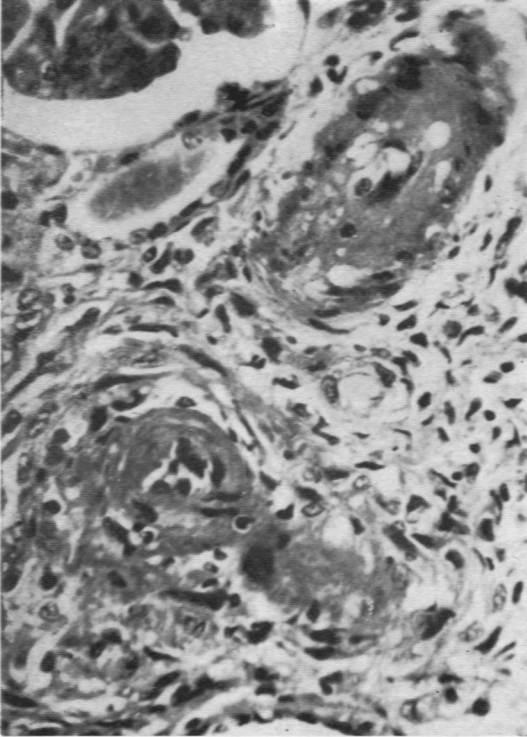


FIG. 5.—Three small afferent arterioles with fibrinoid necrosis (haematoxylin and eosin $\times 310$). *Infant 1.*

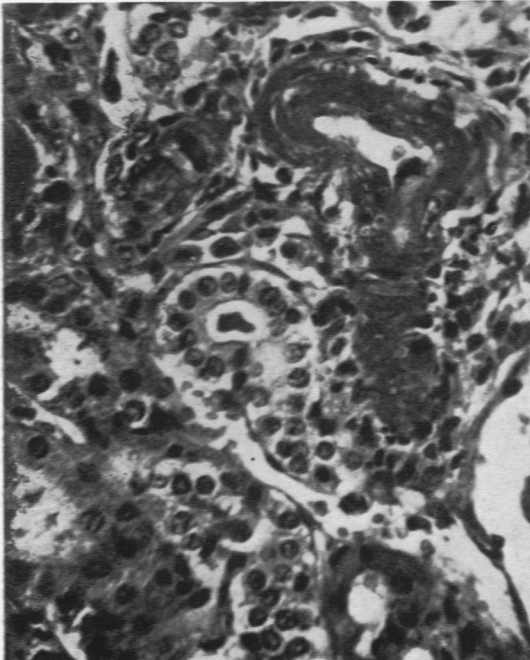


FIG. 6.—An afferent arteriole with fibrinoid necrosis (tangential cut) (haematoxylin and eosin $\times 310$). *Infant 1.*

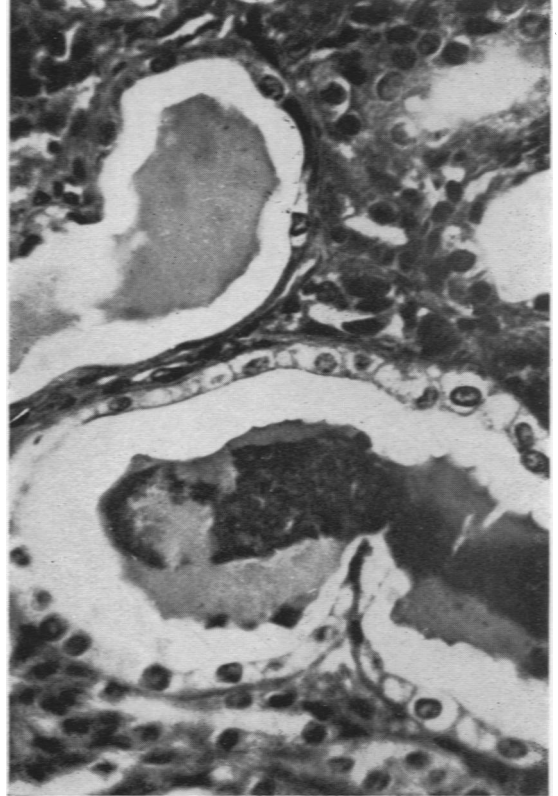


FIG. 7.—Convoluted tubules with 'casts' of eosinophilic material, which were a very prominent feature of this kidney (haematoxylin and eosin $\times 320$). *Infant 1.*

The medium- and large-sized arterioles were normal (Fig. 4). A generalized capillary dilatation was present throughout the kidney. Some of the afferent glomerular arterioles showed fibrinoid necrosis, which in some instances had completely filled the lumen of the blood vessels (Figs. 5 and 6).

A generalized tubular dilatation was present, which affected in particular the proximal convoluted tubules. A special feature of this lesion was the presence of amorphous eosinophilic (presumably) proteinous material, which filled the dilated tubules (Fig. 7).

The interstitial tissue was slightly increased and was oedematous. No inflammatory changes were seen in the renal pelvis.

The lesion was considered to be an acute glomerulonephritis, which was already passing into the subacute phase.

Case 2. The second child, a boy, was born on December 20, 1951. He was 17 days overdue and weighed 6 lb. 14½ oz. at birth. Signs of foetal distress were present just before spontaneous delivery. The baby was born in a state of white asphyxia, but soon recovered. He was breast-fed for six weeks and then weaned on to National dried milk due to the failure of

lactation. During the past two weeks, the baby had also been given rusks. He had had no previous illnesses and had not been vaccinated. The mother had been well throughout the antenatal period.

On May 20, 1952, the baby was seen because of his pallor and the blood-stained urine. On the previous day the mother thought that her baby looked pale. He had had four loose, orange-coloured stools. He was given one teething powder, which contained approximately 0.4 grain of calomel. Overnight the napkins were stained red.

On examination, the baby, aged 5 months, weighed 17 lb. 8 oz., temperature (rectal) 100.2° F., pulse 144 per minute, respirations 36 per minute. He was a vigorous, plump baby with a pale, lemon-coloured skin. The mucous membranes showed a fair colour. The tongue was clean and moist. There were no teeth. The tonsils looked a little enlarged and red. A few purpuric spots were present in both supraclavicular fossae and in the right groin. On examination, the heart, lungs and central nervous system were normal. The abdomen was normal; the liver and spleen were not palpable. There was no oedema. The urine was smoky red and contained much albumin and many red blood cells. The baby was immediately admitted to a general hospital.

CLINICAL COURSE AND TREATMENT. On May 20 Hb was 60%, white cells 12,000 per c.mm. (polymorphs 60%, lymphocytes 36%, monocytes 4%). The platelets were scanty. An occasional smear cell was present but there were no changes in the white cells to suggest a leukaemic condition. The blood group was A Rh positive. The direct Coombs test was negative. The urine contained 2% protein and numerous blood cells, and culture yielded a strong growth of *E. coli*.

On May 21 the blood urea level was 216 mg. %, Hb 42%, and a transfusion of 100 ml. packed cells was given. On May 22 the blood urea was 254 mg. %, Hb 58%, and the baby was more lively and had a better colour. The urine was less bloodstained.

On May 23 the blood urea level was 234 mg. %, Hb 49%, reticulocyte count 6.5%, and a transfusion of 115 ml. packed cells was given. On May 24 blood urea was 230 mg. %, and on May 25 there was a general clinical improvement. The purpura was fading. On May 26 the blood urea was 164 mg. %, Hb 74%, and they had fallen to 144 mg. % and 44% respectively by May 28. The Wassermann and Kahn tests were negative. On May 29 the blood urea level was 124 mg. %, Hb 44%, and a transfusion of 120 ml. packed cells was given. There seemed to be a general clinical improvement, though the baby was still very pale. The haemoglobin level fell less rapidly. The urine was still smoky. By May 30 the blood urea level had risen to 126 mg. % and Hb was 82%.

On June 2 the baby seemed well, except for occasionally vomiting feeds. There was no purpura. The urine was less smoky.

On June 3 the blood urea level was 150 mg. % and Hb 52%. The baby looked very pale. Blood pressure was 104/50 mm. Hg. Two small purpuric spots were

seen on the anterior surface of the left forearm and one spot on each ischial tuberosity.

On June 4 the blood urea was 148 mg. %, and on June 5 there was progressive anaemia, but otherwise the clinical condition was unchanged. The urine was a little more smoky.

On June 6, when the blood urea level was 200 mg. %, a transfusion of 100 ml. packed cells was given.

On June 7 the blood urea level was 161 mg. %, Hb 74%, and the baby was ill-tempered and his pallor was increasing. The feeds had been reduced to half-strength. The bowels were opened four times. The urine was moderately bloodstained. On June 8 the baby was very pale, but no oedema was found. Blood pressure was 132/80 mm. Hg. On June 9 the blood urea level was 236 mg. % and Hb 50%. On June 10 the condition was worse. There was slight oedema around the eyes. Five semi-solid, brownish yellow stools were passed. On June 11 blood urea was 280 mg. %, Hb 36%, and the baby was restless and cross. He vomited all feeds. He died suddenly at noon.

NECROPSY. A necropsy was held on June 12, 1952, when the body was that of a pallid, well nourished and normally developed male infant, with several fontanelle venepuncture marks.

The brain was oedematous, but no haemorrhage or any sign of inflammation was found. The meninges were not thickened and there was no haematoma in the longitudinal sinus.

The heart was normal in size and development. The ductus arteriosus and foramen ovale were closed. The lungs were oedematous, but otherwise were normal. The alimentary tract was normal. The liver was congested. The thyroid, thymus and adrenal glands were normal.

The kidneys were enlarged and pale and their cut surface showed a mottled pattern.

The bladder appeared to be normal. No congenital abnormalities were found in the renal tract.

HISTOLOGY. The liver showed a pronounced degree of central fatty change, of the type which is commonly seen in chronic venous congestion. Free iron was demonstrated in the liver sections. The spleen showed much blood pigment and a moderate excess of free iron.

Both kidneys showed similar lesions. The capsule was not thickened and no subcapsular aglomerular zone was present.

The Glomeruli. Most of them showed pronounced histological changes and only a few of them were spared. The affected glomeruli were swollen to two or three times their normal size (Fig. 8). Some glomerular tufts showed great capillary dilatation and there was a small amount of hyaline capillary thrombosis in them. In other tufts all the capillaries were completely thrombosed and contained a variable number of red blood cells, which were beginning to lose their definition (Fig. 9). Many of the swollen glomeruli showed adhesions to Bowman's capsule. Both early and fully developed crescent formation were seen (Figs. 10 and 11).

The Blood Vessels. Some of the afferent glomerular

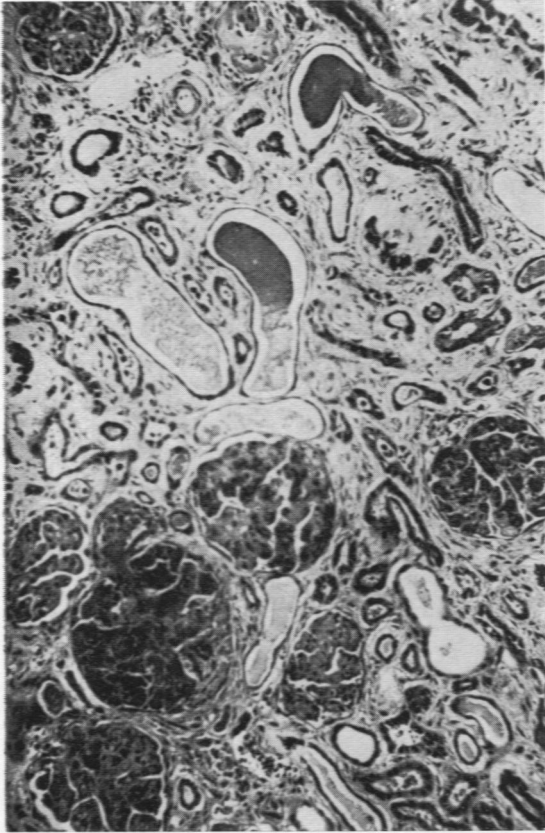


FIG. 8.—Capillary congestion, glomerular swelling and tubular dilatation (haematoxylin and eosin $\times 80$). *Infant 2.*

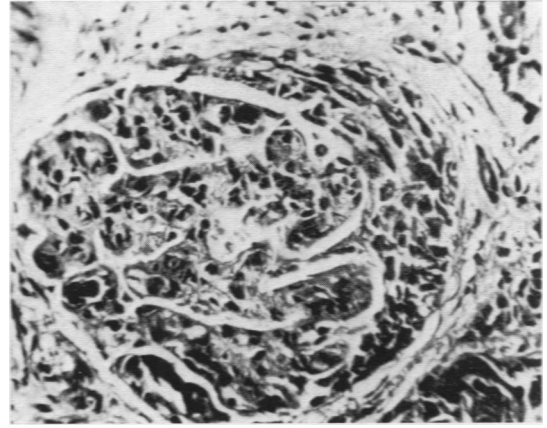


FIG. 10.—A glomerulus with crescent formation (haematoxylin and eosin $\times 160$). *Infant 2.*

vessels showed hyaline necrosis. Other arterioles showed an attempt at recanalization of the blocked lumen.

The Tubules. A generalized tubular dilatation was present, some tubules containing amorphous eosinophilic proteinous material. Other tubules contained fresh blood, altered blood or broken-down red blood cells (Fig. 8).

The interstitial tissue was oedematous and showed signs of early fibrosis.

All these changes were consistent with an acute glomerulonephritis which was passing into the subacute stage. In a comparison of Cases 1 and 2, the lesions appeared to be similar. However, it seemed that the lesion in Case 2 was an older one, for the glomerular lesions were more widespread with fewer normal glomeruli and the crescent formation was much more advanced.

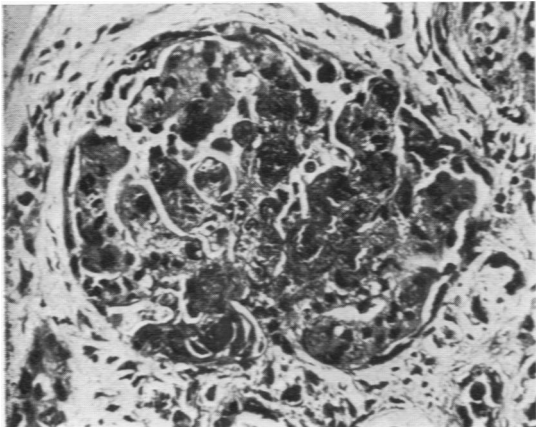


FIG. 9.—A swollen glomerulus with fully developed hyaline thrombi (haematoxylin and eosin $\times 160$). *Infant 2.*

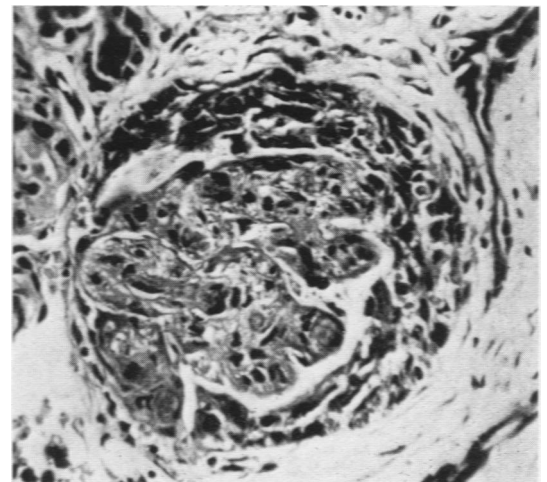


FIG. 11.—A glomerulus with a well formed epithelial crescent (haematoxylin and eosin $\times 150$). *Infant 2.*

Discussion

Familial Tendency in Nephritis. A familial tendency to nephritis is rarely reported (Eason, Smith and Buchanan, 1924; Hurst, 1923). Ernstene and Robb (1931) report a familial epidemic of acute diffuse non-scarlatinal glomerulonephritis in children. Other references include the following: Dickinson (1875), 11 cases of albuminuria in three generations; Kidd (1882), 10 cases of Bright's disease in three generations; Benson (1893), four cases of acute nephritis in four years in one family; Pel (1899), 19 cases of nephritis in three generations; Attlee (1901), three sisters with haematuria and albuminuria; Fergusson (1910), 10 cases of albuminuria; Thomson and Macauley (1920), four cases of acute post-influenzal nephritis in one family. Although familial cases of nephritis have been described, no cases in infancy have yet been found.

Heredity. Heredity may play some part in the cause of nephritis. Hoobler (1924) notes:

'The mother with eclampsia may give birth to an infant with diseased kidneys; or the children of such mothers, though born healthy, may have an inherent susceptibility to renal disease.'

Herrick (1909) states:

'There can be no question that the tendency to nephritis is at times transmitted. This is often a hereditary arteriosclerotic tendency, the kidney sharing in the general vascular change. The chronic forms may even appear in childhood.'

Zuelzer, Kurnitz and Charles (1951) remark on the frequency of renal vascular disease in the newborn, but do not agree that acute glomerulonephritis in infants is rare. They quote cases of renal cortical necrosis, acute glomerular thrombosis, thrombosis of the renal veins and acute haemorrhagic renal infarction.

Biochemical and Clinical Features in Both Cases. All the blood estimations were done on samples obtained by skin punctures of the heel.

Profound anaemia was a notable feature and the lowest haemoglobin levels were respectively 33% and 42%. The anaemia was normochromic and was believed to be the result of the severe renal damage. The histology showed that the primary lesion arose in the glomerulus and afferent glomerular arteriole. In both cases it was remarkable to see how quickly the haemoglobin level dropped in spite of repeated blood transfusion. The reason for this rapid fall has not been explained. It is appreciated that primary blood diseases may lead to secondary renal damage.

The cause of anaemia in renal failure may be due to blood destruction, blood loss in the urine, or

diminished blood formation due to a toxic action on the bone marrow. Platt (1952) suggests that the anaemia of renal failure may be a process of adaptation, since the renal blood flow is limited in quantity.

High blood urea levels in both infants were notable findings from the start of their clinical illnesses. On the second day in hospital the blood urea figures were respectively 268 mg. % and 216 mg. %. In Case 1 the blood urea level dropped to 238 mg. % on the third day, then the uraemia became progressively worse until the blood urea was 650 mg. % on the day before death. The levels in Case 2 were variable; at first there was a steep fall (the lowest figure was 124 mg. % on the tenth day), thereafter the blood urea began to rise until it was 280 mg. % on the day of death.

Blechmann (1950) quotes high blood urea levels in a case of acute glomerulonephritis with uraemia in a 21-month-old baby. The blood urea at the onset of the disease was 40 mg. %; it rose to a maximum figure of 277 mg. % and then settled to 16 mg. % on discharge from hospital.

In both infants the cause of death was uraemia due to acute renal failure. The histology showed gross glomerular lesions with widespread damage throughout the kidneys. It is pertinent to suggest that the blood transfusions may have contributed to the ultimate renal failure by overloading the circulatory system with extra fluid, though there was never any clinical evidence of pulmonary or generalized oedema. At necropsy Case 1 had a little oedema of the legs and Case 2 showed some periorbital oedema on the day before death.

Prognosis. The prognosis of acute glomerulonephritis in infants under 12 months old is difficult, since very few cases have been fully reported. Cases 1 and 2 fit into Ellis's type 1, though both babies died. The high blood urea levels made the immediate and ultimate prognosis difficult to determine, though high blood urea levels do not always lead to death (Blechmann, 1950). Paterson and Moncrieff (1949) state that 5% of children with glomerulonephritis may die within a few days of the illness, either from the infection or from cardiac or renal failure. Nevertheless, the prognosis of nephritis in children over 2 years old is good. Bernheim (1952) gave a guarded prognosis in acute glomerulonephritis in infancy, especially when it was accompanied by cardiovascular complications, a raised blood urea level, anuria and convulsions. This type of nephritis has at least a 50% mortality. Guthrie (1936) found that juvenile nephritis usually assumed a purer form than in adults, due to the absence of

TABLE
INTAKE AND OUTPUT

Date	Oral (oz.)	Intravenous (ml.)	Urine	Bowel	Vomit
Case 1					
Feb. 28		500 saline	+	1	altered blood +
March 1	11.5	120 blood	++	—	1 ++
2	25		++	—	altered blood ++
3	19.5		++	1 dark stool	—
4	14.5		++	—	—
5	13.5		++	2	1 +
6	18	165 blood	++	1	altered blood 3
7	7		++	1	—
8	13		++	3	—
9	18.5		++	—	2½ oz.
10	19		++	1	1½ oz.
11	18		++	1	1 ++
12	17.25		++	1	2
13	7.25		++	—	1 +
14	6.5	95 blood	+	—	1 +
15	17.5		++	1	—
16	16.5		++	—	1 ++
17	16.5		++	1	1 ++
18	11		++	1	1 ++
19	5	120 blood	+	1	—
20			+		Died 6.30 p.m.
Case 2					
May 20	8		+	—	—
21	18	100 blood	3½ oz. bloody	—	—
22	32		4 oz.	—	1 oz.
23	28.5	115 blood	8½ oz.	1	—
24	25		++	1	—
25	23		+++	1	—
26	27		+++	1	1
27	24		+++	—	5 oz.
28	32		+++	—	—
29	28	120 blood	2 oz.	1	2 complete feeds
30	28		+++	—	1 complete feed
31	30		+++	1	—
June 1	20		+++	—	—
2	28		+++	1	1
3	30		+++	1	—
4	28		+++	1	—
5	24		+++	3	2
6	12	100 blood	+++	4	2
7	18		+++	4	—
8	26		+++	3	1
9	25		+++	7	1
10	15.5		3½ oz.	5	Died 12 noon

arterial disease. Chronic sequelae were rare and the prognosis was good. There were 34 deaths in 477 cases of nephritis (mortality rate 7.12%).

Differential Diagnosis. Both cases are regarded as showing evidence of primary renal damage. The following signs were present: albuminuria, haematuria, oedema, pallor and gastro-intestinal symptoms.

In both infants the pallor was a very prominent feature and it was natural to suspect a primary blood disease, *e.g.*, acute haemolytic anaemia or acute leukaemia. However, the red and white cell counts were normal and there was no jaundice nor any clinical enlargement of the liver or spleen.

Mimicry is one of the outstanding features of nephritis in infancy. Cases 1 and 2 had a little gastro-intestinal upset as shown by vomiting and loose stools. Lévesque, Gouygon and Cousin

(1948) report a case of an infant who died from apparent heart failure; the necropsy showed the lesions of acute glomerulonephritis, although during life there were no signs of renal involvement.

Causes of Nephritis in Cases 1 and 2

Heredity. Both infants were born of the same parents, with an interval of 15 months between the births. They were nurtured under good living conditions. Neither infant had any history of previous illness. Both died before they were 7 months old. There was no family history of renal disease. Both parents were healthy and showed no evidence of transmissible disease, *e.g.*, syphilis.

Pathology. The primary lesion was in the glomeruli and not in the tubules. There was no evidence that drugs, especially mercury, ingested poisons, lead paint or aluminium caused this fatal

nephritis. The main clinical features of a rapidly fatal illness were albuminuria, haematuria and pallor. Gross anaemia was present and the blood urea levels were high. Severe renal damage must already have existed when the clinical condition was first apparent.

The main histological findings were a fibrinoid necrosis of some of the afferent glomerular arterioles and gross damage to many glomeruli. Some glomeruli showed pronounced capillary dilatation with hyaline thrombi in their lumina; other glomerular tufts were distorted by adhesions between them and Bowman's capsule. In some instances crescent formation was seen, a lesion which takes four to six weeks to develop. The proximal convoluted tubules showed a generalized dilatation. If this interpretation of the histology is correct, then the renal lesion is a primary glomerulonephritis with secondary changes in the tubules. It is possible that an afferent arteriolar spasm took place in these kidneys with a spread into the glomerular tufts. This was followed by fibrinoid necrosis and thrombosis. The subsequent dilatation of the paralysed blood vessels flooded the glomerular capillary loops with blood, thus causing the haematuria and albuminuria.

The blood pressure readings in Case 2 showed the probable existence of hypertension.

Allergy or tissue hypersensitivity to a toxin has been suggested as a cause of acute nephritis. In Cases 1 and 2 there was never any clinical evidence of a hypersensitive state, e.g., infantile eczema or urticaria. Moreover, there was no known antecedent infection. Both infants had been breast-fed and at 6 weeks were weaned on to National dried milk; they grew and gained weight.

In conclusion, the cause of this glomerulonephritis has not been determined and the following hypothesis has been suggested:

A reservoir of some 'renal toxin' was present at a vital period in the lives of these infants. The toxin might have been produced from the haemolytic streptococcus, group A, type 12. One or both parents might have been temporary carriers of such an organism. At 5 months of age the acquired immunity of the infants had been exhausted and the local conditions, especially in the kidneys, were just right for a 'tissue sensitivity' to be produced by a renal toxin. An acute nephritis developed in these susceptible infants, because they had not yet developed any active acquired immunity to the usual antigens, especially against the streptococcus.

Summary

A fatal acute glomerulonephritis is described in two successive infants of the same family, aged

respectively 5½ months and 6½ months. No cause was found.

Albuminuria, haematuria and anaemia were present and clinical oedema was minimal. High blood urea levels were found at the start of the clinical illness.

The main histological changes were in the glomeruli and in the afferent glomerular arterioles. Some glomeruli showed crescent formation, whilst hyaline thrombi blocked other glomerular capillary tufts. Many tubules were filled by an amorphous eosinophilic material.

Focal sepsis and tissue sensitivity are probably important factors in the cause of nephritis.

The prognosis at this age should be guarded.

The current paediatric literature is reviewed with special reference to nephritis in infants under the age of 1 year. The conclusion is reached that nephritis is rare at this age and little is known of the role of heredity or any familial tendency in this condition.

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