retardation, micrognathia, short neck with redundant skin on the nape, congenital heart disease, cryptorchidism, arch patterns on all 10 fingertips, and failure to thrive.

To our knowledge, the propositus represents the first reported case of a partial trisomy 18 in which the 18q material (18q12→18qter) has translocated to the short arms of a 21 chromosome. Moreover, the satellites of the 21 are included in the translocation. Thus, the patient's chromosome complement would be designated as 46,XY,-21,t(18;21)(18qter→18q12::21p13→21qter).

The translocation chromosome is interesting. Heretofore, translocation formation was believed to require two breaks. In this case, however, the 18q material appears to have adhered to the satellites of chromosome 21 indicating that only one break may have occurred. Satellite associations are a recognized phenomenon, and it may be that satellites also have an affinity for broken chromosome ends in close proximity. This idea can be verified by the use of 'sat-banding' (satellite banding) techniques in cases of translocations involving acrocentric chromosomes. Indeed, one other case with the inclusion of satellites in a translocation chromosome has already been published (Eiberg, 1974).

As with a number of techniques used in human cytogenetics, the mechanism involved in ammoniacal-silver 'sat-banding' is not known. Evidently, satellite composition and/or organization differs in some way from that of the rest of the chromosome. The satellites are thought to be composed of acidic protein (Matsui and Sasaki, 1973; Howell *et al.*, 1975) and DNA cistrons coding for rRNA (Henderson, Warburton, and Atwood, 1973) and/or possibly rRNA itself (Comings *et al.*, 1973). It remains to be seen whether it is one of these components, a chromosomal product functioning in nucleolar organization, or some peculiarity of satellite structure which reacts with the ammoniacal-silver stain.

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Renal function studies in an infant with 4p(-) syndrome*

Summary. An infant with the syndrome of deletion of the short arm of chromosome 4 is described. In addition, this child had renal insufficiency, which is found rarely in association with the 4p(-) syndrome. Previous reports of

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this syndrome have described only isolated gross structural abnormalities of the urinary tract. In the case discussed here, we present clinical and functional data which indicate that this patient had bilateral renal dysplasia.

The 4p(-) syndrome was first described by Wolf *et al* in 1965, and since then at least 25 cases have been reported in the world literature. This syndrome consists of growth deficiency, mental retardation, weak cry, microcephaly, hypertelorism, epicanthic folds, antimongoloid position of eye, ptosis of eyelid, strabismus, coloboma iridis, downturned mouth, micrognathia, cleft lip and/or palate, low set ears, pre-auricular tag or sinus, heart malformations, midline scalp defect, sacral dimple, anomalous genitalia, orthopaedic deformities, haemangiomas, and hypoplastic dermal ridges (Fryns *et al*, 1973).

Chromosome analysis shows partial deletion of the short arm of chromosome 4.

Because of the presentation of a patient to our hospital who had this syndrome and renal insufficiency, we reviewed the literature and found 4 cases with documented renal abnormalities (Taylor, Challacombe, and Howlett, 1970; Wilcock *et al*, 1970; Sidbury, Schmickel, and Gray, 1964; Giorgi, Ceccarelli, and Paci, 1965). These included one with bilateral hydronephrosis, one with absent left kidney, one with a normal and a hypoplastic kidney, and one with a normal and a 'non-functioning' kidney. These previous descriptions were purely structural, not functional, in nature. We performed renal function studies on our patient and report the results because of lack of such information in previous cases.

Case report

A Puerto Rican male was born at 38 weeks' gestation, without anaesthesia, to a 28-year-old mother with three previous full-term pregnancies and two spontaneous abortions. She had a urinary tract infection in the first trimester, treated with sulphafurazole. At birth, the child weighed 2.27 kg, length 45 cm, head circumference 32.5 cm, Apgar 5 at 1 minute, 7 at 5 minutes, requiring O₂, and intermittent positive pressure breathing. Physical examination showed hypoplastic eyelids, hypertelorism, oblique palpebral fissures, and disconjugate gaze (Fig.). He also had malformed, slightly low-set ears with preauricular sinuses, cleft lip and palate, and micrognathia. He had grade 3/6 systolic murmur, excess skin creases of phalanges, elbows, shoulder, gluteal area, and clinodactyly. There was hypospadias, but the testes were descended. Neurologically, the child was alert,

Fig. Appearance of the infant.

hypotonic, with abnormal vertical nystagmus. He was unresponsive to deep pain, had incomplete Moro reflex, absence of tonic neck, and gallant reflexes.

At age 2 days the child developed exposure keratitis, the result of shortened lids, and a temporary tarsorrhaphy was performed. At age 10 days he had an *Esch. coli* urinary tract infection and BUN 12.5 mmol/l (35 mg/100ml), serum creatinine 132.6 μ mol/l (1.5 mg/100ml), and metabolic acidosis. Intravenous pyelogram showed two functioning kidneys without obstruction. He was treated with maintenance bicarbonate and a 2-week course of ampicillin.

Because of renal, neurological, and ophthalmological abnormalities, the child was referred to the Clinical Research Unit of the Rose F. Kennedy Center.

Physical examination at 1 month of age: pulse 90/min, respiration 48/min, temperature 36° C, blood pressure 68 mmHg systolic by flush. Head circumference 34.5 cm, height 50 cm, weight 3.0 kg. General physical examination was unchanged. At neurological examination the child stared at the examiner; cranial nerves II–XII were normal except for disconjugate gaze. No nystagmus was noted. Motor tone was slightly increased. Deep tendon reflexes were brisk bilaterally in upper and lower extremities. He was now responsive to pain.

Laboratory investigations at age 1 month: complete blood count normal. Urinalysis: pH 5.8, albumin (-), glucose moderate, acetone (-). Urine culture was negative. Urine and serum amino acids were normal. Serum C1- 107 mmol/l, CO₂ 21 mmol/l, Na⁺ 137 mmol/l, BUN 8.2 mmol/l (23 mg/100ml), glucose 5.3 mmol/l (95 mg/100ml), urate 0.25 mmol/l (4.3 mg/100ml), creatinine 115 μ mol/l (1.3 mg/100ml), Ca 2.5 mmol/l (10 mg/100ml), phosphorous 1.7 mmol/l (5.4

mg/100ml). Electroencephalogram was normal. X-rays of bones and chest were normal. Chromosome study of the mother showed a normal female karyotype. The patient's karyotype was 46,XY,4p-.

The child is being maintained on sodium bicarbonate, orally, at a dose of 2 mmol/kg per day. At the time of discharge, the child was 4 months old, weighed 4.31 kg, and had a length of 55 cm.

Discussion

The patient's renal evaluation was done at age 2 months. The intravenous pyelogram showed excretion of dye bilaterally, but no evaluation of renal size or shape could be made. A voiding cystourethrogram was normal.

A 12-hour urine collection done under conditions of fluid restriction (Edelmann and Barnett, 1971) showed specific gravity 1.004, osmolality 186 mOsm/kg (normal > 800 mmol/kg), indicating impaired concentrating ability. Protein excretion was raised to 21 mg per 12 hours (normal < 10 mg per 12 hours), and there were 80,000 white blood cells per 12 hours (normal < 500 000 per 12 hours), and no red blood cells or casts.

Blood urea nitrogen was 6.74 mmol/l (18.9 mg/100ml) and serum creatinine was 128 μ mol/l (1.45 mg/100ml). Endogenous creatinine clearance, a measure of glomerular filtration rate, was reduced to 12.74 ml/min per 1.73 m². Expected glomerular filtration rate at this age by inulin clearance is 58 $\pm$ 14–77 $\pm$ 18 ml/min per 1.73 m² (Edelmann and Barnett, 1971).

Fractional phosphate reabsorption, at a normal blood phosphate level of 1.7 mmol/l (5.3 mg/100ml), was 38.1%. This deviation from the normal of more than 80 to 85% represents the renal tubular response to a severe decrease in filtration rate, and is not necessarily suggestive of a primary tubular defect in phosphate reabsorption.

In order to investigate distal tubular acidification capacity, an ammonium chloride load of 75 mmol/m² was given when blood pH was 7.32, blood CO₂ 14 mmol/l, and urine pH 6.25. This procedure is one of the routine diagnostic studies performed in patients with systemic acidosis of this type, and informed parental consent is always obtained before its use. Maximal response was obtained three hours after the acid load, at which time blood pH was 7.19, blood CO₂ 10.5 mmol/l, and urine pH 5.54. Urinary ammonium excretion rate was 17.8 mmol/min per 1.73 m², and urinary titratable acid excretion rate 17.0 mmol/min per 1.73 m². After a similar load, and at similar urine pH values, normal infants of this age have ammonium excretion rates of 30 to 40 mmol/min per 1.73 m² and titratable acid excretion rates of 20 to 30 mmol/min

per 1.73 m² (Kerpel-Fronius, Heim, and Sulyok, 1970).

Expressed in another way, this patient has NH₄ + excretion of 146 mmol/100 ml glomerular filtration rate (GFR) (normal 63 mmol/100ml), and titratable acid excretion of 140 mmol/100ml GFR (normal 43 mmol/100ml). Thus, associated with his decrease in whole kidney GFR, and presumably in functioning renal mass, our patient had a distinct decrease in excretion rate of NH₄ + and titratable acid, and incomplete urine acidification. However, as is seen in renal insufficiency, he had a supra-normal excretion of NH₄ + and titratable acid per functioning nephron.

A biopsy could not be obtained.

In summary this child had diffuse parenchymal renal disease. Glomerular insufficiency is indicated by pronounced depression of creatinine clearance rates. Decreased functioning tubular mass was shown by the defects in concentrating and distal acidifying capacity. A proximal tubular defect in HCO₃ – reabsorption was suggested by the presence of an alkaline urine (pH 6.25) at a time when blood total CO₂ was 14 mmol/l, with consequent acidification of the urine to pH 5.54 when blood total CO₂ was reduced to 10.5 mmol/l.

The prolonged renal insufficiency in this child, in the absence of obstruction or history of acute renal insult, and in the context of multiple congenital anomalies, is most consistent with bilateral renal dysplasia. This entity has not previously been described with the 4p(–) syndrome, nor have renal functional data been presented in other cases.

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A case of partial trisomy 3q

Summary. A case report on an infant with trisomy of the long arm of chromosome No. 3 is presented. The condition has not been described previously.

A case of presumptive trisomy 3 was reported by Sinha (1968) and a few cases of partial trisomy 3 have been reported (Clarke *et al*, 1964; Walzer *et al*, 1966; Aarskog, 1969; Rethoré *et al*, 1972; Sachdeva, Smith, and Justice, 1974). Among these cases, three cases of Rethoré and one case of Sachdeva were identified as the duplicated portion of the short arm of No. 3 chromosome by chromosome banding methods.

A case of partial trisomy 3q is presented and the clinical features and necropsy findings will be compared with cases of either partial or complete trisomy 3.

Case report

The propoita (Fig. 1a and b), a 1-month-old female, was born to a 26-year-old mother and a 28-year-old father. Gestation was full term with polyhydramnios. The parents were phenotypically normal but many abortions, stillbirths, and congenital malformations were found among the maternal relatives. A pedigree of the family is shown in Fig. 2 and the propoita is indicated by an arrow.

Birthweight was 2630 g, length was 48.5 cm, and head circumference was 41 cm.

The clinical features were as follows: square-shaped face, hypertelorism, small, malformed ears, prominent nasal bridge, cleft palate, micrognathia, short, webbed neck, wide-set nipples, camptodactyly, clinodactyly of the 5th fingers, hypoplastic nails, hypoplastic dermal ridge. She died at 32 days of age and necropsy showed hypoplastic cerebellum, cystic dilatation of 4th ventricles, renal cortical cyst, bicornuate uterus, and double vagina.

Cytogenetic studies

Chromosomal studies were performed on a culture of peripheral blood. The karyotype of the propoita was 46,XX,2p+ and the mother's was 46,XX,2p+,3p or q-. This karyotype suggested that the propoita was partial

FIG. 1a and b. Front (a) and side (b) view of propoita.