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P.K. 66, 06240 Samanpazarı, Ankara, Turkey

Telephone : (4) 311 22 53 - 324 23 26 - 324 49 90
Telex : 42999 tcsm tr
Fax . : (4) 311 22 53

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A REVIEW OF 43 CASES OF TETANUS NEONATORUM*

*Işık Yalçın MD***, Nermin Güler MD***, Rejin Kebudi MD****
*Ülker Öneş MD***, Nuran Salman MD*****

SUMMARY: Yalçın I, Güler N, Kebudi R, Öneş Ü, Salman N. (Department of Pediatrics, İstanbul University Faculty of Medicine at Çapa, İstanbul, Turkey). A review of 43 cases of tetanus neonatorum. Turk J Pediatr 34: 121-125, 1992.

Forty-three patients with neonatal tetanus admitted to the Infectious Diseases Ward of the İstanbul University Faculty of Medicine Children's Hospital at Çapa from 1982-1989 are presented. Thirty-two (74.4%) of the subjects were boys.

The overall mortality was found to be 60 percent and the mean incubation period 6.1 ± 20 days. The mean period between onset of symptoms and hospital admission was 1.7 days.

Thirty-nine (90.7%) of the 43 patients were unhygienic home deliveries and only two cases were delivered with a midwife in attendance. None of the mothers of the children in our series had been immunized with tetanus toxoid. The incidence of neonatal tetanus in Turkey is on the decline, but a fraction of the population, the so-called urban poor, is still at high risk for preventable diseases. Every contact an unvaccinated person has with a health care professional should be viewed as an opportunity for tetanus immunization. *Key words: tetanus neonatorum.*

Tetanus, a disease which can be prevented by active immunization, continues to be a serious threat to public health in many parts of the world. Its frequency varies widely from place to place and it is much higher in tropical than in temperate climates, although local customs are probably more important than climate in its etiology. In the developing world, the incidence of neonatal tetanus ranges between 5 and 60 per 1000 live births, and in some areas, deaths from tetanus account for 30-72 percent of neonatal mortality[1].

Despite the nationwide anti-tetanus immunization policy, tetanus, especially neonatal tetanus, continues to occur in Turkey[2]. In this article, we review 43 cases of neonatal tetanus admitted to our hospital and discuss guidelines for the prevention of neonatal tetanus in Turkey.

Material, Methods and Results

The study population consisted of 43 neonatal cases of tetanus who had been admitted to the Infectious Diseases Ward of the İstanbul University Faculty of

* From the Department of Pediatrics, İstanbul University Faculty of Medicine at Çapa, İstanbul.
** Professor of Pediatrics, İstanbul University Faculty of Medicine.
*** Fellow in Pediatrics, İstanbul University Faculty of Medicine.
**** Pediatrician.
***** Associate Professor of Pediatrics, İstanbul University Faculty of Medicine.

Medicine Children's Hospital at Çapa from January 1982 to December 1989. There were 32 (74.4%) boys and 11 (25.6%) girls. The annual distribution of the patients is noted in Table I.

TABLE I: Annual Distribution of Patients

Year	No. of Patients
1982	6
1983	9
1984	8
1985	4
1986	3
1987	4
1988	4
1989	5
Total	43

All patients were residents of İstanbul or its environs and lived in close proximity to a hospital.

Thirty-nine (90.7%) of the 43 patients were born at home where the umbilical cord had been separated by either a pair of scissors, knife or razor blade. A midwife was in attendance at only two births and four were hospital deliveries.

The families were of low socioeconomic level. Most parents were either illiterate or had only attended primary school. None of the mothers had been previously immunized against tetanus.

The mean age of the patients on admission was 7.8 ± 2.4 days (range 3-16 days) and the mean incubation period was 6.1 ± 2.0 days (range 3-13 days). All families were aware of their baby's poor sucking and excessive crying, but only brought their infant to the hospital when spasms occurred. In all cases, diagnosis was based on clinical findings. On admission, sustained tonic contractions and spasms were observed in most patients. An opisthotonus posture was noted in five patients, cyanosis in six patients and generalized convulsions in two patients.

The mean hospitalization period was 18.3 ± 15.3 days (range 1-57 days). Twenty-six of the 43 neonates died. The overall mortality rate was 60.5 percent.

High fever was present in 11 of the 26 (42.3%) patients that died and in only three of the 17 (17.6%) survivors ($p<0.05$). The mean incubation period was 5.6 ± 1.3 days for the fatal cases and 6.9 ± 2.5 days for the survivors ($p<0.05$). The mean hospitalization period was 8.2 ± 8.9 days for the fatal cases and 31.3 ± 11.4 days for the survivors.

Conventional treatment consisted of diazepam for sedation and tetanus antitoxin and benzylpenicillin. Subsequent infections were treated using the appropriate antibiotic. All patients were kept in quiet, darkened rooms, movement was kept to a minimum, and all unnecessary handling of the patient was avoided.

The Student-*t* test, and the Fisher and Yates tests were used for statistical analysis.

Discussion

Tetanus is a serious illness with high mortality. It occurs mainly in populations in which facilities for the care of its victims are least available[2].

In most parts of the world, particularly in developing countries, reported neonatal tetanus cases appear to be more common in males than in females[3]. In our study, most of our patients (74%) were males.

Our study indicates that the annual distribution of hospitalized neonatal tetanus patients has declined in recent years (Table I). The incidence of neonatal tetanus in Turkey is on the decline due to widespread tetanus toxoid use in pregnant women, an increasing number of hospital births, and improvements in post-partum hygiene[4].

Age at onset, severity of illness, preterm birth, secondary infections and mode of treatment all affect survival in neonatal tetanus[5]. Our results show that a short incubation period and fever are signs of poor prognosis.

The case fatality rate of neonatal tetanus ranges between 25-90 percent with therapy, depending on the intensity of supportive care[6]. The İstanbul University Faculty of Medicine Children's Hospital at Çapa is one of the most developed university clinics in Turkey. In spite of intensive care and adequate treatment, the mortality rate from neonatal tetanus is quite high. In our patients, this rate was determined to be 60.5 percent which substantiates the reports of other centers in our country[4,7-9].

The age at onset of symptoms is one of the most important factors influencing prognosis. In our study, this period was found to be 6.1 ± 2.0 (mean) days and the fatal cases showed a significantly shorter mean incubation period than the survivors, which is in accordance with results from other studies[7,10,11].

In this study, the mean period between onset of symptoms and hospital admission was found to be 1.7 days. In a recent paper published by the Hacettepe University Faculty of Medicine in Ankara, this period was reported as 2.2 days[4] while the same period was found to be 3.2 days in Pakistan[12]. This may be due to inadequate information regarding diseases in the community and the application of traditional treatment at home.

Although İstanbul is located in a more developed part of Turkey, its population is heterogenous. In 1988, neonatal tetanus was a cause of 30 of the 4230 neonatal

deaths reported in İstanbul Municipality[13]. The mortality rate of neonatal tetanus can be used as a criterion to evaluate the quality of mother and child health services and the effectiveness of immunization programs. Approximately five cases of neonatal tetanus are encountered annually in a hospital population which indicates that a fraction of the population, the so-called urban poor, is still at high risk for preventable diseases.

Tetanus is a totally preventable disease. Results of conventional treatment have been disappointing in neonatal tetanus. The prevention of neonatal tetanus is important not only because of the high mortality rate associated with the disease, but also because sequelae in survivors are not uncommon[14]. This indicates an urgent need for promotion of hygienic deliveries and tetanus immunization of pregnant women in underdeveloped regions where neonatal tetanus continues to be a cause of death due to inappropriate handling of the cord and lack of maternal immunity[15,16].

Most newborns in the world are susceptible to tetanus because their mothers have not received two or more doses of tetanus toxoid. It has been estimated that from 1986 to 1989, only 15-25 percent of pregnant women in developing countries received at least two recent doses of tetanus toxoid[17,18]. None of the mothers in our series were immunized against tetanus.

Epidemiologic studies in Turkey show that the majority of infants with neonatal tetanus are born to mothers not previously immunized for tetanus, which is in accordance with studies reported from other countries[4,6].

The major problem in tetanus prevention today is the difficulty involved in delivering routine immunization to those in need. Every contact that a susceptible female of child bearing age has with a health care professional should be viewed as an opportunity for updating her tetanus immunization status.

Thirty-nine (90.7%) of the 43 patients we studied were unhygienic home deliveries and only two patients were delivered with a midwife in attendance. Most of the patients were delivered by inexperienced persons. Similar studies from Turkey indicate that most infants are delivered under such circumstances and that when a midwife is in attendance, neonatal tetanus is a rare occurrence[4].

Increasing the number of trained midwives may be effective in reducing the incidence of neonatal tetanus as well as decreasing neonatal mortality due to tetanus and other causes.

Despite the existence of a nationwide antitetanus immunization policy whereby women are vaccinated before and during pregnancy in Turkey, the occurrence of neonatal tetanus, even in large cities, suggests the need for more vigorous efforts emphasizing risk groups living in urban areas.

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THE EVALUATION OF VACCINATION AGAINST MEASLES AT NINE MONTHS OF AGE
(Report of an epidemic)*

*Mehmet Ceyhan MD***, Güler Kanra MD****
*Serpil Vargel MD*****, Yusuf Işıkçelik MD*****

SUMMARY: Ceyhan M, Kanra G, Vargel S, Işıkçelik Y. (Department of Pediatrics, Hacettepe University Faculty of Medicine, Ankara, Turkey). The evaluation of vaccination against measles at nine months of age (report of an epidemic). Turk J Pediatr 34: 127-133, 1992.

Sixteen measles cases were studied during an epidemic that broke out in Etimesgut district of Ankara. Eight of these children had never been vaccinated against measles while the remainder had been vaccinated at nine months of age. In the sera obtained during the course of the illness, anti-measles antibody was not detectable in six vaccinated children and in four unvaccinated children. Upon observing the siblings of the subjects, it was determined that one out of three who had not been vaccinated against measles and three out of seven who had been vaccinated at nine months of age contracted the disease within a month. However none of the siblings who had been vaccinated against measles at 15 months contracted the disease. In our cases, although vaccination at nine months of age could not prevent measles, it resulted in a milder form of the disease. It seems that measles vaccine administered to infants at around nine months of age does not prevent the occurrence of the disease in many children. *Key words: measles, vaccination, epidemic, anti-measles antibody.*

Measles continues to be a serious health problem in many countries of the world. Of vaccine-preventable diseases, measles remains one of the most important causes of childhood morbidity and mortality in developing countries. Almost all unvaccinated children contract measles, and over two million children die of this disease each year[1,2].

Immunization against measles with a live, attenuated virus vaccine saves lives. A single dose of measles vaccine can produce permanent immunity[3]. National public health recommendations for measles vaccination differ from country to country. In most developed countries, measles vaccine is administered at about the age of 15 months. By then, all maternal antibody has disappeared[4-6]. About 95 percent of children vaccinated at this age develop immunity against measles[7]. Because the disease is mostly seen during the latter part of the first year of life, measles cases continue to occur at a high rate despite successful immunization at 15 months of age[8]. The persistence of maternal antibody that interferes with the

* From the Department of Pediatrics, Hacettepe University Faculty of Medicine, Ankara.
** Associate Professor of Pediatrics, Hacettepe University Institute of Child Health.
*** Professor of Pediatrics, Hacettepe University Faculty of Medicine.
**** Practitioner, Etimesgut District Hospital, Ankara.

immune response to vaccination in very young infants hinders immunization at one month of age[9]. Following reports from a number of African, Latin American and Asian countries, suggesting that the optimal age for vaccination against measles in these areas should be about nine months of age, the World Health Organization has also recommended that infants in developing and underdeveloped countries should be immunized against measles at around nine months of age[10-13]. Soon afterwards, almost all developing and underdeveloped countries adopted the policy of vaccinating their infants at the said age. Turkey has also changed its immunization policy, whereby the minimum age for vaccination against measles has been lowered from 15 months to nine months. Since the efficacy of measles vaccination is mostly dependent on elimination of maternal antibody, vaccination administration to infants less than 12 months of age is controversial. The age at which infants completely lose maternal antibody against measles varies from country to country[14]. Since the elimination of maternal anti-measles antibody in Turkish children is not known, it is not possible to determine the optimal age for measles vaccination.

Although it had been previously thought that the incidence of measles had declined in Turkey after the initiation of mass measles immunization campaigns in which infants were vaccinated at nine months of age, we observed a measles epidemic between February and March 1989 in Ankara's Etimesgut district. To obtain data about the efficacy of measles vaccination programs in which infants are inoculated at nine months of age, we studied the clinical features of measles patients during that epidemic.

Material and Methods

This study was undertaken following the presentation of a febrile child with a rash in February 1989, whose symptoms resembled the clinical picture of measles. We then requested that midwives assigned to the Etimesgut district (20 km from Ankara) bring in all children with a rash to the Etimesgut Rural Hospital of Hacettepe University for evaluation. These children were examined by the first author of this paper, and their symptoms and signs were recorded. The vaccination status of the children was assessed by questioning the parents and examining the vaccination records of the Etimesgut Health Center which carries out the vaccination program for the Etimesgut area. Anti-measles antibody levels were determined from blood samples taken four weeks apart, the initial one obtained at presentation. Each child was monitored at home by a midwife who was instructed to bring in to the hospital any child who might be suspected of having signs of complications. All siblings of the subjects were monitored at home by midwives for symptoms of measles. Their vaccination status against measles was also evaluated.

Separated first and second serum samples were stored at −20 °C until titration in the laboratory. Specific antibody titers against measles virus were determined by

a hemagglutination-inhibition test performed in 50 µl volumes in V well microtiter plates using standard procedures. Sera were inactivated at 56 °C for 30 minutes and then absorbed with washed rhesus monkey erythrocytes. Twofold dilutions in PBS (phosphate buffered saline) were prepared in 50 µl volumes to cover the range of 1:5 to 1:640. Following reaction with four units of measles hemagglutination (Behring) for 90 minutes at room temperature, 0.5% v/v erythrocytes were added and the plates were incubated at 37 °C for one hour. Negative control serum and the International Reference Preparation (IRP) of measles antibody were tested on each plate in all tests. End points were read as the highest dilution of serum which inhibited red cell agglutination.

Seroconversion for the diagnosis of acute measles infection in each patient was accepted as the appearance of a fourfold increase in the levels of anti-measles antibody in the second serum sample as against that in the first.

Results

Of the 20 children with fever and rash brought in to the hospital in Etimesgut district, we report 16 cases in whom measles was verified by immunological seroconversion. No seroconversion was demonstrated in the four remaining children, and they therefore were not enrolled in the study. Eight of the 16 subjects with measles had never received a measles vaccination while the remaining eight had been vaccinated at nine months of age (Table I).

As seen in Table I, all subjects demonstrated at least a fourfold increase in anti-measles antibody levels. The initial sera obtained during the course of the illness showed that only two children vaccinated at nine months of age and two unvaccinated children had a detectable antibody level. The antibody levels of the remaining 12 subjects, six vaccinated and six unvaccinated were nondetectable.

Although fever and rash were present in all children (Table II), the duration of the rash was less in the vaccinated group (4.3 ± 2.3 days versus 6.7 ± 3.7 days). During the first two days of the illness, Koplik's spots were present in all unvaccinated children, but were not evident in two vaccinees. The incidence of cough, conjunctivitis and coryza was 5/8 (62.5%), 4/8 (50.0%) and 7/8 (87.5%), respectively in the children who had been vaccinated at nine months of age while all of these signs were present in all unvaccinated children.

While complications such as convulsions (one case) and pneumonia (one case) were observed in the unvaccinated group, there were no complications noted in the vaccinated group.

There were four measles cases from two different families (two from each family) (Table I). The 16 patients in the study had a total 25 siblings who lived in the same house with the subjects during the epidemic (four of them were also subjects of the study). Three of the siblings had not been previously vaccinated against

TABLE I: Anti-measles Antibody Levels of Measles Cases and Vaccination Status of the Cases and their Siblings

Case No.	Age		Antibody Levels		Siblings	
	Infection (yrs)	At Vaccination (mo.)	First Sera	Second Sera	Age At Vaccination (mo.)	Measles
1	3	9	32	≧640	15	–
					15	–
2	9	–	20	320	–	–
					15	–
3	2	9	<5	320	15	–
					–	+***
4*	3.5	9	<5	160	15	–
					15	–
					9	+****
5*	10	–	20	160	15	–
					15	–
					15	–
6	3	9	5	160	9	–
7	9	–	<5	320	9	–
8	5	9	<5	80	15	–
9	11	–	<5	80		
10**	4	9	<5	80	9	+*****
11**	3	9	<5	≧640	9	+******
12	10	–	<5	20	–	–
13	7	–	<5	40	15	–
					9	–
14	2.5	9	<5	320	15	–
					15	–
15	9	–	<5	160	15	–
					15	–
16	13	–	<5	80	9	–

*,** Two separate siblings.
*** Case 5.
**** Case 4.
***** Case 11.
****** Case 10.

TABLE II: Clinical Findings of Measles Cases

Clinical Findings	Vaccinated		Unvaccinated	
	Positive Cases / Cases Examined		Positive Cases / Cases Examined	
Fever (38.5 °C)	8/8	(100 %)	8/8	(100 %)
Rash	8/8	(100 %)	8/8	(100 %)
Duration of rash (mean ± SE) (days)	4.3 ± 2.3		6.7 ± 3.7	
Koplik's spots				
1. day of rash	4/6	(66.6%)	4/4	(100 %)
2. day of rash	5/7	(71.4%)	7/7	(100 %)
3. day of rash	0/8	(0)	2/8	(25 %)
4. day of rash	0/8	(0)	0/8	(0)
Cough	5/8	(62.5%)	8/8	(100 %)
Conjunctivitis	4/8	(50 %)	8/8	(100 %)
Coryza	7/8	(87.5%)	8/8	(100 %)
Complications				
Pneumonia	0/8	(0)	1/8	(12.5%)
Febrile convulsion	0/8	(0)	1/8	(12.5%)

measles, 15 had a measles vaccination at the age of 15 months and seven at the age of nine months. While one of three unvaccinated children and three of seven children vaccinated at nine months contracted the disease, none of the 15 siblings who had been vaccinated at the age of 15 months showed any signs or symptoms of measles.

Discussion

The most important problem in measles immunization is the timing of vaccination. In spite of individual and geographic variations in patterns of maternal antibody transfer and antibody half-life, the World Health Organization recommends that measles immunization in developing and underdeveloped countries be undertaken when an infant reaches nine months of age[12,13]. Health officials in Turkey have adopted this policy. Since the immune response rate has been reported as 80-90 percent when vaccination is undertaken at nine months of age[3], a high vaccination rate was obtained, and therefore, no measles epidemic was expected. When we saw the first measles case in Etimesgut, where an effective vaccination program had been recently carried out, we were alarmed for there was a possibility that measles might crop up in older children because most of them had not been vaccinated. Contrary to our expectation of disease in the

unvaccinated group, half of the children who contracted measles had been vaccinated at nine months of age.

There is no doubt with regard to the preventive role of measles vaccine when administered at 15 months of age, the age at which many children in Etimesgut had been inoculated[15]. None of these children contracted measles during the epidemic. Despite the occurrence of measles in three of seven siblings of cases who had a measles vaccination at nine months of age and in one of three unvaccinated siblings, none of the 15 siblings vaccinated at 15 months contracted the disease.

The ineffectiveness of the vaccination at nine months of age is evident by low levels of anti-measles antibody during the illness. Failure to seroconvert is classified as primary vaccine failure and is generally attributed to neutralization of the attenuated vaccine virus by persistent maternal antibody in infants under 12 months of age or to inadequate immunization[16,17]. The latter may be a consequence of storage conditions and/or handling. On the other hand, secondary vaccine failure refers to the development of clinically apparent infection despite an immune response to vaccination[17,18]. In our subjects, low anti-measles antibody levels indicated primary vaccine failure. Because of a good "cold chain system" in Etimesgut district, neutralization of vaccine virus by maternal antibody is suspected as the reason rather than poor storage and handling conditions. Since we believe that the optimal age for immunization can be accurately predicted for any population by determining anti-measles antibody levels in children during the first few births of life to 12 months of age, another study is being carried out to observe the elimination of maternal anti-measles antibody.

Despite the absence of protective antibody levels, an obvious variation in clinical course was present in the vaccinated cases. The duration of rash was less and there was a lower incidence of cough, coryza and conjunctivitis in the vaccinated cases than in the unvaccinated cases. Koplik's spots were not present in two vaccinated cases. Although two unvaccinated cases developed complications, there were no complications noted in the cases who had been vaccinated at nine months of age. It seems that even if vaccination at nine months of age does not prevent the occurrence of measles, it results in a milder form of the disease.

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THE CORRELATION BETWEEN THE CLINICAL, LABORATORY AND HISTOPATHOLOGICAL FEATURES OF CHILDHOOD MEMBRANOPROLIFERATIVE GLOMERULONEPHRITIS AND RESPONSE TO TREATMENT*

*Fatoş Yalçınkaya MD***, Erdal İnce MD****
*Necmiye Tümer MD*****, Mesiha Ekim MD******

SUMMARY: Yalçınkaya F, İnce E, Tümer N, Ekim M. (Department of Pediatric Nephrology, Ankara University Faculty of Medicine, Ankara, Turkey). The correlation between the clinical, laboratory and histopathological features of childhood membranoproliferative glomerulonephritis and response to treatment. Turk J Pediatr 34: 135-144, 1992.

In this study, the clinical, laboratory and histopathological features of 50 children with membranoproliferative glomerulonephritis are reviewed. Age distribution varied from 5 to 15 years. The clinical presentation in the patients was nephrotic syndrome (24%), acute nephritic syndrome (20%) and nephritic/nephrotic syndrome (56%). Hypertension, macroscopic hematuria and hypocomplementemia were present in 40 percent, 58 percent and 34 percent of the patients, respectively. Light microscopic findings were as follows: glomerular lobulation (36%), mesangial sclerosis (20%), tubulointerstitial findings (36%), and crescents (26%). C_3 (93%) was the most common immunofluorescence and IgM (86%), the most frequently encountered immunoglobulin. Response to treatment could not be anticipated by the initial clinical and laboratory features. Patients who did not have tubulointerstitial changes tended to have a greater response to therapy. *Key words: childhood, membranoglomerulonephritis, response to treatment.*

Membranoproliferative glomerulonephritis (MPGN) is a chronic nephritis which occurs most commonly in late childhood and early adulthood. The disease was first defined by West and co-workers[1] in 1965. Its etiology is unknown and the pathogenesis is unclear[2-4]. Although the clinical and laboratory features vary in individual patients, the disease has a generally progressive course.

Membranoproliferative glomerulonephritis has been demonstrated in only 5 to 14 percent of renal biopsy series[4-6]. However, the disease is responsible for more than 25 percent of the cases of terminal renal failure caused by glomerulonephritis[4]. It has been reported that 7 percent of patients have total remissions after the first treatment, but most patients have relapses[7]. No

* From the Department of Pediatric Nephrology, Ankara University Faculty of Medicine, Ankara.
** Resident in Pediatric Nephrology, Ankara University Faculty of Medicine.
*** Resident in Pediatrics, Ankara University Faculty of Medicine.
**** Professor of Pediatrics, Ankara University Faculty of Medicine.
***** Associate Professor of Pediatric Nephrology, Ankara University Faculty of Medicine.

treatment exists which can prevent progressive nephron loss, and end-stage renal disease occurs within ten years in approximately 50 percent of patients[8-12].

The aim of this study was to review the clinical, laboratory and pathological features of MPGN in children and to determine if a correlation exists between these features and early and late responses to treatment.

Material and Methods

Patients were selected for this study on the basis of clinical and laboratory features and a renal biopsy diagnostic for MPGN. The study involved 50 patients whose follow-ups were available. At the time of the first examination, the patients' ages were between one to 15 years (mean 9.8 ± 3.6 years) (Fig. 1). There were 28 males and 22 females.

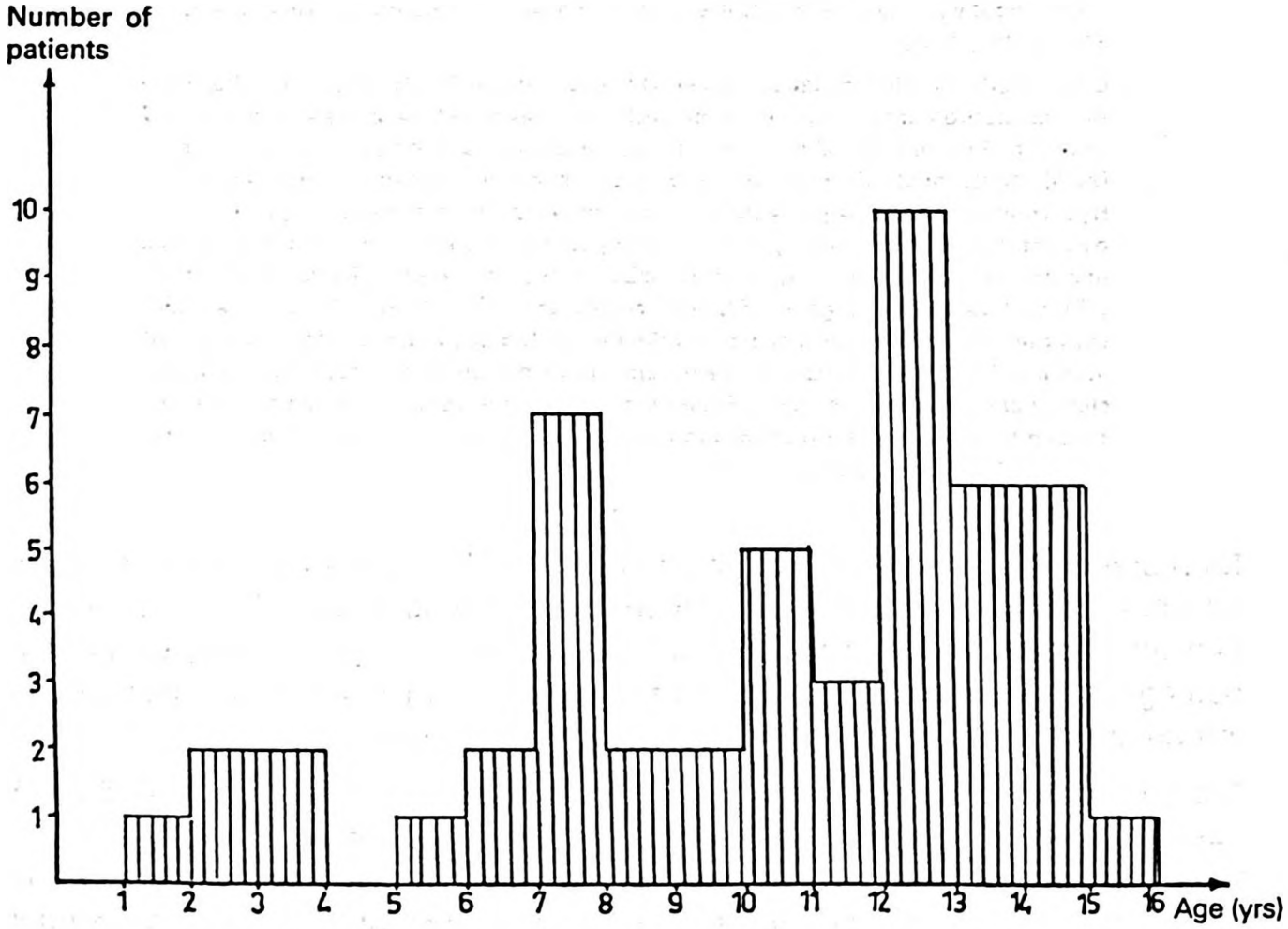

Fig. 1: Age at onset of disease.

Hypertension was defined as a systolic and a diastolic blood pressure ≧95 percent for age based on the Pediatric Task Force recommendations[13]. Proteinuria was evaluated by dipstick estimation and by a 24-hour quantitative measurement. Hematuria was defined as positive if the microscopic examination of the urinary sediment showed ≧5 RBC/hpf and gross if visible with the naked

eye. Renal insufficiency was defined as an elevation of the serum creatinine level above 1.2 mg/dl. Routine urinalyses and tests for urea, albumin and C_3 were performed by standard techniques.
Nephrotic syndrome was defined as massive proteinuria if exceeding 2 g/m^2/day and hypoalbuminemia if less than 3 g/dl, with or without edema. Patients were described as having acute nephritic syndrome when they displayed hematuria, edema, hypertension and/or renal insufficiency.

Renal biopsy was obtained three weeks to 12 months (average three months) after the onset of disease and before the initiation of treatment. Biopsies were performed using Franklin modified Vim-Silvermann needles. The number of glomeruli studied in each biopsy ranged from 8-24 (mean 16). Immunofluorescence studies were carried out on 30 available specimens. Fluoresceinated antisera specific for IgG, IgM, IgA and C_3 were employed in all cases. Discrimination of the types of MPGN was not available.
Patients received steroid therapy with or without cytotoxic agents for variable periods of time (3 to 18 months). Early response was recorded at the end of the first month of therapy and late response after completing the therapy.

Patients were divided into three groups for subsequent analyses according to clinical and laboratory findings: Group 1. Complete response: patients in whom clinical and urinary abnormalities resolved i.e., disappearance of edema, hypertension, hypoalbuminemia, hematuria and proteinuria. Group 2. Partial response: patients in whom a partial clinical and laboratory response had occurred i.e. disappearance of hypoalbuminemia and/or hematuria with or without hypertension. Group 3. No response: patients in whom no change was noted.

The average follow-up for all patients was 36.5 months, with a range of 12 to 112 months.
The chi-square and Fisher exact tests were used for statistical analyses because of the small sample size.

Results

Clinical features at onset of the disease are shown in Table I. The main complaints were edema (92%), gross hematuria (64%) and oliguria (20%). The initial physical examination revealed edema in 86 percent of the patients and hypertension in 40 percent of the patients.

Laboratory data are described in Table II. Urinalyses revealed that hematuria was present in 82 percent of patients (macroscopic 58%). All the patients had proteinuria and 88 percent had urinary protein exceeding 2 g/m^2/day. Elevated serum creatinine levels (>1.2 mg/dl) were detected in 42 percent of patients at presentation and hypocomplementemia in 34 percent of patients. HBs Ag was positive in the serum of 24 percent of the patients.

TABLE I: Clinical Features at Onset of Illness

Main Complaints	n (50)
Edema	46 (92%)
Gross hematuria	32 (64%)
Oliguria	10 (20%)
Initial Physical Examination	
Edema	43 (86%)
Hypertension	20 (40%)
Hepatosplenomegaly	15 (30%)
Ascites	14 (28%)
Growth retardation	5 (10%)
Goitre	4 (8%)

n: Number of patients.

TABLE II: Laboratory Data Prior to Renal Biopsy

		n (50)
Hematuria	Macroscopic	29 (58%)
	Microscopic	41 (82%)
Proteinuria	Mild	50 (100%)
	Massive	44 (88%)
Elevated Serum Creatinine (>1.2 mg/dl)		21 (42%)
Reduction of Serum C_3 (<50 mg/dl)		17 (34%)
Anemia		24 (48%)
Positive HBs Ag		12 (24%)

The mode of presentation of disease was nephrotic syndrome in 24 percent of the patients, acute nephritic syndrome in 20 percent and nephritic/nephrotic syndrome in 56 percent of the patients (Fig. 2). Six patients (12%) had secondary MPGN (five Henoch Schönlein purpura and one partial lipodystrophy).

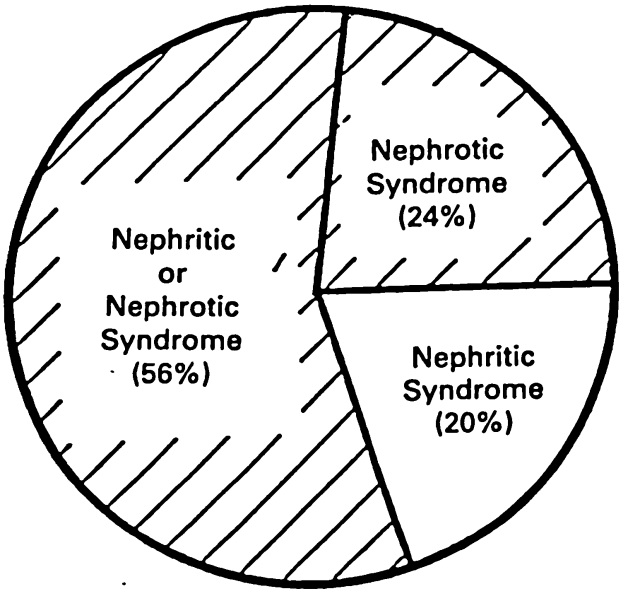

Fig. 2: Mode of presentation of disease.

Table III represents the light microscopic findings of the patients. All cases showed a thickening of the glomerular basement membrane (GBM) and proliferation of mesangial cells and/or matrices. Glomerular lobulation was present in 12 percent and mesangial sclerosis in 20 percent of the patients. Tubulo-interstitial findings (tubular atrophy and/or interstitial fibrosis) were found in 18 of the 50 patients. Epithelial crescents were present in 26 percent of the patients. The results of immunofluorescence studies of 30 specimens and a comparison with the literature are shown in Table IV. C_3 (93%) was the most

TABLE III: Light Microscopic Findings in MPGN

	n (50)
Thickened GBM	50 (100%)
Proliferation of Mesangial Cells and Matrices	50 (100%)
Glomerular Lobulation	6 (12%)
Mesangial Sclerosis	10 (20%)
Tubular Atrophy and/or Interstitial Fibrosis	18 (36%)
Crescents	13 (26%)

TABLE IV: Renal Immunofluorescence in MPGN (Comparison with the literature)

	Our Study 1990	Tınaztepe et al[6] 1986	Cameron et al[11] 1983		Mayo Clinic[14] 1979	
			Type I	Type II	Type I	Type II
	%	%	%	%	%	%
C_3	93	82	93	72	100	100
IgM	86	61	52	28	60	20
IgA	63	38	59	0	50	20
IgG	56	32	35	0	33	20
Negative	7	15	7	39		

common immunofluorescence while IgM (86%) was the most frequently encountered immunoglobulin. Immunofluorescent staining was absent in two cases (7%).

The patients received steroid therapy with or without cytotoxic agents for a period of three months to 1.5 years. After the first month of therapy, three patients (6%) experienced complete remission. Twelve patients were lost to study before completion of the treatment. Of the remaining 38 patients, 16 had a complete response, 16 had a partial response and six had no response at all (Table V).

TABLE V: Late Response to Treatment (n: 38)

Complete Response	Partial Response	Resistance
n	n	n
6 (42%)	16 (42%)	6 (16%)

No correlation could be found between the presence of nephrotic syndrome, hypertension, gross hematuria, elevated serum creatinine levels or hypocomplementemia at onset or during response to treatment. Of the 18 patients with tubulointerstitial findings, three were excluded from the study. Of the remaining 15 patients, five did not respond to treatment, nine had a partial response, and one patient had a complete response to treatment (Table VI).

TABLE VI: Tubulointerstitial Findings and Response to Treatment

Tubular Atrophy and/or Interstitial Fibrosis	Complete Response	Partial Response	Resistance
Positive n: 15	1	9	5
Negative n: 23	15	7	1
TOTAL n: 38	16	16	6

Discussion

In this study, comprising 50 patients with MPGN, we found the results to be only slightly different from reports in the literature[3,4,6,11,14-17] (Table VII). In general, the age at onset of MPGN is between five to 30 years,and a diagnosis before the age of six is uncommon[3,6]. Twelve percent of our patients were under six years of age (Fig. 1).

TABLE VII: A Comparison of MPGN Features Reported in the Literature With those Observed in Our Patients

		Our Study 1990 n: 50	Tinaztepe et al[6] 1986 n: 95	Cameron et al[11] 1983 n: 23	Habib et al[15] 1973 n: 105	Other Reports in the Literature[3,4,14,16,17]
Age (years) Mean		1-15 9.8	3-18 10	<15	2-17 10	5-30
Sex (males %)		56	63	40	63	no sex predominancy
Edema	%	86	97		43	40-63
Hypertension	%	40	29	22	25	20-30
Hematuria	%	82	66	96	86	86-100
Macroscopic	%	58		35		15-30
Proteinuria	%	100	100			
Renal Insufficiency	%	42	52	39		40
Hypocomplementemia	%	34	25	57	48	44-75
Underlying Primary Disease	%	12	9			16
Nephrotic Syndrome	%	80	60	31	67	31-60
Pure Nephritic Syndrome	%	20	38	30	33	15-41

The clinical features of this disease vary. We found the main symptom to be edema (86%), and more than half of the patients we studied had macroscopic hematuria. Cameron et al[11] reported that children presented more frequently with macroscopic hematuria at onset than hypertension. However, both hypertension (40%) and macroscopic hematuria (58%) were found to be more common in our series than in series reported in the literature[3-6,8,11,16].

Activation of the complement system is a hallmark of MPGN. Hypocomplementemia and reduced renal function were present in 34 and 42 percent of the patients, respectively. These results are similar to the data in reported series[4,6,11,14,16,17]. HBs Ag was positive in 24 percent of our patients. Since HBs Ag was not demonstrated in the glomeruli, we could not confirm that chronic viremia was the cause of MPGN in these patients. We can only speculate as to its being the cause; perhaps it is only a coincidence.

Nephrotic syndrome is the most common mode of presentation of MPGN in both children and adults[4,7,18]. If we evaluate the nephrotic syndrome group (including the patients with nephritic/nephrotic syndrome), 80 percent of our patients had nephrotic syndrome as the most common clinical presentation (Fig. 2).

A thickening of the glomerular basement membrane and an increment in the mesangial matrix were reason for inclusion in the study group. Crescents were observed in 26 percent of our patients, however, a lower incidence (6%) was reported in the Tınaztepe et al[6] series. We did not find a correlation between the presence of crescents and response to treatment. Our immunofluorescence microscopic findings were similar to the results of other studies[3,4,6,11,14] (Table IV). Immunofluorescence staining was negative in 7 percent of our patients, which is less than that reported by Tınaztepe et al[6] (15%) and Cameron et al[11] (23%).

There are many studies on the factors used to predict the prognosis of MPGN, but the results are controversial. The clinical features that appeared to be indicators of a poor outcome included the presence of macroscopic hematuria, hypertension, nephrotic syndrome, hypocomplementemia, and an elevation in the serum creatinine concentration[3-5,10,12,14,16]. Although, some authors have noted that clinical features are not useful indicators for the progression of the disease, they state that a number of pathological findings appear to be useful. Mesangial sclerosis, increased glomerular lobulation and the presence of crescents were reported as the features which may indicate a poor prognosis[16,19-21].

In our series, no correlation was noted between the presence of the clinical and pathological findings mentioned above and response to treatment. But of the 15 patients who had tubulointerstitial findings and whose follow-ups were sufficient, only one patient had a complete response to treatment. Five of the remaining patients did not respond to treatment and nine had only a partial response. On the

other hand, 16 of the 23 patients who did not have tubulointerstitial findings had a complete response to treatment (Table VI). These results are in agreement with Schmitt et al[22] and Taguchi et al[23], who showed a correlation between the tubulointerstitial changes and the unfavorable course of the disease.

We also noted that the patients who did not have tubulointerstitial changes tended to respond to therapy more than the others. Our study demonstrated the importance of tubulointerstitial findings and early renal biopsy to predict the response to treatment in childhood MPGN.

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The Turkish Journal of Pediatrics 34:145-152, 1992

THE RELATIONSHIP BETWEEN BLOOD GLUCOSE AND SERUM ELECTROLYTE LEVELS IN CHILDREN WITH ACUTE DIARRHEA*

*Kadriye Yurdakök MD***, Olcay Oran MD****

SUMMARY: Yurdakök K, Oran O. (Department of Social Pediatrics, Hacettepe University Institute of Child Health, Ankara, Turkey). The relationship between blood glucose and serum electrolyte levels in children with acute diarrhea. Turk J Pediatr 34: 145-152, 1992.

The relationship between simultaneous serum electrolyte and blood glucose levels was studied in 119 moderately or severely dehydrated children with acute infectious gastroenteritis. Their ages ranged between two months to fifteen years. A positive correlation was found between blood glucose and serum sodium levels in the children with serum bicarbonate values below 15 mmol/L. This correlation is more prominent in cases of severe metabolic acidosis with serum bicarbonate values less than 10 mmol/L. No correlation was found between blood glucose, serum potassium and chloride levels. Our results show that a positive correlation between blood glucose and serum sodium levels is present only in cases with metabolic acidosis, which is contrary to classical knowledge. *Key words: blood glucose, serum electrolytes, acute diarrhea, metabolic acidosis.*

Hypoglycemia and hyperglycemia have been reported in patients with acute childhood diarrhea[1-9]. Hypoglycemia has been described as a potentially fatal complication of acute infectious diarrhea whereas hyperglycemia has been associated with the hypernatremic dehydration of acute diarrhea[1-9]. The studies cited suggest that changes in blood glucose levels may occur during diarrheal illness and complicates the course of the disease especially when it is associated with electrolyte disturbances. However, the relationship between blood glucose and serum electrolytes has not been thoroughly investigated in children with diarrhea. The aim of this study was to determine blood glucose and serum electrolyte levels simultaneously and to ascertain if a relationship exists between them. To our knowledge, this is the first time that such a study has been undertaken in dehydrated children with acute gastroenteritis.

Material and Methods

This study was carried out at the Hacettepe University Children's Hospital Oral Rehydration Therapy and Training Unit from July to September 1990. Patients who had received an oral rehydration solution or drugs prior to admission were

* From the Department of Social Pediatrics, Hacettepe University Institute of Child Health, Ankara.

** Pediatrician, Hacettepe University Institute of Child Health.

*** Professor of Pediatrics, Hacettepe University Institute of Child Health.

excluded from the study. One hundred and nineteen moderately or severely dehydrated children whose blood samples were drawn simultaneously on admission were included in the study. The degree of dehydration was assessed according to the World Health Organization (WHO) criteria[10]. A complete medical history was obtained and a physical examination was performed on each patient.

There were 78 males and 41 females in the study group. Their ages ranged between two to 15 years. Patients were divided into two groups according to age in order to reduce age-dependent variabilities of clinical and laboratory findings. The first group consisted of 89 children two years of age or under while the second group consisted of the remaining 30 children above two years of age. Clinical and laboratory findings were then evaluated in each group according to serum bicarbonate levels. The nutritional status of the patients was expressed as weight for age percentiles described by the National Center for Health Statistics[11].

Venous blood samples were obtained simultaneously to determine blood pH, glucose and serum electrolyte levels before therapy. The blood pH and serum bicarbonate levels were measured using an automatic blood gas analyzer (AVL 990; Medizintechnik, Austria). Serum electrolyte and blood glucose concentrations were determined by a discrete analyzer with continuous optical scanning (Dacos plus lytes, Coulter Electronics Inc; Florida, USA).

Entry of data into the computer and statistical testing were performed using Epi Info Version 5 software. The results were expressed as a mean ± Standard Deviation. Student's *t* test was used for statistical analysis.

Results

All patients had moderate or severe dehydration. Ten patients with severe dehydration and electrolyte disturbances required hospitalization and were treated intravenously. The others were given the standard WHO glucose/electrolyte solution, and responded well to treatment[10]. Sixty-four patients (53.8%) had body weight/age ratios below the 10th percentile and were considered undernourished.

Hypernatremia (serum $Na^+ > 150$ mmol/L) was present in nine (7.6%) patients. One patient presented with a serum Na^+ level of 170 mmol/L, but had no neurologic symptoms. Hyponatremia (serum $Na^+ < 130$ mmol/L) was documented in four patients, but their levels were not lower than 125 mmol/L. In five patients, serum potassium levels were less than 3 mmol/L.

Moderate or severe metabolic acidosis with blood pH levels below 7.30 was noted in 63 (53.0%) patients. Fourteen patients (11.8%) had blood pH levels below 7.20 and three (2.5%), with blood pH levels less than 7.05, were given intravenous bicarbonate therapy. In 58 patients (48.7%), the serum bicarbonate

level was below 15 mmol/L, and in 15 of them (12.6%) it was less than 10 mmol/L. Acidosis was more prominent in the dehydrated children under two. None of the children above two had serum bicarbonate levels below 10 mmol/L.

Hyperglycemia (blood glucose > 140 mg/dL) in a range between 151-240 mg/dl was documented in 13 patients (10.9%). Hypoglycemia was noted in only one patient with a blood glucose level of 31 mg/dL, who showed no symptoms. Disregarding the age factor, the mean serum sodium level was significantly higher in the hyperglycemic patients than in the rest of the patients (144.8 ± 6.7 mmol/L and 139.2 ± 6.8 mmol/L, respectively; $p < 0.01$), but their serum bicarbonate and blood pH levels showed no statistical significances (15.1 ± 4.7 mmol/L and 15.3 ± 4.6 mmol/L, respectively; $p > 0.05$, and 7.27 ± 0.12 and 7.30 ± 0.09 respectively; $p > 0.05$).

The mean age, body weight, blood glucose, serum potassium and chloride levels, and the mean time since the last feeding on admission were found to be similar according to serum bicarbonate levels in both groups of children (Tables I and II). In children under two, the mean serum sodium levels were found to be higher when their serum bicarbonate levels were below 11 mmol/dL and between 11-15 mmol/dL compared to those with serum bicarbonate levels above 15 mmol/dL ($p < 0.05$ and $p < 0.05$, respectively; Table I). In the second group, serum sodium and blood pH levels showed no statistical differences according to serum bicarbonate levels (Table II).

TABLE I: Clinical and Laboratory Findings of Children Under Two Years of Age with Acute Diarrhea

	Serum HCO_3^- levels			
	<10 mmol/L n: 15	11-15 mmol/L n: 35	>15 mmol/L n: 39	Total n: 89
Mean age (mo)	9.1 ± .7	10.7 ± .2	9.5 ± .5	9.9 ± .4
Body weight (kg)	7.1 ± 2.2	7.9 ± 2.1	7.2 ± 2.1	7.5 ± 2.1
Time since last feeding (hr)	7.3 ± 7.1	5.3 ± 3.7	3.8 ± 3.5	4.9 ± 4.4
Blood pH	7.18 ± 0.11*,***	7.26 ± 0.06*,***	7.33 ± 0.06**,***	7.28 ± 0.09
Blood glucose (mg/dL)	108.2 ± 46.3	102.9 ± 24.6	101.4 ± 22.9	103.2 ± 28.
Serum electrolytes				
Na^+ (mmol/L)	142.2 ± 8.9*	140.7 ± 7.9**	137.1 ± 5.5*,**	139.4 ± 7.
K^- (mmol/L)	4.6 ± 0.9	4.2 ± 0.6	4.3 ± 0.8	4.4 ± 0.8
Cl^- (mmol/L)	108.2 ± 13.7	107.0 ± 13.2	104.6 ± 10.9	105.7 ± 12.

Statistical comparisons:
for blood pH * $p < 0.02$, **,*** $p < 0.001$.
for serum sodium *,** $p < 0.05$.

TABLE II: Clinical and Laboratory Findings of Children Above Two Years of Age with Acute Diarrhea

	Serum HCO_3^- levels		
	11-15 mmol/L n: 8	>15 mmol/L n: 22	Total n: 30
Mean age (mo)	61.5 ± 21.5	74.1 ± 43.1	70.7 ± 8.6
Body weight (kg)	16.8 ± 3.9	22.1 ± 11.1	20.1 ± 9.9
Time since last feeding (hr)	4.5 ± 3.7	3.5 ± 2.1	3.6 ± 2.5
Blood pH	7.33 ± 0.07	7.36 ± 0.04	7.36 ± 0.05
Blood glucose (mg/dL)	132.6 ± 29.0	117.7 ± 30.0	121.7 ± 30.0
Serum electrolytes			
Na^+ (mmol/L)	139.4 ± 4.5	141.5 ± 3.8	140.9 ± 4.0
K^- (mmol/L)	4.0 ± 0.4	4.2 ± 0.7	4.2 ± 0.6
Cl^- (mmol/L)	101.3 ± 12.4	100.6 ± 9.5	100.9 ± 10.0

In all comparisons $p > 0.05$.

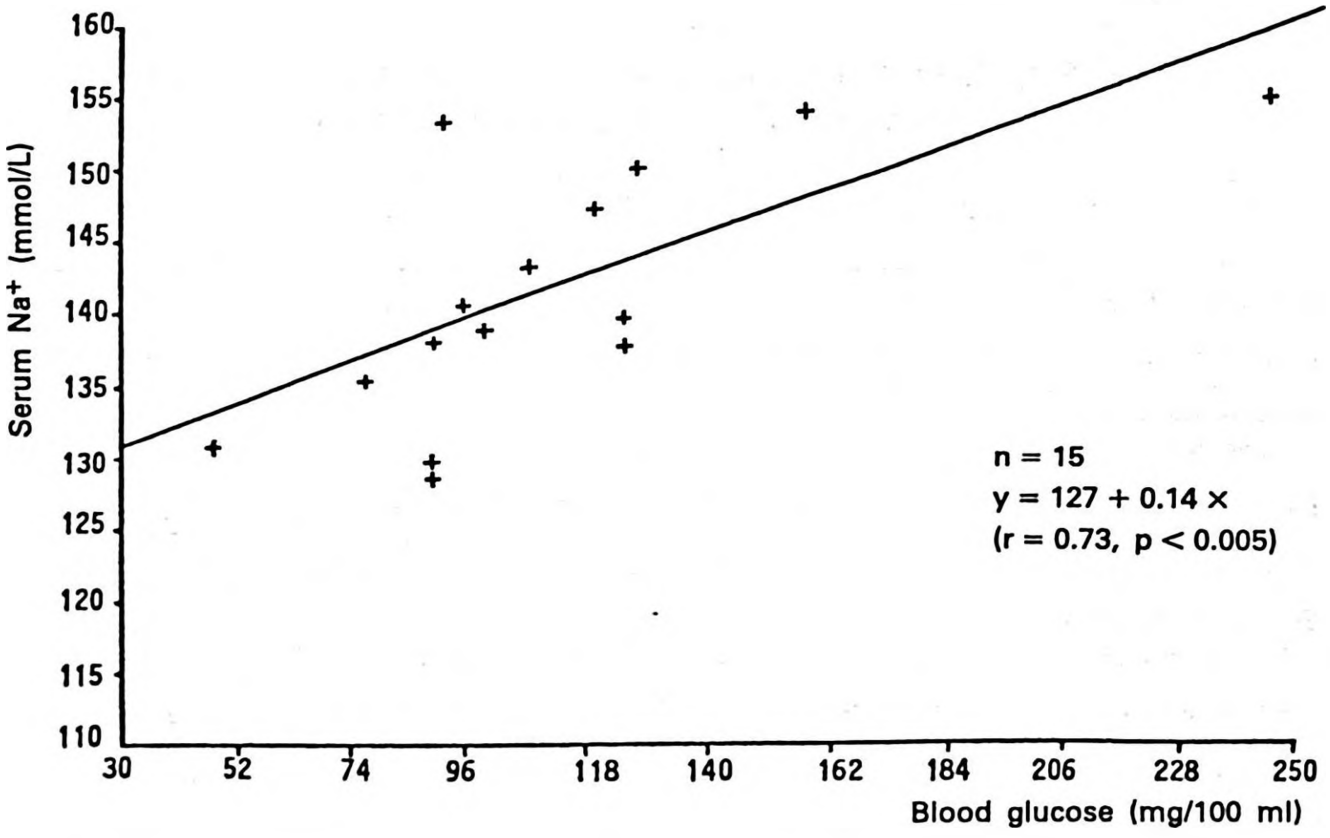

Fig. 1: The relationship between blood glucose and serum sodium values in severely acidotic (serum HCO_3^- level ≤ 10 mmol/L) children under two years of age.

Positive correlations were found between blood glucose and serum sodium levels in the children under two with bicarbonate levels below 15 mmol/L, but not in the older age groups (Figs. 1, 2). This correlation was very high when the bicarbonate level was less than 10 mmol/L (Fig. 1). There was no relationship found between the blood glucose and serum potassium or chloride levels in all age groups.

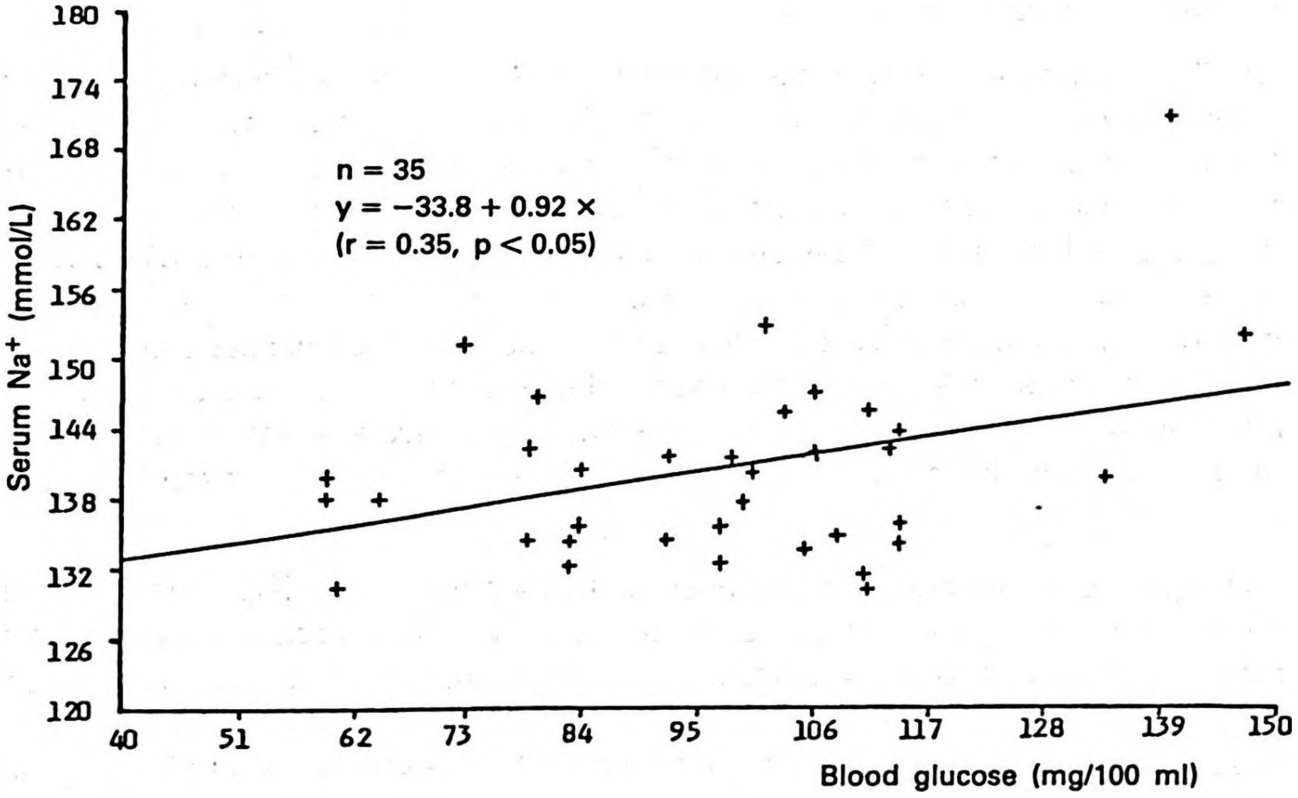

Fig. 2: The relationship between blood glucose and serum sodium values in moderately acidotic children (serum HCO_3^- level between 11-15 mmol/L) under two years of age.

Discussion

There have been reports of abnormalities in serum glucose levels in childhood diarrheal diseases[1-9]. Symptomatic hypoglycemia in acute childhood diarrhea was first described in 13 children by Hirschhorn et al[1]. He and his associates also studied blood glucose levels in children with acute gastroenteritis, and symptomatic hypoglycemia was found due to gastroenteritis in three. Later Jones[2] reported 14 cases of hypoglycemia among 378 dehydrated children due to gastroenteritis. Recently, the incidence of hypoglycemia, as a complication of acute diarrhea, has been reported to be 4.5 percent in children aged 2-15[4]. Although 53.8 percent of our patients had body weight/age ratios below the tenth percentile, hypoglycemia was observed in only one patient. Mean blood glucose levels were found to be above 100 mg/dL in all age groups.

In reported studies, hypoglycemia is observed in both well-nourished and malnourished children, suggesting that malnutrition is not a major factor

contributing to the development of hypoglycemia in patients with acute gastroenteritis[1,2,4]. Predisposing and etiologic factors in the pathophysiology of hypoglycemia in these children remain obscure. Hyperinsulinemia and counter-regulatory hormone deficiencies can not be regarded as a cause of hypoglycemia because Hirschhorn[1] found low plasma insulin levels, and Bennish and co-workers[4] reported elevations in almost all counter-regulatory hormones in hypoglycemic patients.

Our finding that a high positive correlation exists between blood glucose and sodium levels in dehydrated and severely acidotic children may suggest that hyponatremia might also occur along with hypoglycemia in some of the hypoglycemic patients reported above, especially in those with severe acidotic dehydration. But simultaneous serum electrolyte and blood glucose levels were not studied in any of these reports. However, the occurrence of low plasma insulin[1] and high plasma glucagon levels[4] in these hypoglycemic patients permits us to speculate a finding that a decrease in the serum sodium levels could also be a finding in these studies, since insulin is known to have a direct effect on renal tubular sodium handling, and glucagon increases sodium excretion and natriuresis[12].

Although the simultaneous occurrence of hyponatremia and hypoglycemia has not been noted in acute gastroenteritis, the presence of hyperglycemia along with hypernatremia has been reported by several authors[5-8]. Levin and Geller-Bernstein[6] reported hyperglycemia in some dehydrated infants with acute gastroenteritis, and they noted high serum sodium and low blood pH levels in these infants. Later, Roberts[7] reported hyperglycemia in five hypernatremic dehydrated children due to acute gastroenteritis. In the series of Bruck et al[8], six of 28 hypernatremic acidotic infants with diarrhea had hyperglycemia. Stevenson and Bowyer[9] also reported three hyperglycemic cases with hypernatremic dehydration due to acute infectious diarrhea. High blood glucose levels in induced hypernatremia in rats have been demonstrated by Nitzan and Zelmanowsky[13].

Hypernatremia is known to cause severe metabolic acidosis which might be the major determinant of glucose intolerance and the diabetogenic effect of hypernatremia[13-15]. The occurrence of peripheral resistance to insulin and decreased peripheral glucose utilization may contribute to hyperglycemia in patients with acidosis[13,15]. Therefore; despite malnutrition, we may explain the high mean blood glucose concentrations as being due to metabolic acidosis which developed during diarrheal dehydration in our patients. The positive correlation found between serum sodium and glucose levels was also more prominent in the patients with severe metabolic acidosis and the mean serum sodium levels were found to be higher in these patients (Table I). In addition, the simultaneous occurrence of hyperglycemia and hypernatremia has also been reported in other

diseases such as diabetes mellitus, ketoacidotic diabetic coma, nonketotic hyperosmolar coma, severe burns, and acute intracranial injuries[13]. However, these studies and our findings contrast with the classical sodium and glucose relationship, especially reported as occurring in diabetes mellitus. A classical relationship examined mathematically is that for each 1 g/L increase in blood glucose above 1 g/L there is a decrease in the serum sodium concentration by 1.6 mmol/L[16]. But Strand and associates[17] have shown that this negative correlation is not prominent as it is classically known in 100 spontaneous hyperglycemic children. On the other hand, we showed that a positive correlation exists between blood glucose and serum sodium concentrations in acidotic children with gastroenteritis, but not in non-acidotic children. Therefore, we may speculate that the positive correlation between serum sodium and blood glucose levels occurs only in metabolic acidosis and increases with the severity of metabolic acidosis. However, additional studies are needed to arrive at a reliable conclusion.

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ATRIAL NATRIURETIC PEPTIDE AND ALDOSTERONE IN SICK PREMATURE NEONATES*

F. Ayşenur Paç MD**, M. Ramazan Yiğitoğlu MD***
A. Gazi Kalaycı MD****, Bahattin Adam PhD*****

SUMMARY: Paç FA, Yiğitoğlu MR, Kalaycı AG, Adam B. (Department of Pediatrics and Biochemistry, Atatürk University Faculty of Medicine, Erzurum, Turkey). Atrial natriuretic peptide and aldosterone in sick premature neonates. Turk J Pediatr 34: 153-156, 1992.

Plasma atrial natriuretic peptide (ANP) and aldosterone concentrations were investigated in 25 sick premature neonates. Group A consisted of 11 premature neonates with sepsis and group B of 14 neonates with hyperbilirubinemia. In both groups, ANP and aldosterone levels were found to be higher than in the controls. Group A concentrations of ANP and aldosterone were also higher than in group B. *Key words: aldosterone, atrial natriuretic peptide, premature sick neonate.*

Atrial natriuretic peptide (ANP) affects kidney function by altering renal hemodynamics, increasing excretion of sodium and water[1] and inhibiting renin and aldosterone secretion[2]. ANP is a hormone involved in the regulation of sodium and body fluid homeostasis[3,4]. Plasma aldosterone concentration is relatively high in human newborn infants[5,6]. In the newborn, the homeostatic function of the kidney may be limited[7].

The present study was designed to determine ANP and aldosterone levels in 25 sick premature neonates.

Material and Methods

The study population comprised 25 infants, 14 boys and 11 girls, who were the products of uncomplicated pregnancies that were delivered vaginally. No congenital defects were present. Apgar scores at one minute were >7. Eleven of the infants were included in the study because of sepsis with positive blood cultures (Group A), and 14 were born in our hospital and had hyperbilirubinemia with a total bilirubin level exceeding 12 mg/dl (Group B). Gestational ages ranged from 32 to 37 weeks and birth weights from 1350 to 2410 g (1650 ± 245 g). All studies were performed between 7-12 days of life. The infants were all breast fed. Blood and urine samples were obtained before infusion and drug therapy.

* From the Departments of Pediatrics and Biochemistry, Atatürk University Faculty of Medicine, Erzurum.
** Associate Professor of Pediatrics, Atatürk University Faculty of Medicine, Erzurum.
*** Assistant Professor of Biochemistry, Atatürk University Faculty of Medicine, Erzurum.
**** Pediatrician, Atatürk University Faculty of Medicine, Erzurum.
***** Biochemist.

Urine was collected in plastic bags for 12 to 24 hours. Arterial blood samples were drawn from femoral arteries. EDTA-Plasma contained 400 KIU/ml of aprotinin (Trasylol®) which was added to measure the ANP level. Plasma ANP levels were determined using the RIA method (Incstar Corp., Stillwater, Minnesota, CANADA Cat. no: 22750). Plasma aldosterone levels were also determined using the RIA method (Diagnostic Products Corp., Coat-A-Count, USA Cat no: TKAL1). The plasma ANP and aldosterone levels were determined in twenty healthy neonates with similar characteristics, who were used as controls.

Creatine clearance (Ccr) and fractional excretion of sodium (FENa) were calculated from the formula shown below:

$$Ccr\ (ml/min/kg) = (Ucr \times V)/Scr$$

$$FENa\ (\%) = [(UNa \times SNa)/Ucr \times Scr)] \times 100$$

The data were expressed as a mean ± SEM. The Student's *t*-test was used for statistical analysis.

Results

Body weight, plasma sodium concentration, creatine clearance, fractional sodium excretion, plasma aldosterone and ANP concentrations of the groups are shown in Table I.

TABLE I: Plasma ANP and Aldosterone Levels in Sick Neonates and in Controls

Group	Birth Weight (g)	Serum Na (mEq/L)	Ccr ml/min/kg	FENa (%)	P-Aldosterone pg/ml	p-ANP pg/ml
A (n = 11) (sepsis)	2150 ± 115	141 ± 3.9	2.2 ± 0.8	0.37 ± 0.28	1870 ± 398	105 ± 48
B (n = 14) (hyperbilirubinemia)	1870 ± 372[c]	139.3 ± 2.7[b]	1.85 ± 0.6[b]	0.42 ± 0.20[b]	985 ± 445[a,c]	53 ± 32[a,b]
C (n = 20) (Control)	–	–	–	–	382 ± 107	29 ± 8.4

a: $p<0.001$ as compared with controls
b,c: $p>0.05$ and $p<0.001$ as compared with other patient groups, respectively.

The children with sepsis had the highest p-ANP and aldosterone values. In addition, the children with hyperbilirubinemia had higher p-ANP and aldosterone levels than the controls.

Discussion

ANP may provide a sensitive and important hormonal system for the control of sodium balance, even in premature neonates[8]. It is observed that premature infants with a birth weight of 1500g have markedly elevated plasma concentrations of ANP during the early postnatal period[8]. Hypersecretion of human ANP in

respiratory distress syndrome (RDS) and meconium aspiration syndrome (MAS) may play an important part in initiating spontaneous diuresis in sick neonates[9]. ANP inhibits renin and aldosterone secretion[2], but plasma aldosterone concentration is relatively high in newborn infants[5].

In our study, we found no differences between groups A and B in serum sodium concentrations, Ccr, and FENa (%). But plasma aldosterone concentrations in groups A and B were higher than in the controls ($p<0.001$). In addition, aldosterone concentrations in group A were higher than those in group B ($p<0.001$). Plasma concentrations of ANP in the sick premature neonates were higher than in the controls ($p<0.001$). Plasma ANP levels in the sepsis group were higher than in the hyperbilirubinemia group. In contrast to reports in the literature, we found that aldosterone levels did not decrease with an increase in ANP levels.

Kojima et al[10] found that plasma aldosterone concentrations were especially higher in younger premature infants and that ANP levels were higher in this age group when compared with healthy adults. High plasma aldosterone concentrations possibly act to enhance the reabsorptive capacity of the distal nephron for sodium intake and ANP may be released to control the extracellular space in premature infants[10].

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NEONATAL PERITONITIS*

*Ünal Zorludemir MD***, Mesut Koca MD***, Işık Olcay MD****
*Selçuk Yücesan MD*****

SUMMARY: Zorludemir Ü, Koca M, Olcay I, Yücesan S. (Department of Pediatric Surgery, Çukurova University Faculty of Medicine, Adana, Turkey). Neonatal peritonitis. Turk J Pediatr 34: 157-166, 1992.

A retrospective study was undertaken over an eight-year period to assess the mortality rate of 66 newborns who had undergone surgery in our clinic because of peritonitis. The mortality rate for the patients admitted in poor condition was 95.2 percent, whereas it was 45.5 percent for those in good condition. There was a 100 percent mortality associated with newborns that had hypothermia and with those that had severe respiratory difficulties, whereas it was 92.3 percent for low-birth-weight infants and 86.5 percent for dehydrated infants. All babies with sclerema neonatorum died. The newborns with white blood cell counts under 5,000/mm^3 also did not survive (83.3%). Etiologically, congenital megacolon, meconium ileus and spontaneous gastrointestinal perforations were the most frequent anomalies leading to death (100%). In the newborns with gastrointestinal perforations, most deaths occurred in patients with perforations of the cecum, duodenum and stomach (100%). Mortality seemed to be greater in patients with complications (77.3%), and it rose to 83.3 percent for patients who had to undergo a repeat operation due to complications. The overall mortality rate was found to be 71.2 percent. *Key words: peritonitis, newborn.*

In the last decade there have been many developments in the intensive care techniques applied to the newborn, but in spite of all these improvements, peritonitis of the newborn is still one of the most frequent causes of mortality. Until Agerty et al[1] first operated on this condition in 1943, newborn peritonitis was considered to be incurable. Rickham[2] reported that peritonitis is the leading cause of mortality in newborns. The purpose of this study is to evaluate the mortality rate and the factors affecting mortality in a group of newborns with peritonitis.

Material and Methods

A retrospective clinical evaluation was made of 66 newborns with peritonitis hospitalized between 1977-1988 at the Çukurova University Faculty of Medicine. Peritonitis caused by ruptured omphalocele or gastroschisis is not included in this review. The diagnosis of peritonitis was arrived at from operative findings.

* From the Department of Pediatric Surgery, Çukurova University Faculty of Medicine, Adana.
** Associate Professor of Pediatric Surgery, Çukurova University Faculty of Medicine.
*** Pediatric Surgeon.
**** Professor of Pediatric Surgery, Çukurova University Faculty of Medicine.
***** Professor of Pediatric Surgery, Ankara University Faculty of Medicine, Ankara.

Parameters and their effects on mortality were as follows: age, sex, period elapsed up to admission, general condition, body temperature, pulse rate, respiration, body weight, skin turgor and tonus, sclerema neonatorum, white blood cell count in peripheral blood, etiology, gastrointestinal perforations, complication (s), reoperation (s).

The general condition of the patient, which is one of the parameters, was classified as a) poor: patients with serious respiratory problems, sclerema neonatorum, septic shock, metabolic acidosis or severe (>10%) dehydration; b) moderate: patients with mild respiratory problems, moderate (5-10%) dehydration or decreased neonatal reflexes; c) good: patients with mild (5%) dehydration.

Temperatures between 36.0° - 37.5 °C obtained by skin monitoring were defined as normothermia, those below 36.0 °C as hypothermia, and temperatures above 37.5 °C as hyperthermia.

Results

Of 66 neonates with peritonitis, 47 died (71.2%). None of the patients were admitted during the first day of life. Twenty-three of the newborns were 24-48 hours old on admission and 15 of them died (65.2%). The mortality rate of the 33 newborns in the 2-7 day age-group was found to be 72.7 percent. The 8-15 day age-group consisted of four patients, all of whom died. The 22-30 day age-group, which consisted of four newborns, had a 50 percent survival rate (Table I).

TABLE I: Mortality According to Age Group

Age of Infant	Number of Patients	Mortality Rate (%)
24-48 hours	23	15 (65%)
2-7 days	33	24 (72.7%)
8-15 days	4	4 (100%)
16-21 days	2	2 (100%)
22-30 days	4	2 (50%)
Total	66	47 (71.2%)

As regards sex, 37 (75.5%) of a total 49 male newborns and 10 (58.8%) of a total 17 female newborns did not survive.

The interval between onset of symptoms and admission ranged between 24 hours to 9 days. The number of deaths as a function of this interval was 15 out of 23 patients presenting in the first 24-48 hours (65.2%) and 32 out of 43 patients presenting after 48 hours (74.4%) (Table II).

TABLE II: Effect of Time of Admission on Mortality

Interval between Onset of Symptoms and Admission	Number of Patients	Mortality
24-48 hours	23	15 (65.2%)
3 days	18	16 (88.8%)
4 days	8	5 (62.5%)
5 days	2	1 (50%)
6 days	6	3 (50%)
7-9 days	9	7 (77.7%)
Total	66	47 (71.2%)

At admission, 21 of the patients (31.8%) were in poor condition, while 34 (51.5%) were in moderate and 11 (16.6%) were in good condition. In respect to their general condition, the mortality rates of the babies in poor condition were 95.2%, moderate condition 64.7% and good condition 45.5% (Table III).

TABLE III: General Condition and Mortality of 66 Newborns With Peritonitis

General Condition of Patient	Number of Patients	Mortality
Poor	21	20 (95.2%)
Moderate	34	22 (64.7%)
Good	11	5 (45.5%)
Total	66	47 (71.2%)

Physical findings at admission and their relation to the mortality rate can be summarized as:

a) Body temperature: All of the five patients with hypothermia died at admission. Of the 52 patients with normal body temperatures, 36 (69.2%) died, while of the nine with hyperthermia, six (66.7%) died.

b) Pulse rate: Nine newborns had a pulse rate below 120/min and the remainder had rates above this figure. The mortality rate was 77.7 percent in the first group of patients and 70.1 percent in the second group of patients.

c) Respiration rate: Eight of the ten newborns with bradypnea (80%) and all 18 newborns with tachypnea died. With regard to the 38 newborns with a normal respiration rate, mortality was found to be 55.2 percent.

d) Body weight: Thirteen newborns weighed below 2500 g and 53 were above that weight in the study group. The mortality rate of the underweight patients was 92.3 percent (12 out of 13) and for those above 2500 g, it was 66.0 percent (35 out of 53). Of the 13 newborns with a body weight below 2500 g, eight were premature and all died.

e) Turgor and tonus: There were 52 patients with decreased turgor and tonus and 45 of them (86.5%) died. The mortality rate of the 14 patients who were normal with respect to turgor and tonus was found to be 14.2 percent (2 out of 14).

f) Sclerema neonatorum: All 20 newborns with sclerema neonatorum died. The mortality rate was 58 percent in the remaining 46 patients.

Ten of the 12 newborns with white blood cell counts below 5000/mm^3 (83.3%), 36 of the 51 newborns with counts in the range of 5,000-15,000/mm^3 (70.5%) and one of three newborns with a count above 15,000/mm^3 (33.3%) died.

The etiological factors that resulted in peritonitis in our patients were grouped as follows: a) primary etiological factors (this refers to factors that cause peritonitis in patients who have not undergone surgery).
In this group, seven of 11 patients (63.6%) with an imperforate anus; seven of ten patients (70%) with intestinal atresia; all seven patients with Hirschsprung's disease; four of five patients (80%) with intrauterine gastrointestinal perforations; all four patients with meconium ileus; one of four patients (25%) with necrotizing enterocolitis (NEC); one of three patients (33.3%) with intussusception, and two patients with spontaneous gastrointestinal perforations died. b) secondary etiological factors (patients with leakage from previous intestinal anastomosis were included in this group). Primary pathologies for anastomosis were: Ileal atresia in three newborns, anal atresia in two, meconium ileus in two, and jejunal atresia in two. There was one newborn with duodenal web, one with an annular pancreas, and one with an ileal web. Ten of the 12 (83.3%) patients with anastomotic leakage died (Table IV).
Of the 66 newborns operated on, 53 (80.3%) had perforations or anastomotic leakage. In 12 of these 53 patients, peritonitis was caused by anastomotic leakage that developed after the initial operation. The location of the perforations in the remaining 41 newborns were twenty-three perforations (56%) of the colon and rectum, 14 (34.1%) of the jejunum and ileum, and four (9.7%) of the stomach and the duodenum.

Of the 53 patients with perforations and anastomotic leakage, 37 (69.8%) died. Perforations of the stomach, duodenum and cecum resulted in a fatal outcome for all of these patients. Fifteen of 23 newborns (65.2%) with perforations of the colon and 12 of 18 newborns (66.7%) with perforations at locations other than the colon also died.

Postoperative complications developed in 22 patients, and the mortality rate in this group was 77.3 percent. In the 44 newborns with no postoperative complications, the mortality rate was found to be 68.1 percent.

Twelve neonates with peritonitis had to be operated on again due to complications, and ten subsequently died (83.3%). Of the 54 patients who did not require a repeat laparotomy, 37 died (68.5%).

TABLE IV: The Relationship Between Mortality and Etiological Factors

Etiology	Number of Patients	Mortality
Anastomotic leakage	12	10 (83.3%)
Imperforate anus	11	7 (63.6%)
Intestinal atresia	10	7 (70%)
Congenital megacolon	7	7 (100%)
Intrauterine perforation	5	4 (80%)
Meconium ileus	4	4 (100%)
N.E.C.	4	1 (25%)
Intussusception	3	1 (33.3%)
Spontaneous GI perforation	2	2 (100%)
Birth trauma	2	– (0%)
Iatrogenic	2	– (0%)
Annular pancreas	1	1 (100%)
Primary peritonitis	1	1 (100%)
Rectosigmoid tumor	1	1 (100%)
Volvulus due to malrotation	1	1 (100%)
Total	66	47 (71.2%)

Discussion

Mortality from newborn peritonitis is high. Churchill[3] reported in 1825 that six percent of all childhood deaths that occurred in Trouves Children's Hospital were due to peritonitis. Several attempts had been made to establish the mortality rate of newborn peritonitis between 1939 and 1984.

It has been found that the mortality rates for this disease vary from 33 to 99 percent (mean 67%; Table V)[2,4-13]. In a review of 515 patients with gastrointestinal perforations, Lloyd[14] found the mortality rate to be 71 percent. In a study on mortality caused by meconium peritonitis, Tibboel and Molenaar[13] evaluated the

TABLE V: Mortality Rates Reported by Other Authors

Author	Publication Date	Number of Patients	Mortality Rate (%)
Thelander[4]	1939	85	99
Rickham[2]	1954	17	40
Cruze[5]	1961	58	78
Fonkalsrud[6]	1966	172	78
Birtch[7]	1969	99	62
Cerise[8]	1969	11	82
Singer[9]	1972	32	66
Emanuel[10]	1978	55	65
Prevot[11]	1979	32	68
Bell[12]	1983	60	33
Tibboel[13]	1984	67	67

years between 1940 and 1980, and divided them into five periods. They reported that there was no significant decrease in mortality rates, with the lowest recorded at 55 percent. Lister and Rickham[15], found that 40 percent of all fatalities in the newborn surgery units are due to neonatal peritonitis. These reports obviously demonstrate that the 71.2 percent mortality rate observed in our study group correlates with other findings.

In contrast to the high incidence of one-day-old babies in previous reports, all the newborns in our study group were more than two days old. In our series, the mortality rate was found to be high in 8 to 21 day-old babies (100%), while it was significantly lower (50%) in the 22 to 30-day-old group. This difference was probably not a factor of age difference, but rather because peritonitis in the older age group was not congenital and that the interval which had elapsed between the initial signs of peritonitis and hospitalization was short. The younger group with congenital peritonitis was brought to the hospital when more than one week old, which is probably why such a long-lasting pathology contributed to the high mortality rate.

The reported sex ratio (boy/girl) in peritonitis of the newborn varies from 1/1 to 3/1[9,12,13]. This ratio was 3/1 in our series. Bell[12] reported that the mortality rate in males was two-fold that of females. In our series, 75.5 percent of the male cases and 58.8 percent of the female cases died. Therefore, the survival rate in girls is 1.7-times more than in boys. There seems to be no explanation for this fact in the literature.

There are several studies which demonstrate that the period between the onset of symptoms of peritonitis and the initiation of treatment affects mortality. Tibboel and Molenaar[13] reported that in newborns, for which this period is less than 48 hours, the mortality rate was 48 percent, and that this rate increases up to 91 percent for the remainder of cases. In a series of 99 patients, Birtch et al[7] reported that for 50 patients whose hospital admission occurred in less than 24 hours, the mortality rate was 51 percent; for those admitted between 24 and 48 hours it was 71.5 percent, and for the patients admitted after 48 hours this rate increased to 80 percent. In the same study, it was also reported that the survival rate increased 2.5-times if the patients were operated on within the first 24 hours. Bell[12] found that the mean interval between onset of symptoms and admission in surviving newborns with peritonitis was 19 hours, whereas it was several hours for fatal cases. In a study of 11 patients conducted by Cerise and Whitehead[8], the two babies that survived were admitted after 48 hours. In our series, as we have already mentioned, no patient was admitted to our clinic in the first 24 hours of life. As for the patients who were admitted between 24 and 48 hours, mortality was 65 percent and for those who were hospitalized after 48 hours, it was 74.4 percent. In our study, the mean admission period for survivors was 32 hours and for fatal cases, 80 hours.

Body temperature also affects mortality in newborns. Some reports support the view that hypothermia increases mortality[6,9]. In our series, the mortality rate was 100 percent in hypothermic patients, whereas it was 66.6 percent in the others Normally, inflammatory pathologies cause an increase in body temperature. If the patient's resistance is low, the body temperature does not increase. Therefore, body temperature of the newborn is inversely proportional to mortality.

Bradycardia is seen in severe cases of neonatal peritonitis, and generally results in death[6,9,12,15]. In our study group, the mortality rate was 77.8 percent in the babies with pulse rates below 120/min, and 70 percent in babies with pulse rates above 120/min. Reports in the literature confirm our findings which support the view that bradycardia is more serious than tachycardia in newborns with peritonitis.

Respiratory difficulties, which are seen in almost half of the patients, also affect mortality in newborn peritonitis[6,8,9,15]. Birtch et al[7] calculated a mortality rate of 87 percent in patients with respiratory difficulties, and a mortality rate of 49 percent in other patients. In our series, eight of ten newborns (80%) with bradypnea and 18 with tachypnea all died, whereas in 38 patients with no respiratory problems, the mortality rate was 55.2 percent. These findings indicate that respiratory difficulties increase mortality two-fold. In other words, respiratory difficulties become more serious when peritonitis is severe.

There is a close correlation between body weight and mortality in neonatal peritonitis. Fonkalsrud et al[6] reported a mortality rate of 90 percent in a group of

172 newborns who weighed less than 2500 g and 72 percent for the others. Singer and Hammar[9] studied 32 patients and reported a mortality rate of 90 percent in the babies under 2500 g, and 42 percent in the babies exceeding 2500 g. Birtch et al[7] showed that in a study comprising 99 patients, the mortality rate was 71 percent in the infants under 2000 g, 53 percent in the infants between 2000-3500 g and 70 percent in the infants over 3500 g. Bell[12], who reported a 33 percent mortality rate in 60 cases, indicated a mean weight of 1300 g for fatal cases and 1700 g for survivors. Tibboel and Molenaar[13] found an 83 percent mortality rate in premature babies and 57 percent in full-term babies. In our series, the mortality rate was 46 percent for babies under 2500 g and 66 percent for those over 2500 g. All premature babies died. Our study and the reports in the literature indicate that prematurity and/or low birth weight significantly increases the risk of mortality in neonatal peritonitis.

Although there are many studies which emphasize the need to solve hydration problems preoperatively, the effect of dehydration on mortality has not yet been examined[6,12,15]. The mortality rate was recorded as 86.5 percent in our patients with dehydration, whereas it was 14.3 percent in the patients with normal hydration. We believe that, although the dehydrated patients underwent surgery after their fluid and electrolyte deficits were restored, the irreversible tissue changes that developed due to hypovolemia increased the mortality rate. We also believe, that if the necessity arises, such patients should be transferred to a hospital for medical treatment from other health care centers, and that intravenous fluid and electrolyte transfusion should then be started during or before transport.

Fonkalsrud et al[6] reported that even though the general condition and prognosis for newborns with sclerema neonatorum is poor, it does not always portend a fatal result. Twenty of the 66 patients we studied had sclerema neonatorum at admission, and they all died. None of the patients with sclerema neonatorum had septicemia at admission. It would not be erroneous to point out here that sclerema neonatorum is a high risk factor for all newborns including those with peritonitis.

Birtch et al[7] reported a mortality rate of 56 percent for patients with white blood cell counts less than 5000/mm^3, 72 percent for those with counts ranging between 5000-15,000/mm^3 and 41 percent for those with counts exceeding 15,000/mm^3. In our study, the mortality rates with respect to leukocyte count were: 83.3 percent for those with counts under 5000/mm^3; 70.6 percent for those with counts ranging between 5000-15,000/mm^3 and 33.3 percent for those with counts over 15,000/mm^3. Leukocyte counts increase as a reaction to inflammatory events. For those babies with leukocyte counts over 15,000/mm^3, the challenge due to peritonitis is great, and hence, the survival rate increases. For babies with white blood cell counts less than 5000/mm^3, mortality is higher.

It is believed that the etiology of peritonitis also affects mortality. Tibboel and Molenaar[13] reported that anastomotic leakage and meconium ileus increase mortality. Bell[12] reported an average mortality rate of 33 percent in his series (50% mortality resulting from perforations that developed after the use of a feeding catheter; 40% mortality in relation to NEC and 10% mortality resulting from spontaneous gastric perforation). In our series, the highest mortality (100%) was due to meconium ileus, congenital megacolon and spontaneous gastric perforation, while a mortality rate of 83.3 percent resulted from anastomotic leakage. We believe, that in addition to peritonitis, repeat operations greatly affect an unfavorable outcome. We found the mortality rate to be 80 percent in patients with intrauterine perforations, 70 percent in patients with intestinal atresia, and 63.3 percent in patients with an imperforate anus. The mortality rate was significantly lower in patients with intussusception (33.3%) and in those with NEC (25%).

The effects the location of a perforation has on mortality have been discussed in several reports. Fonkalsrud et al[6] reported that perforations are seen in the following descending order of frequency: colon, stomach, ileum, jejunum and duodenum. They found a mortality rate of 88 percent in patients with ileum, cecum and stomach perforations; 75 percent in patients with jejunal perforations and 45 percent in patients with colon and duodenum perforations. Birtch et al[7] reported that perforations in the newborns they studied were located in order of descending frequency in the ileum, colon, jejunum, duodenum and stomach. They also found that the mortality rate associated with perforations of the cecum was 16 percent, while it was 20 percent in perforations of the stomach, 76 percent in perforations of the duodenum, jejunum and ileum, and 83 percent in other locations of the colon. Bell[12] also encountered perforations of the colon, ileum, stomach, duodenum and jejunum in order of descending frequency. He reported the highest mortality rates in patients with perforations of the duodenum and the lowest in patients with perforations of the stomach. Lloyd[14] reported an overall mortality rate of 71 percent in the cases that he studied with neonatal peritonitis. He found perforations of the stomach to occur more commonly than perforations of the colon, ileum, duodenum and jejunum, in order of descending frequency. He also reported that there were no significant differences in mortality rates. After a search of the literature, we ascertained that the most frequently seen perforations seem to be located in the colon (including the cecum). Perforations of the stomach, ileum and other locations seem to be less[6,7,12,13]. In this review, the locations of perforations in order of descending frequency were the colon, cecum and the ileum. Most of the fatal cases in our series were due to perforations of the cecum, duodenum and the stomach (100%). Ascending colon perforations caused 75 percent of the fatalities. All of the nine patients with perforations in other locations of the colon survived. The mortality rate of the patients with

perforations of the colon including the cecum (65.3%) did not differ much from the mortality rate of patients with perforations in other parts of the gastrointestinal tract (66.6%).

Postoperative complications also significantly affect mortality[12]. In our series, 77.3 percent of the patients with complications died, whereas the mortality rate in the patients with no complications was 68 percent. In contrast, the mortality rate of the patients who underwent a second laparotomy because of other complications rose to 83.3 percent. This rate was 68.5 percent in the patients in whom a second operation was not necessary. Hence, a second surgical trauma that occurs after a short interval is an important factor which results in an increase in mortality.

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TWO-DIMENSIONAL AND DOPPLER ECHOCARDIOGRAPHIC FINDINGS OF CONGENITAL CORONARY ARTERY FISTULA*

*Süheyla Özkutlu MD**, Muhsin Saraçlar MD**, Semra Atalay MD***
*Arman Bilgiç MD**, Yurdakul Yurdakul MD****, Sevim Çiçek MD*****

SUMMARY: Özkutlu S, Saraçlar M, Atalay S, Bilgiç A, Yurdakul Y, Çiçek S. (Department of Pediatric Cardiology, Hacettepe University Institute of Child Health, Ankara, Turkey). Two-dimensional and Doppler echocardiographic findings of congenital coronary artery fistula. Turk J Pediatr 34: 167-174, 1992.

Three patients with coronary artery fistula confirmed by coronary angiography and surgery were studied using two-dimensional and Doppler echocardiography. Two of these patients had left coronary artery-right ventricle fistula. The proximal dilatation of the coronary arteries was visualized in all three patients by two-dimensional echocardiography. The course of the dilated right coronary artery and left circumflex artery was demonstrated by two-dimensional echocardiography in two patients. We were able to detect the disturbed flow at the drainage site in one patient by using the conventional Doppler echocardiography.

In conclusion, it should be emphasized that two-dimensional and Doppler echocardiography can be useful methods in diagnosing coronary artery fistula. *Key words: congenital coronary artery fistula, echocardiography.*

Congenital coronary artery fistula is relatively uncommon and generally occurs as an isolated anomaly[1-3]. The diagnosis of coronary artery fistula is established by cardiac catheterization and selective coronary angiography[1,4]. More recently, advances in two-dimensional echocardiographic techniques have aided in identifying a dilated involved coronary artery. It is possible, however, to obtain additional information by employing pulsed Doppler echocardiography for detecting shunt flow in selected patients with coronary artery fistula[5-11].

We present three patients with coronary artery fistula diagnosed by two-dimensional and Doppler echocardiography which was also confirmed by angiocardiography. The diagnosis of two of these patients was also substantiated by surgery.

* From the Department of Pediatric Cardiology, Hacettepe University Institute of Child Health, Ankara.

** Professor of Pediatrics and Pediatric Cardiologist, Hacettepe University Faculty of Medicine.

*** Pediatrician, Hacettepe University Faculty of Medicine.

**** Professor of Thoracic and Cardiovascular Surgery, Hacettepe University Faculty of Medicine.

***** Resident in Pediatrics, Hacettepe University Faculty of Medicine.

Material and Methods

Of the patients referred to the Department of Pediatric Cardiology of the Hacettepe University Institute of Child Health between 1983-1990, a diagnosis of congenital coronary artery fistula was established in three using echocardiography, cardiac catherization and selective coronary angiography Fig. 1).

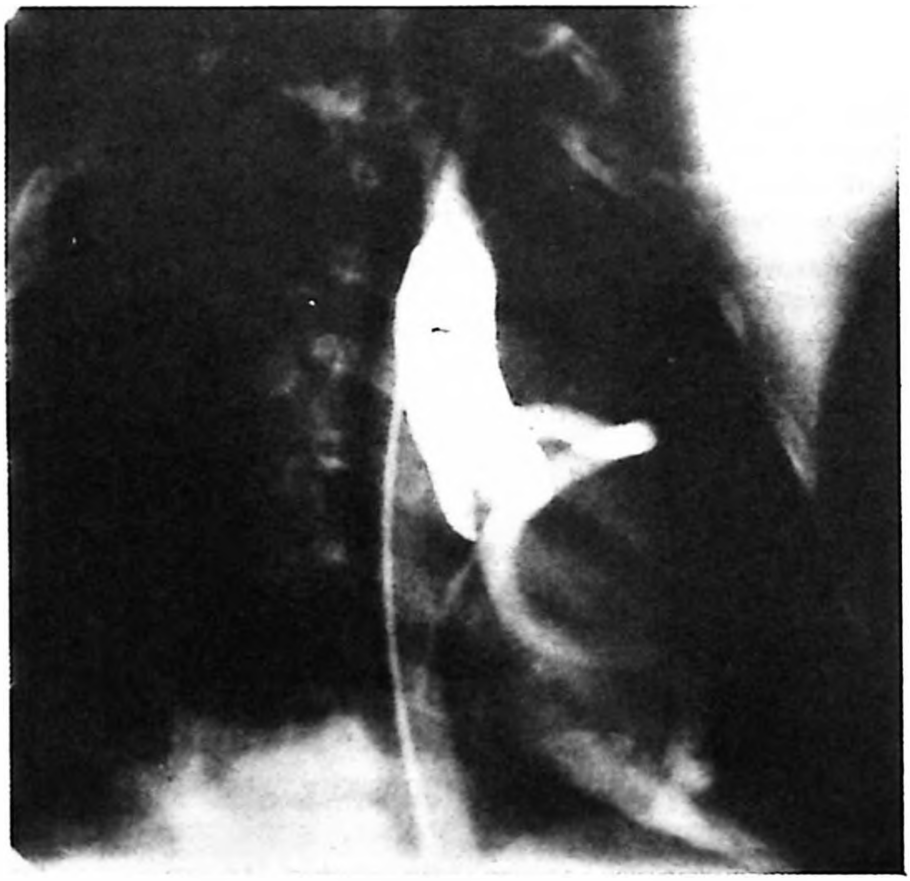

Fig. 1: Aortic root injection in the right anterior oblique position. Drainage of the left circumflex coronary artery into the right ventricular apex is seen (Case No 3).

This study was carried out between 1983 and 1990. The ages of the patients ranged between 3-5 years. Two patients had undergone surgical closure of the fistula.

Echocardiography: The echocardiographic examination included two-dimensional and Doppler studies using a Toshiba-Sonolayer-S SSH 60 A scanner with 2.5 and 3.75 MHz transducers.

Case Reports

The clinical manifestations and laboratory findings of our patients are presented in Table I. Echo findings were as follows:

TABLE I: Clinical and Laboratory Findings of the Patients

Case No	Age (yr) sex	Murmur	Cardiac catheterization	Angiocardiography	Treatment and outcome
1 (1983)	5, F	3rd intercostal space continuous murmur with diastolic accentuation	RVP : 35 mm Hg PAP : 25/10 mm Hg mean : 12 mm Hg Qp/Qs: 1.2	Left coronary artery-right ventricular outflow tract fistula	Surgical therapy recommended
2 (1987)	4, F	4rd intercostal space continuous murmur with diastolic accentuation	RVP : 27 mm Hg PAP : 21/7 mm Hg mean : 12 mm Hg Qp/Qs: 1.4	Right coronary artery-right ventricular outflow tract fistula	Fistula closed with patch
3 (1990)	3, F	Continuous murmur with diastolic accentuation at the apex	RVP : 30 mm Hg PAP : 20/5 mm Hg mean : 14 mm Hg There was no shunt	Left coronary artery-right ventricular apex fistula	Fistula closed with patch

RVP: right ventricular pressure
PAP: pulmonary artery pressure
Qp : pulmonary flow
Qs : systemic flow

Case I

Two-dimensional echocardiography showed that the dimensions of the cardiac chambers were within normal limits. In the high parasternal short axis records, dilatation of the proximal portion of the left coronary artery was seen (Fig. 2). The diameter of the coronary artery on this side was 9 mm and the aortic root 24 mm. The ratio of the coronary artery diameter to the aortic root diameter was 0.37.

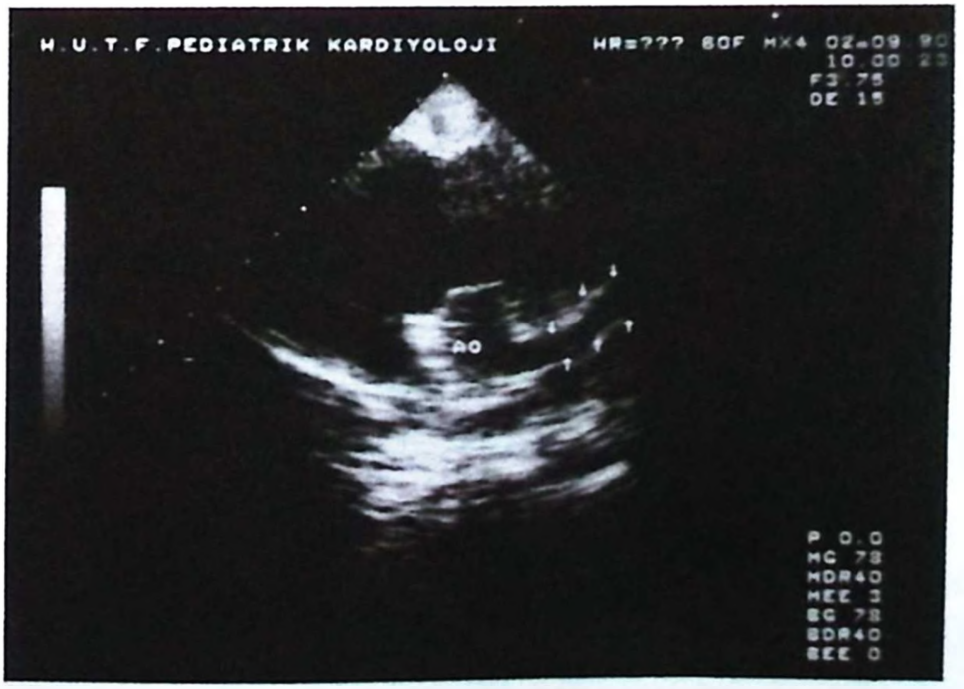

Fig. 2: In the parasternal short-axis view, proximal dilatation of the left coronary artery is seen (arrows).
Ao: aorta

Case 2

Echocardiographic examination revealed slight right atrial and right ventricular dilatation. Left ventricular functions were normal. The high parasternal short-axis records demonstrated dilatation of the proximal portion of the right coronary artery, which was 9 mm in diameter (Fig. 3). The aortic root was 21 mm and the ratio of the coronary artery diameter to the aortic root was 0.42. The dilated right coronary artery was demonstrated on the anterior groove of the right ventricle in the subcostal position.

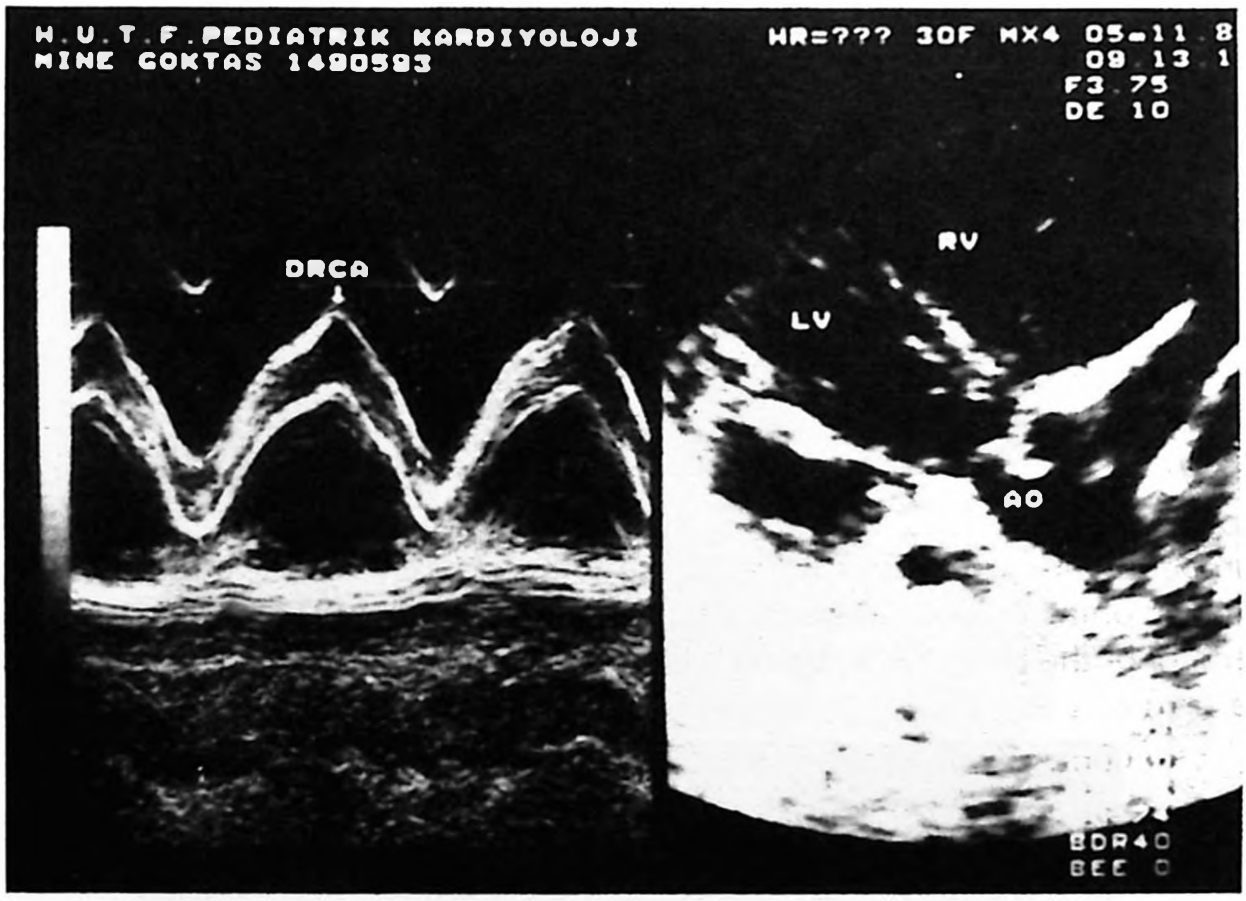

Fig. 3: Dilated right coronary artery (arrow) is demonstrated by two-dimensional (right) and M-mode echocardiography (left).

Case 3

Echocardiographic studies revealed that the diameters of the cardiac chambers and left ventricular functions were within normal limits. The proximal dilatation of the left coronary artery was demonstrated in the high parasternal short axis view, which was 7 mm in diameter. The ratio of the left coronary artery diameter to the aortic root diameter was 0.41.

The complete course of the circumflex coronary artery was visualized on the right ventricle from the apical four-chamber view (Fig. 4).

Doppler echocardiography revealed a continuous disturbed flow with diastolic accentuation in the right ventricular cavity near the apex (Fig. 5).

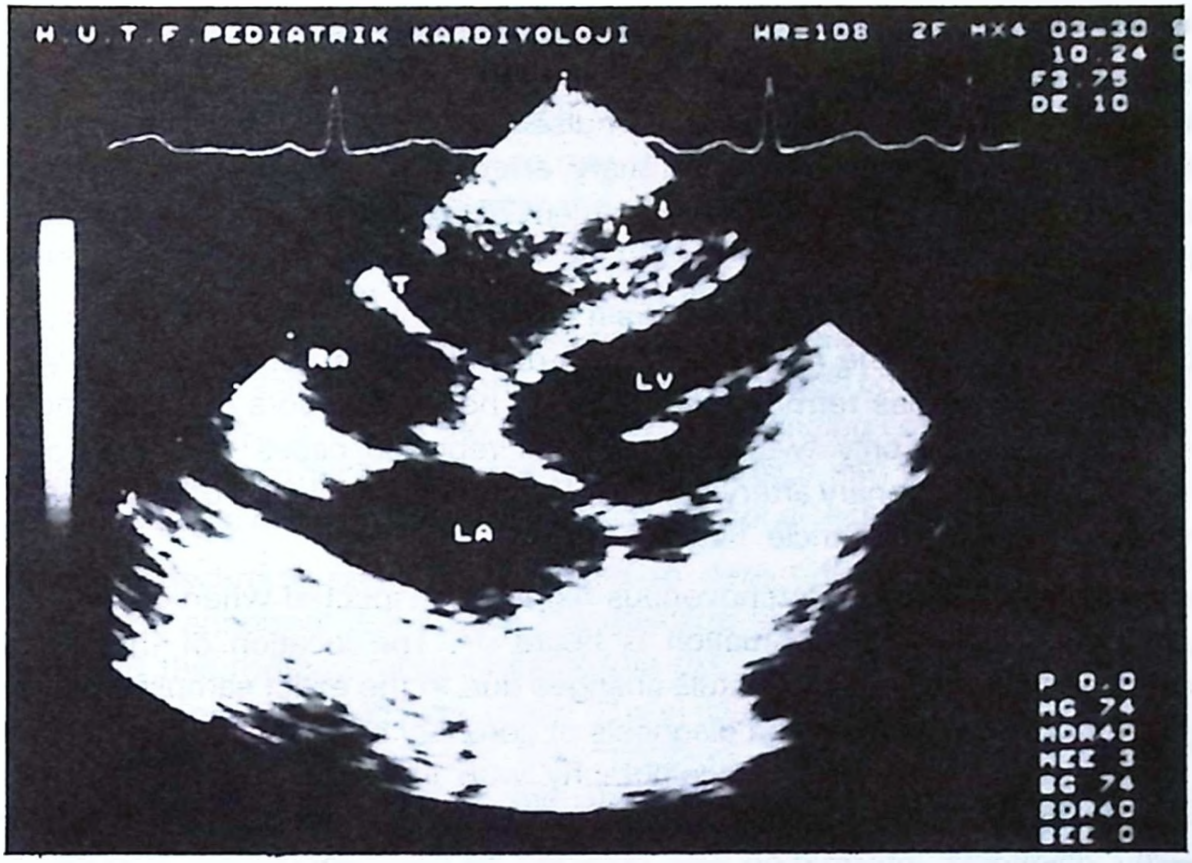

Fig. 4: Complete course of the left circumflex coronary artery (arrows) is demonstrated.

RA: right atrium
T : tricuspid valve
LA: left atrium
LV: left ventricle

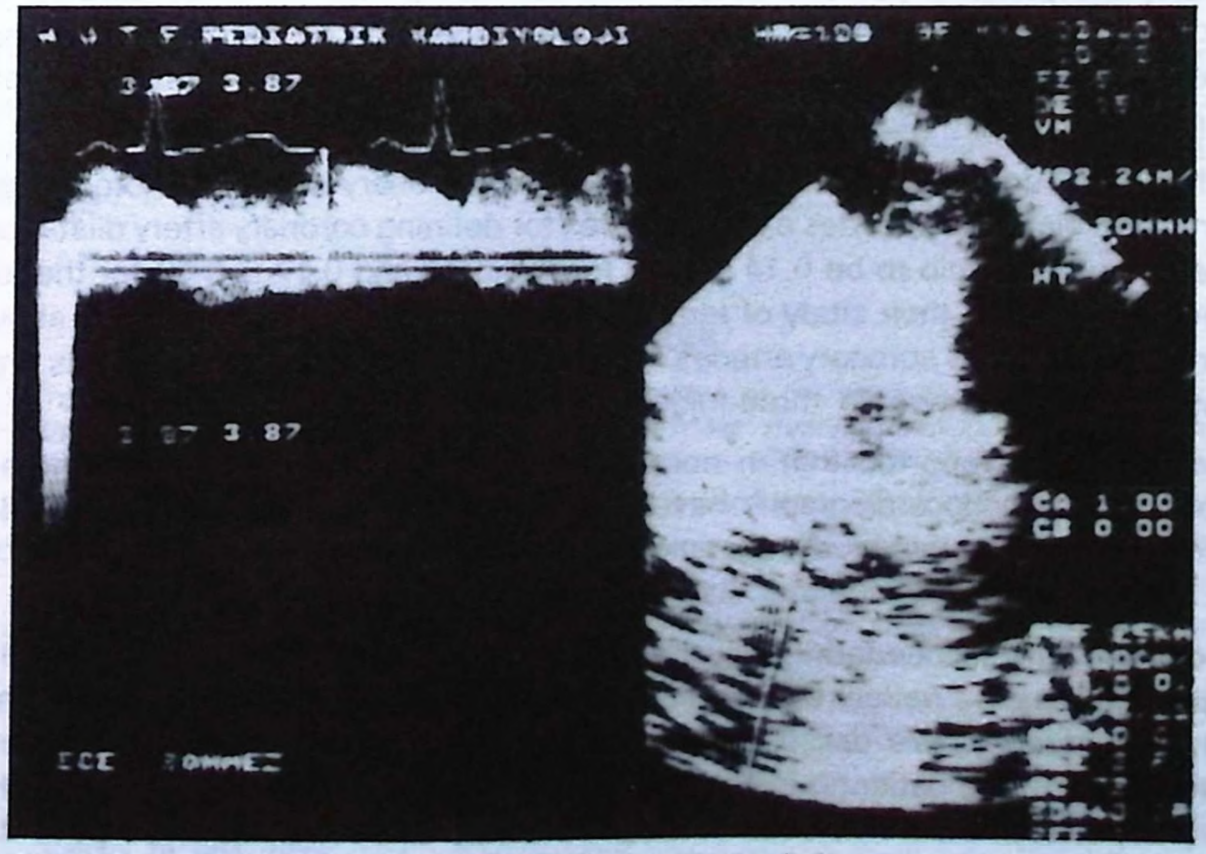

Fig. 5: Continuous disturbed flow with diastolic accentuation (left) demonstrated near apex by Doppler echocardiography.

Discussion

The incidence of coronary artery fistula varies between 0.26 and 0.40 percent in selected case series of congenital heart disease[9]. Coronary artery fistulas more commonly arise from the right coronary artery (50-60%) than from the left (30-40%)[1,12,13]. It is reported that 90 percent of coronary artery fistulas drain to the venous site of the heart[1-3].

Thirty-nine percent of these fistulas drain into the right ventricle and 33 percent into the right atrium. The remainder (20%) drain into the pulmonary artery[14-16]. Coronary artery fistulas terminating in the left heart chambers are exceptionally rare, and constitute only two percent of all reported cases[12,17]. Two of our patients had a left coronary artery-right ventricle fistula, while the other had a right coronary artery-right ventricle fistula.

The diagnosis of coronary arteriovenous fistula is suspected when a continuous murmur with diastolic accentuation is heard[1,12]. The location of the murmur caused by the coronary artery fistula changes due to the exact sampling site with the chamber of drainage[12]. The diagnosis of coronary artery fistula is established by cardiac catheterization and angiography with injection of contrast material either into the aortic root or selectively into the coronary arteries[1,4,6,18,19]. More recently, diagnostic information was obtained by two-dimensional, conventional and color Doppler echocardiography[5-11].

Usually the proximal portions of the coronary artery may be demonstrated by two-dimensional echocardiography[5-7,9-11]. Demonstration of the dilated coronary artery is much easier. It is necessary to know the normal ranges of coronary artery diameters in order to evaluate the coronary arteries[5,6].

Velvis et al[6] demonstrated that the ratio of the coronary artery diameter to the aortic root diameter provides a reliable index for defining coronary artery dilatation. They found this ratio to be 0.14 ± 0.03 for the right and 0.17 ± 0.03 for the left coronary artery. In their study of ten patients, this ratio was 1.5 to 4 times above normal for proximal coronary arteries feeding the fistula[6]. In our patients, this ratio was found to be two to three-fold above normal.

Shakudo et al[5] reported that in normal populations, coronary artery diameters measured by echocardiography have a diameter ranging between 3.5 and 6.0 mm. According to this study, dilatation of the coronary artery was considered to be present when the luminal diameter was greater than 6 mm[5].

Rodgers et al[8] succeeded in visualizing the proximal and distal portions of the coronary artery in a patient with coronary arteriovenous fistula by two-dimensional echocardiography. We demonstrated proximal dilatation of the coronary artery fistula in our three patients. In the study of Velvis et al[6] proximal dilatation of the coronary artery fistula was seen in ten patients, as was observed in our patients.

They visualized the orifice of the coronary sinus or the right ventricle in five of their patients in whom the left circumflex coronary artery was the feeding vessel and the fistula drained into the right atrium. We visualized the proximal dilatation of the left coronary artery and complete course of the left circumflex artery in Case No 3. They did not demonstrate whether the coronary artery fistula drained from the posterior atrioventricular groove into the right atrium on the right ventricle in three of their patients in whom the right coronary artery was the feeding vessel. In our second case, the course of the dilated right coronary artery was demonstrated by two-dimensional echocardiography, but its drainage site could not be visualized. In another two cases, in which the left anterior descending coronary artery was the feeding vessel, neither the course nor the drainage site of the coronary artery fistula could be demonstrated by two-dimensional echocardiography.

Doppler echocardiography can be used to detect flow velocities in fistulous vessels and abnormal flows from the drainage site in cases of coronary artery fistula, but this method requires extensive experience, patience and skill[5,6,8,11]. Velvis et al[6] demonstrated a disturbed flow in dilated coronary arteries feeding the fistula in eight patients by color flow mapping. In our study, we were able to detect the disturbed flow at the drainage site in Case No 3 by using conventional Doppler echocardiography. Velvis et al[6] and Fukuda et al[11] reported that this disturbed flow had occurred primarily in late systole and early diastole. We recorded a continuous disturbed flow with diastolic accentuation in Case No 3, as was reported by Kronzon et al[10].

This report, along with others, demonstrates that two-dimensional echocardiography combined with Doppler echocardiography are non-invasive methods which can be employed for evaluating a coronary artery fistula and identifying its drainage site.

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CONGENITAL CORONARY ARTERIOVENOUS FISTULA IN A TEN-YEAR-OLD BOY WITH ANGINA PECTORIS*

*Talat Cantez MD***, Ümrah Aydoğan MD***, Enver Dayıoğlu MD****
*Ertan Onursal MD*****, Ilmay Bilge MD******

SUMMARY: Cantez T, Aydoğan Ü, Dayıoğlu E, Onursal E, Bilge I. (Departments of Pediatrics and Cardiovascular and Thoracic Surgery, İstanbul University Faculty of Medicine, İstanbul, Turkey). Congenital coronary arteriovenous fistula in a ten-year-old boy with angina pectoris. Turk J Pediatr 34: 175-178, 1992.

Congenital arteriovenous fistula (CAVF) is a rare cardiac lesion. Angina pectoris is uncommon in younger patients with CAVF. Fistula-related symptoms, complications of this anomaly and surgical complications have a strong correlation with the age of the patient. A ten-yer-old male patient with angina pectoris in whom the diagnosis of CAVF was established, and who, following surgical ligation recovered, is presented.
Key words: coronary artery anomalies, coronary arteriovenous fistula.

Congenital coronary arteriovenous fistula (CAVF) is one of the rare congenital heart lesions. The term CAVF describes the fistulous communications between branches of the coronary arteries and a large vessel or cardiac chamber. According to Wenger's estimate[1], the incidence of CAVF is 1 per 6,250,000. Dyspnea on exertion, fatigue and angina are the major symptoms of this anomaly. However, only nine percent of patients under the age of 20 are symptomatic[2].

In this report, we describe a ten-year-old boy with CAVF who presented with all the known symptoms associated with this anomaly.

Case Report

A ten-year-old boy was admitted to the İstanbul University Faculty of Medicine Children's Hospital with a history of dyspnea, angina on exertion, and fatigue of four years' duration.

Physical examination revealed a weight of 31.5 kg (25th-50th percentile), and height of 1.34 m (25th-50th percentile). The heart rate was 72 beats/min, with a

* From the Departments of Pediatrics and Cardiovascular and Thoracic Surgery, İstanbul University Faculty of Medicine, İstanbul.
** Professor of Pediatrics and Pediatric Cardiologist, İstanbul University Faculty of Medicine.
*** Chief Resident in Pediatrics, İstanbul University Faculty of Medicine.
**** Associate Professor of Cardiovascular and Thoracic Surgery, İstanbul University Faculty of Medicine.
***** Professor of Cardiovascular and Thoracic Surgery, İstanbul University Faculty of Medicine.
****** Resident in Pediatrics, İstanbul University Faculty of Medicine.

sinusal rhythm. The blood pressure was 110/70 mmHg. Radial and femoral pulsations were normal on palpation. Cardiac examination revealed that S_1 and S_2 were single and not accentuated. A continuous murmur was audible at the 3^{rd}-4^{th} left intercostal margin. No other abnormalities were noted.

The results of laboratory studies were within normal limits. The teleroentgenogram demonstrated that the heart was of normal size, but that the apex was slightly upturned and pulmonary vascular tracings were slightly elevated. The electrocardiogram showed no anomalies. The electrocardiogram stress test was also within normal limits. M-mode and two-dimensional echocardiography showed normal findings. Color Doppler echocardiography revealed a blood flow from the right ventricular apex into the cavity (Fig. 1). Based on these findings, a tentative diagnosis of CAVF of the right coronary artery into the right ventricle was established. Hemodynamic examination showed that the catheter passed into the left atrium through the foramen ovale. O_2 saturation in the right atrium was 79 percent, while it was 83 percent in the right ventricle, showing a four percent increment. Systolic, diastolic and end-diastolic pressures in the right ventricle were within normal limits. The Qp/Qs ratio was 1.22 and the L-R shunt was calculated as 1.38 L/min. Selective coronary artery injections showed no anomaly in the left coronary artery, but the right coronary artery showed an aneurysmal dilatation from the aortic end to the apex of the heart, where the fistula entered

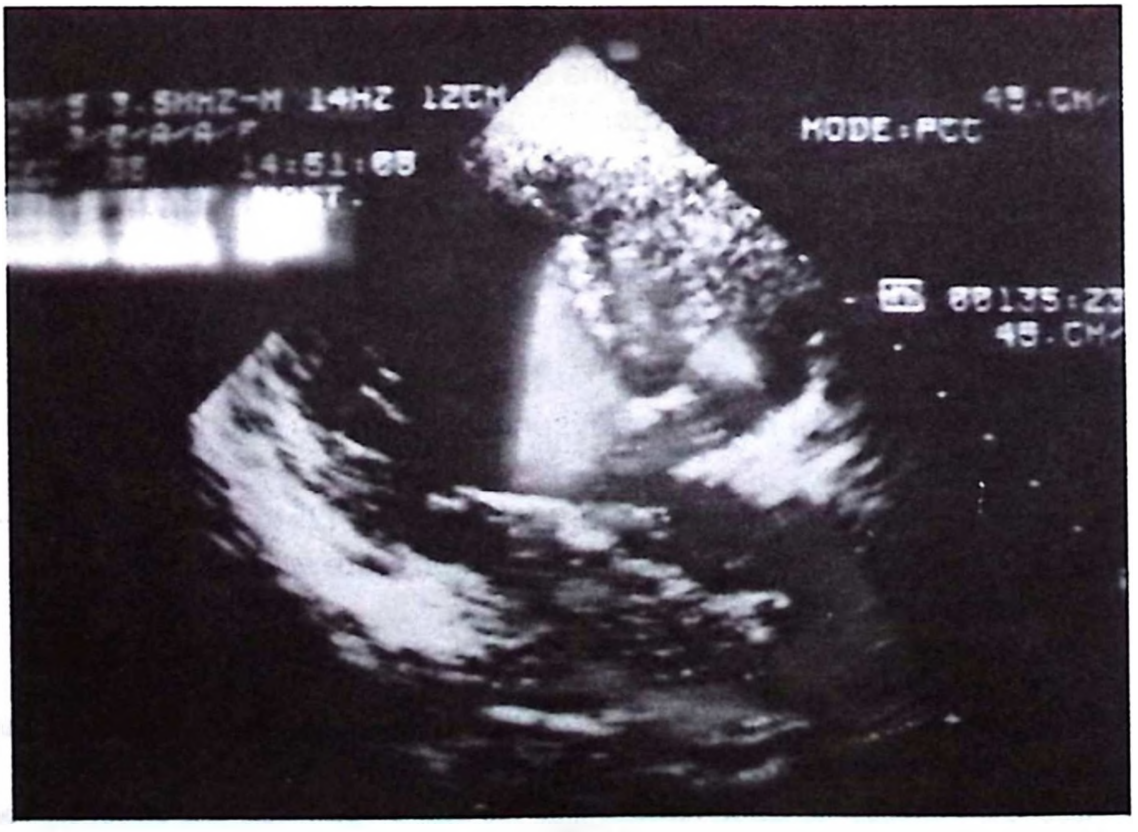

Fig. 1: Turbulent flow from the apex of the RV on color Doppler echocardiography.

the right ventricle (Fig. 2). The distal end of the coronary artery was too puny. Cardiac cineangiography demonstrated no other anomaly. The fistulous communication was surgically ligated, resulting in the disappearance of all complaints.

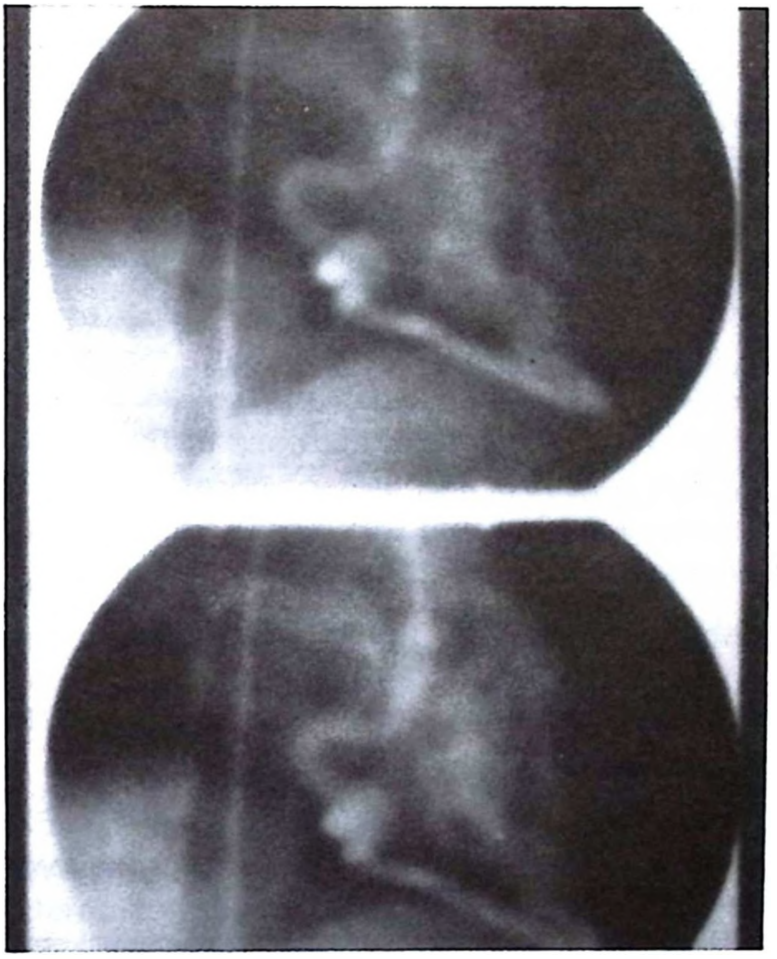

Fig. 2: Dilated right coronary artery and visualization of the right ventricular cavity by the epical fistula.

Discussion

Since its initial description in 1865, about 350 patients with CAVF have been reported[2-9]. Embryologically, these fistulas seem to represent persistent junctions of the primordial sinusoidal circulation. They vary from a single vessel, frequently tortuous, with a single origin and a single termination, as was the situation in this patient, to complex, worm-like aneurysmal cavities in which blood may stagnate, clot and calcify[10]. Aneurysmal dilatation results from a structural weakening of the vessel wall due to increased blood flow through the fistula[11].

More than half of CAVF patients of all ages are clinically asymptomatic. They show normal stress tolerance despite their moderate volume overloads. According to some authors, the mean shunt does not differ significantly from

those with or without symptoms or complications, especially in patients under the age of twenty[2,9]. Liberthson et al[2], in their review of 186 patients reported in the literature, grouped the patients according to age. Among the 88 patients over the age of twenty, 67 percent had preoperative symptoms of CAVF-related complications such as congestive heart failure, subacute bacterial endocarditis, myocardial infarction, fistula rupture or a fatal outcome. In contrast, the frequency of symptoms and CAVF-related complications in the younger group was only 19 percent. Only three percent of the younger patients had symptoms peculiar to angina pectoris. The frequency of angina pectoris in younger patients is also uncommon in later reports[4,7-9]. In these patients, angina pectoris is attributed to insufficient blood flow to the distal end of the fistula (coronary steal)[10].

In view of the fact that there is a high incidence of fistula-related late symptoms/complications, increased morbidity and mortality associated with surgical intervention in older patients and the low incidence of spontaneous closure, fistula ligation was attempted in this patient. The fistulous communication was ligated by two transfixion sutures of nonabsorbable material, without resorting to cardiopulmonary bypass. Shortly after the operation, the patient's complaints disappeared, and no complications related to the surgery occurred.

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The Turkish Journal of Pediatrics 34:179-185, 1992

MECKEL GRUBER SYNDROME: A CASE DIAGNOSED IN UTERO*

*Sevim Balcı MD***, Behsan Önol MD***, M. Derya Erçal MD****
*Sinan Beksaç MD*****, Canan Erzen MD******, Okan Akhan MD*******

SUMMARY: Balcı S, Önol B, Erçal MD, Beksaç S, Erzen C, Akhan O. (Departments of Pediatrics, Pathology, Obstetrics and Gynecology, and Radiology, Hacettepe University Faculty of Medicine, Ankara, Turkey). Meckel Gruber syndrome: a case diagnosed in utero. Turk J Pediatr 34: 179-185, 1992.

A case of Meckel Gruber syndrome is presented, diagnosed prenatally from the medical history of the mother which revealed a previous malformed stillborn with anencephaly, meningomyelocele, polydactyly and ambiguous genitalia. This was the first prenatally diagnosed case ever reported in Turkey. The clinical, computed tomography and postmortem findings and the related literature are reviewed. *Key words: Meckel Gruber syndrome, Dandy-Walker malformation, prenatal diagnosis.*

Meckel Gruber syndrome is a rare autosomal recessive disorder characterized by multiple central nervous system anomalies and gastrointestinal, genitourinary and skeletal system malformations. Most of the cases are either stillborn or die soon after birth. Genetic counselling is important for parents considering a future pregnancy who have had previous stillbirths with similar malformations[1,2].

We recently diagnosed a case of Meckel Gruber syndrome associated with Dandy-Walker malformation in utero. The mother of the infant had had a previous stillbirth with similar anomalies.

Case Report

A 28-year-old mother was admitted to the Obstetrics and Gynecology Clinic of the Hacettepe University Faculty of Medicine in the 33rd week of gestation for ultrasonographic examination which demonstrated a hydrocephalic fetus with an enlarged abdomen and oligohydramnios. The medical history revealed a previous stillbirth in the 38th week of gestation that had ambiguous genitalia, polydactly,

* From the Departments of Pediatrics, Pathology, Obstetrics and Gynecology, and Radiology, Hacettepe University Faculty of Medicine, Ankara.
** Professor of Pediatrics, Hacettepe University Institute of Child Health.
*** Professor of Pathology, Hacettepe University Faculty of Medicine.
**** Instructor in Pediatrics and Fellow in Clinical Genetics, Hacettepe University Institute of Child Health.
***** Associate Professor of Obstetrics and Gynecology, Hacettepe University Faculty of Medicine.
****** Associate Professor of Radiology, Hacettepe University Faculty of Medicine.

anencephaly and meningomyelocele. This pregnancy was followed by the birth of three healthy children. The parents were unrelated. The alpha-fetoprotein level (AFP) was 55 ng/dl, which was considered to be within normal limits for this gestational age.

Meckel Gruber syndrome was suspected prenatally because of the past history of the mother and the ultrasonographic determinations. The pregnancy was terminated by the induction of labor, during which the malformed fetus died. The fetus was examined using ultrasonography and computed tomography (CT) prior to postmortem examination. Postmortem examination revealed a fetus with short, deformed ribs and an enlarged abdomen (Fig. 1). Computed tomography showed a dilated foramen magnum and an absence of the fourth ventricle. There was a cystic mass behind the location of the fourth ventricle having cerebrospinal fluid density which elevated the tentorium and displaced the mesencephalum anteriorly. These findings mimicked a Dandy-Walker malformation (Fig. 2). The cervical and thoracal vertebral canals were also dilated.

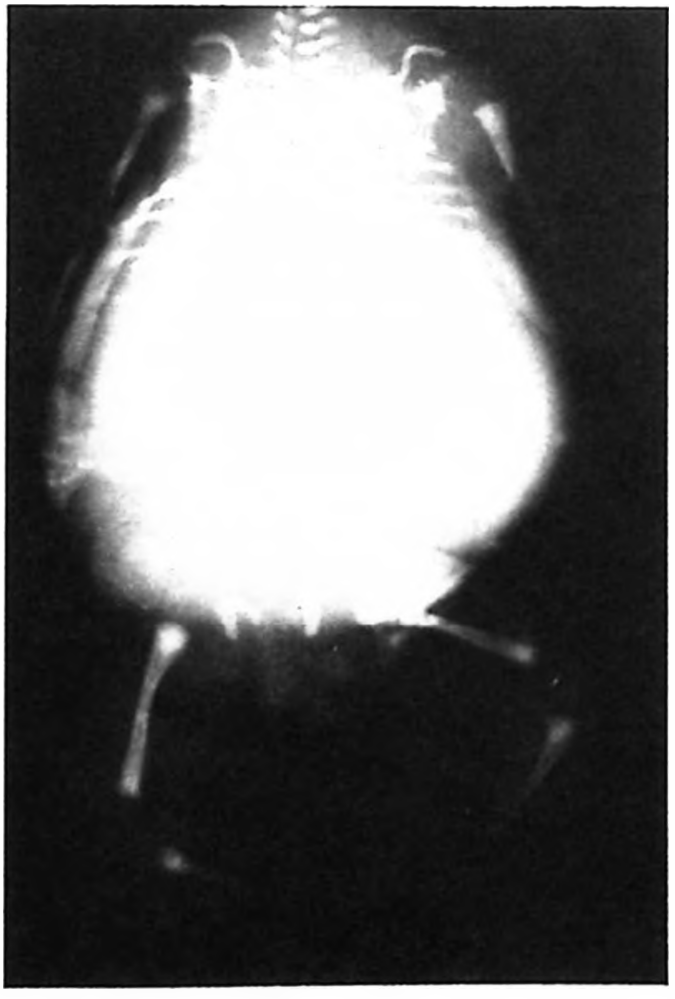

Fig. 1: Postmortem X-ray demonstrates deformed, short ribs on the right side of the fetus.

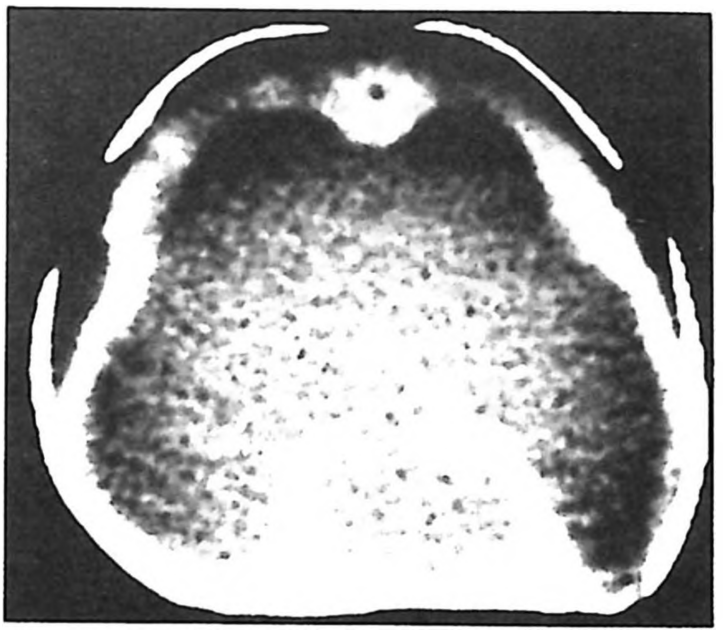

Fig. 2: CT reveals dilation of the lateral ventricles, hydrocephaly and an arachnoidal cyst in the posterior fossa.

Abdominal CT demonstrated hepatomegaly and bilateral polycystic kidneys with minimal ascites.

Postmortem examination revealed a fetus with a weight of 3400 g, length 51 cm, head circumference 39 cm, chest circumference 30 cm and abdominal circumference 41 cm. It had a macrocranium with edematous skull skin, a low set right auricule and the left side of the mandible was hypoplastic with micrognathia. It had a cleft palate and tongue, hypotelorism, a flattened nose and a fold rising up from the inner canthus sweeping downward and laterally below the eyes. The thorax was hypoplastic, the abdomen was enlarged with renal masses and hepatomegaly was present. The hands and feet had postaxial polydactyly and the left hand also had clinodactyly. Bilateral simian lines were also present (Fig. 3).

The gross appearance of the brain demonstrated flattened gyri, cerebellar hypoplasia and a cystic posterior fossa. Olfactory bulbs were absent (Fig. 4). Coronal sectioning showed an extreme dilation of the lateral and third ventricles, with the association of dilation of the aqueduct of Sylvius and agenesis of the corpus callosum. There was also cystic dilation of the fourth ventricle. The dorsal part of this particular cyst was covered only by a leptomeningeal covering which was about four cm in diameter in toto. Because of the compression of the cyst, the medulla was so distorted that it resembled a Dandy-Walker malformation in shape.

The right kidney weighed 300 g and measured 13 × 7 × 5 cm. On cross section, it contained several cysts, the most prominent one being 0.5 cm in diameter. The

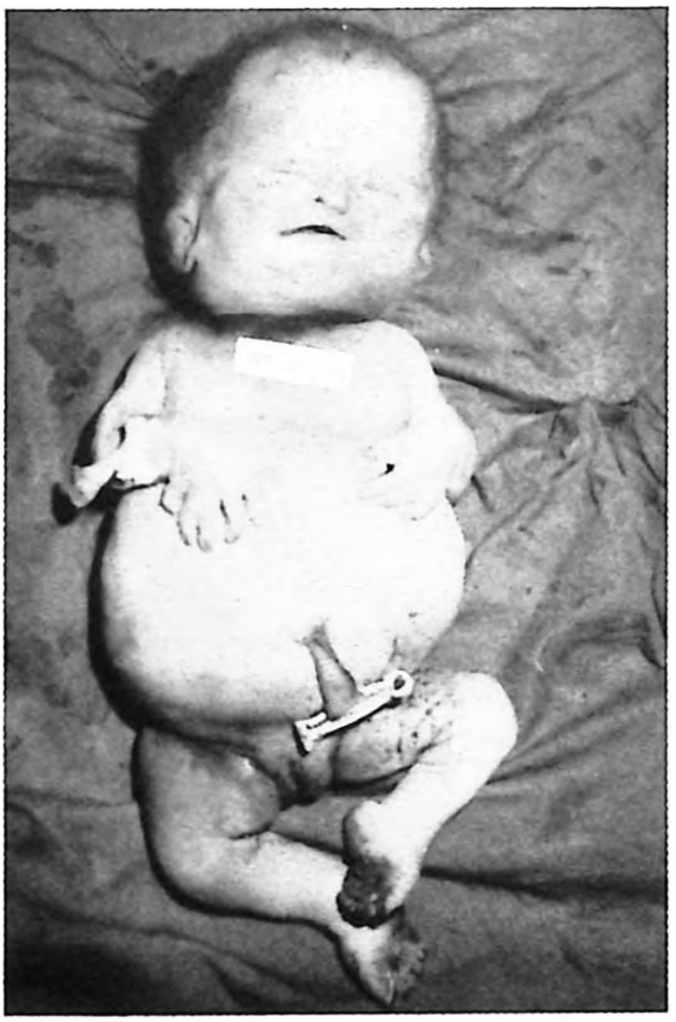

Fig. 3: Note large head, low set ears, inner canthal folds, micrognathia, polydactyly of the hands and feet, and a large abdomen.

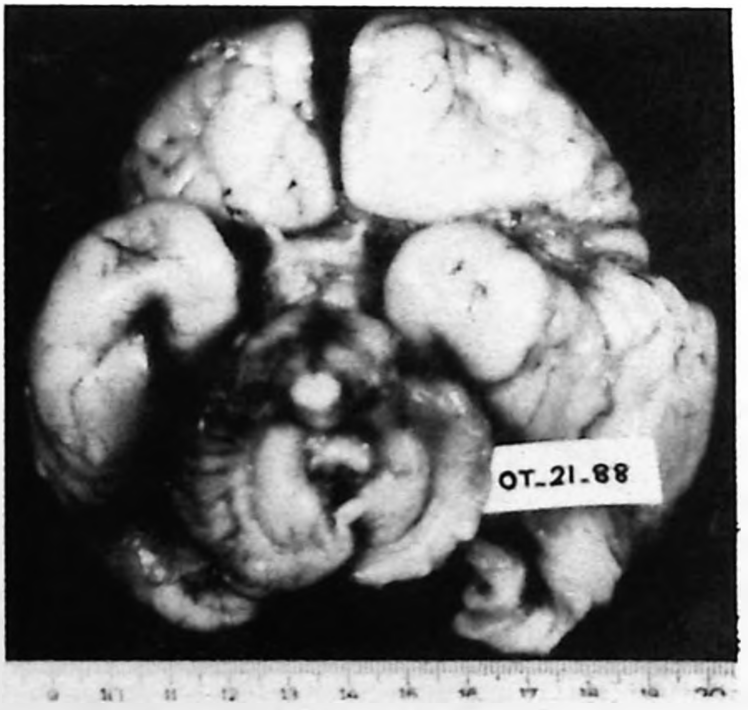

Fig. 4: Postmortem examination of the brain reveals the absence of olfactory bulbs; cerebellar hypoplasia, vermis agenesis and a dilated cystic fourth ventricle were noted.

medulla was so distorted that it resembled a Dandy-Walker malformation in shape.

The right kidney weighed 300 g and measured 13 × 7 × 5 cm. On cross section, it contained several cysts, the most prominent one being 0.5 cm in diameter. The left kidney weighed 270 g and also contained several cysts, the most prominent one being 0.6 cm in diameter (Fig. 5). Microscopically, tubules with very scanty glomeruli were detected in the cortices of both kidneys. The cystic collecting tubules of varying sizes surrounded by dense fibrous stroma were observed in the medulla. The ureters and bladder were normal.

Chromosome analysis was performed on cultures of peripheral lymphocytes and it was determined that the fetus was a normal female, 46 XX.

Fig. 5: Note hepatomegaly and enlarged cystic kidneys.

Discussion

This syndrome, first described by Meckel in 1822, is characterized by the presence of polycystic kidneys, polydactyly and occipital encephalocele. Gruber in 1934 referred to it as "dysencephalica splancho cystica" because of the additional central nervous system, somatic and splanchnic malformations[1-3]. The mode of transmission of this rare syndrome is an autosomal recessive gene[3]. The affected fetus is either stillborn or dies soon after birth. A careful examination should be made of every affected fetus keeping in mind this autosomal recessive condition so as to advise parents regarding future pregnancies. This syndrome is considered to be rare, and is more prevalent among Jews (1 in 50,000). However it has also been recorded in the Turkish medical literature[4-6].

The diagnostic criteria for Meckel Gruber syndrome requires that at least two of the three following conditions be present: occipital encephalocele, polydactyly, cystic kidneys in addition to a normal chromosome constitution. Fifty-seven percent of patients have all three major abnormalities[2].

Polycystic dysplasia is the most common and constant entity in Meckel Gruber syndrome[7]. Cystic changes in the renal parenchyma can be seen in all cases. Some patients only have microscopic cysts while others have huge polycystic kidneys. Histologically, the cysts are variably of the proximal and distal tubules or in the medulla. Ultrasonographic examination is a noninvasive method for prenatal detection of kidney anomalies[8].

The major CNS anomalies are occipital encephalocele and microcephaly. Encephalocele exists in four out of five cases. Various degrees of hydrocephaly and arrhinencephaly, and the absence of olfactory bulbs and optic nerves may accompany the CNS features. Cerebellar hypoplasia, hydrocephaly with Dandy-Walker malformation and agenesis of bulbus olfactorius were the CNS malformations observed in the patients we studied. Three cases of hydrocephaly associated with Meckel Gruber syndrome have been reported by Simopoulos[9], and two cases by Walbaum[10]. After a search of the literature, we were unable to find a report of a case that had CNS anomalies similar to our patient.

This syndrome is being increasingly recognized prenatally in the mid-second trimester because of an increase in amniotic fluid and maternal serum AFP levels[11,12]. The maternal AFP was normal because in the presented case there was no open neural tube defect.

As far as we know, this is the first case of Meckel Gruber syndrome associated with Dandy-Walker malformation (hydrocephalus, cyst of the posterior fossa and cerebellar hypoplasia) diagnosed in utero and published in Turkey.

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The Turkish Journal of Pediatrics 34:187-191, 1992

BRONCHOGENIC CYST IN A 14-MONTH OLD BOY*
(A Case Report)

*M. Ali Altın MD***, Z. Hülya Gündoğdu MD****, Zeynep Şenel MD*****

SUMMARY: Altın MA, Gündoğdu ZH, Şenel Z. (Departments of Pediatric Surgery and Pathology, Numune Hospital, Ankara, Turkey). Bronchogenic cyst in a 14-month-old boy: a case report. Turk J Pediatr 34: 187-191, 1992.

A patient with a bronchogenic cyst in the mediastinum is presented. This rare cyst was found by chance in a 14-month-old boy suffering from respiratory distress due to partial compression of a bronchus. Ultrasonographic and tomographic examinations revealed a cystic mass measuring 3 × 3 cm in diameter located within the apex of the right lobe of the lung. Bronchogenic cyst should be considered when these signs present in early childhood. Key words: bronchogenic cyst, posterio-medial cysts of the mediastinum.

Childhood mediastinal cysts are most often classified as bronchogenic, dermoid, enterogenous, pericardial and nonspecific malformations.[1] Although the bronchogenic cyst is a rare thoracal mass, it should nevertheless be considered in the differential diagnosis of other mediastinal masses. This report is of an infant with a histologically-diagnosed bronchogenic cyst which caused respiratory distress.

Case Report

A 14-month-old boy was transferred to the Pediatric Surgery Clinic of Numune Hospital for evaluation of a posterior mediastinal mass. The parents noticed that the child was irritable, exhibited respiratory distress, and had intermittent episodes of cyanosis. Physical examination on admission revealed a child with a sad expression who was tachypneic and had mild shortness of breath, but displayed no labored respiration or cyanosis. Examination of the chest revealed nothing abnormal. The remainder of the physical examination was unremarkable.

Roentgenography examination revealed a posteroanterior mediastinal soft tissue mass projecting to the right and measuring 3×3 cm (Fig. 1). Ultrasonography of the thorax showed a hypoechoic, cystic mass measuring 3×3 cm within the apex of the right lobe of the lung. These findings were confirmed by computerized tomography (Fig. 2). The barium swallow esophagogram was normal. The following diagnostic possibilities were considered: mediastinal cyst of foregut

* From the Departments of Pediatric Surgery and Pathology, Numune Hospital, Ankara.
** Associate Professor of Pediatric Surgery, Numune Hospital.
*** Pediatric Surgeon, Numune Hospital.
**** Pathologist, Numune Hospital.

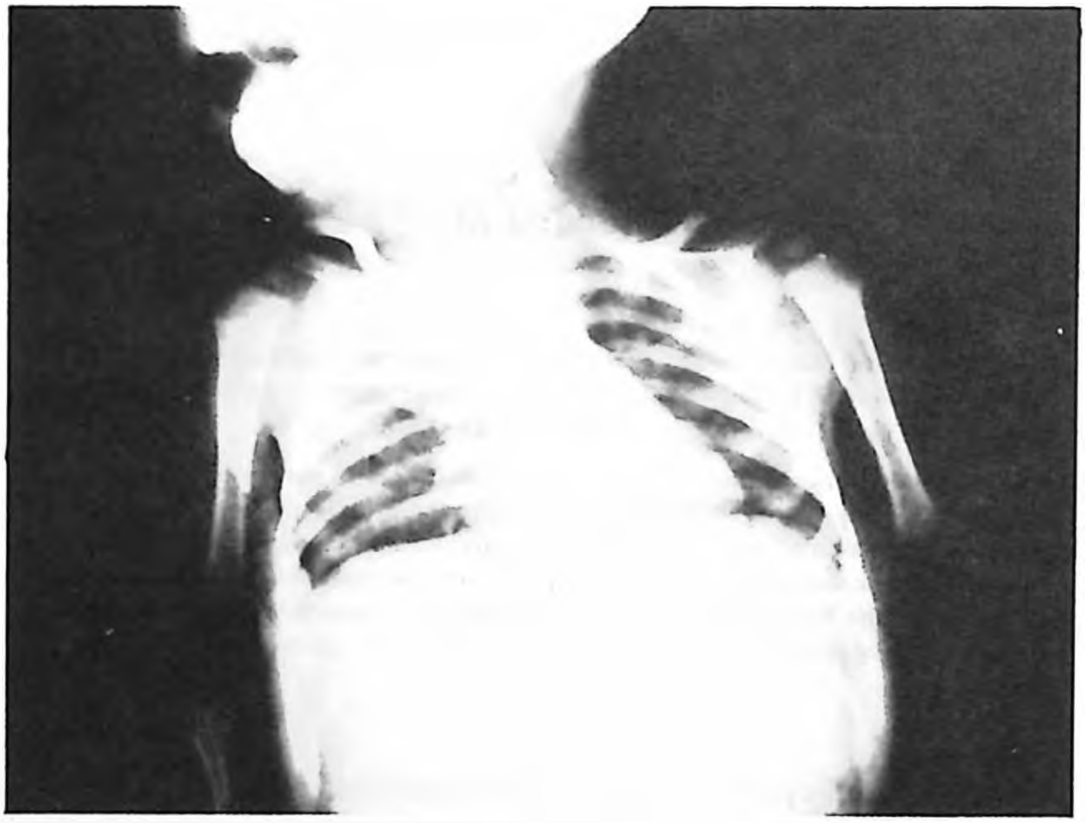

Fig. 1: Plain chest radiogram on admission.

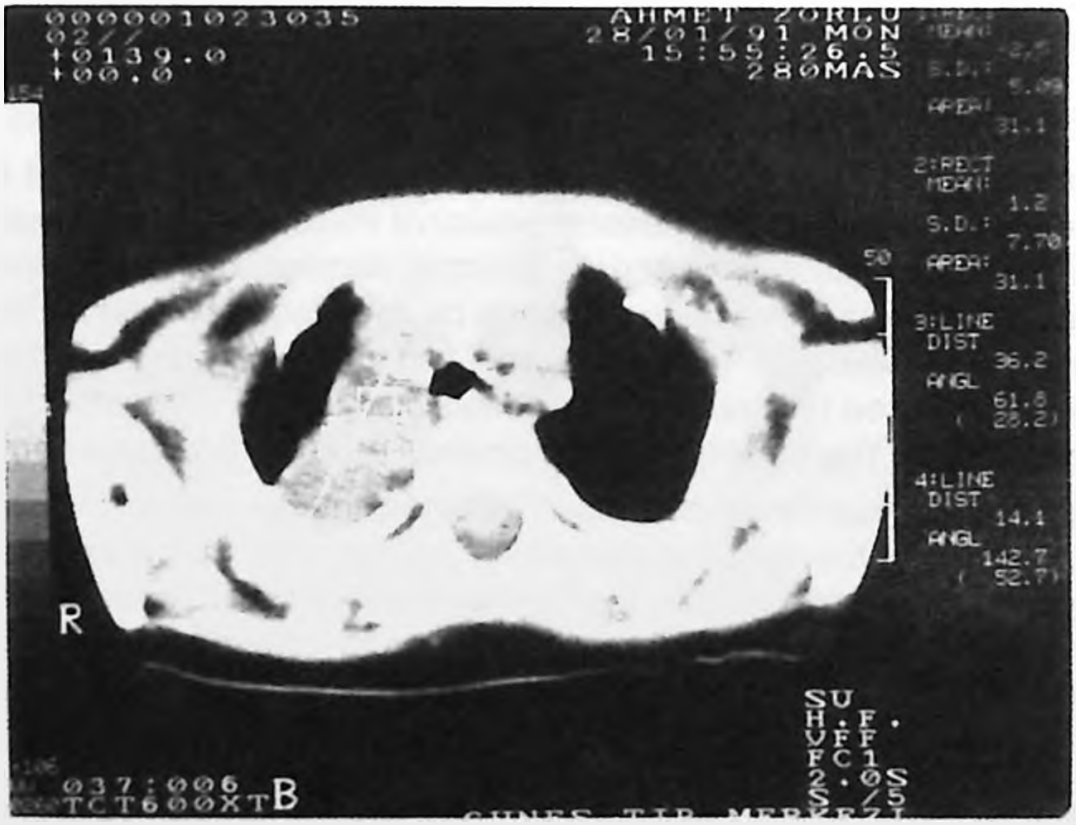

Fig. 2: Computerized tomography demonstrating a cystic mass measuring 3 × 3 cm located within the apex of the right lobe of the lung.

origin; anterior meningocele, and a neurogenic tumor. In regard to the above-mentioned possibilities, a surgical procedure was performed which consisted of a right posterolateral thoracotomy incision made through the fourth intercostal space. A rather large, round, well-circumscribed mass was present in the posterior mediastinum. By the extraperitoneal route, the cystic mass was freed and totally excised. A chest tube was inserted, and routine closure of the thoracotomy incision was performed.

The postoperative course of the patient was uneventful. The chest tube was removed on the second postoperative day. No respiratory embarrassment was encountered, and on the third postoperative day, the chest X-ray showed complete expansion of the lungs.

Histopathological examination demonstrated ciliated, single cell columnar epithelium. The wall consisted of fibrous tissue devoid of cartilage and mucous glands (Fig. 3).

On follow-up three months later, the infant was well and symptom-free. Computerized tomography showed a normal lung.

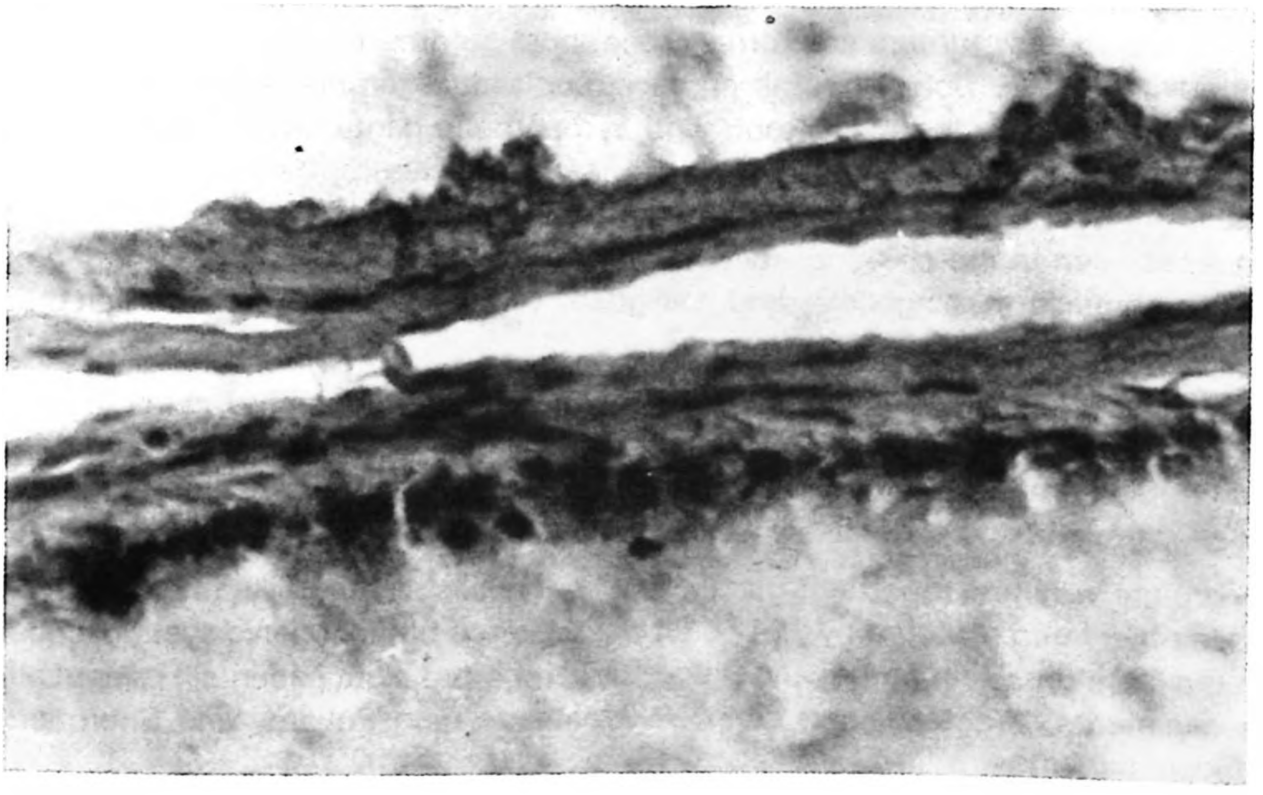

Fig. 3: Histopathologic examination of the bronchogenic cyst demonstrates diliated, single cell columnar epithelium. The wall consists of fibrous tissue devoid of cartilage and mucous glands (HE × 100).

Discussion

Bronchogenic cysts may occur in any portion of the mediastinum, but are most often seen near the carina in the middle part of the mediastinum.[2]. Although these cysts frequently produce symptoms in young children causing respiratory embarrassment and an increased susceptibility to infection, as was the case in our patient, in adults, most cysts do not cause significant symptoms[3].

Bronchogenic cysts arise from budding of the respiratory epithelium of the developing lung bud, and again are characterized by their position rather than by the presence of ciliated respiratory epithelium and bronchial elements such as cartilage in the walls. They are situated either within the lung or, as is more usual, in association with main bronchi, and they may or may not communicate with bronchial lumen[4]. Cysts with identical histologic findings are found peripheral to, or even completely separate from the lung. These lesions are more properly termed "lung cysts" as a means of distinguishing them from cysts that are adherent to the main airway. The histologic similarity of these cysts is not surprising, since all of them are derived from the ventral or anterior primitive foregut[5].

A number of benign and malignant tumors are found in the posterior mediastinum. Neurogenic tumors are some of the most common tumors, accounting for approximately 20 percent of all primary mediastinal tumors and cysts[6]. These lesions arise from the nerve roots and sympathetic ganglia in the paravertebral sulcus. The types seen are neuroblastomas, ganglioneuroblastomas, neurilemomas, neurofibromas, ganglioneuromas and pheochromocytomas. The other masses seen in the posterior mediastinum are bronchogenic and enterogenous cysts, thoracic meningocele, and malignant tumors such as Ewing's sarcoma, lymphoma, and rhabdomyosarcoma[7].

The mass is usually discovered during routine chest radiographs, as in our case. Tomography, barium swallow, fluoroscopy, ultrasonography and computerized tomography may be helpful in localizing and identifying mediastinal tumors. In all cases, however, the definitive diagnosis has to await histologic examination.[8]

There are very few reports of this type of cyst published in the literature. Only 76 cases had been reported by 1947[9]. Of the cases of bronchogenic cyst described in the literature, Heimburger and Battersby[10] reported eight patients, Haller et al[11] two patients, Whittaker and Lynn[3] five patients, and Pokorny and Sherman[12] eleven patients.

All patients who underwent excision of the cyst, and were followed up, showed no complications, as was the case in our patient[13,14].

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The Turkish Journal of Pediatrics 34:193-195, 1992

DUPLICATION OF THE RECTUM RESEMBLING A JUVENILE POLYP*

*Fatih Kızılcan MD***, F. Cahit Tanyel MD***, Gülsev Kale MD****
*Akgün Hiçsönmez MD*****

SUMMARY: Kızılcan F, Tanyel FC, Kale G, Hiçsönmez A. (Departments of Pediatric Surgery and Pediatric Pathology, Hacettepe University Faculty of Medicine, Ankara, Turkey). Duplication of the rectum resembling a juvenile polyp. Turk J Pediatr 34: 193-195, 1992

A five-year-old boy with a rectal mass mimicking a rectal polyp, which proved to be a cystic duplication of the rectum, is presented. In a child with painless rectal bleeding, a mass palpated during rectal examination is usually diagnosed initially as being a rectal polyp. However, the case presented revealed the possibility of rectal duplication. *Key words: rectal duplications, intestinal duplication, anal bleeding, rectal polyp.*

Duplications of the rectum are rare entities and account for 3.2 percent of total duplications in the alimentary tract[1]. The most common type of rectal duplication is cystic duplication which is located behind the rectum[2]. These duplications may cause rectal and urinary obstructions[3], and are sometimes mistaken for presacral teratomas[4]. Rectal duplication may occasionally prolapse through the anus[4], resulting in rectal bleeding.

Although rectal polyp is not considered in the differential diagnosis of rectal duplication, the case presented indicates the possibility of confusion in diagnosis.

Case Report

A five-year-old boy was admitted to our hospital for evaluation of rectal bleeding of 15 days' duration and a mass in the anus. After painless defecations, a few drops of bright, red blood and a mass protruding through the anus were noticed by his mother. Physical examination revealed a healthy child with normal findings. A digital rectal examination was performed and a polypoid mass measuring 3×3 cm located at the posterior rectal wall four cm above the dentate line was palpated. The patient underwent a proctosigmoidoscopic examination under general anesthesia with the diagnosis of juvenile polyp. The rectal mucosa was found to

* From the Departments of Pediatric Surgery and Pediatric Pathology, Hacettepe University Faculty of Medicine, Ankara.
** Resident in Pediatric Surgery, Hacettepe University Faculty of Medicine.
*** Associate Professor of Pediatric Surgery, Hacettepe University Faculty of Medicine.
**** Professor of Pediatric Pathology, Hacettepe University Faculty of Medicine.
***** Professor of Pediatric Surgery, Hacettepe University Faculty of Medicine.

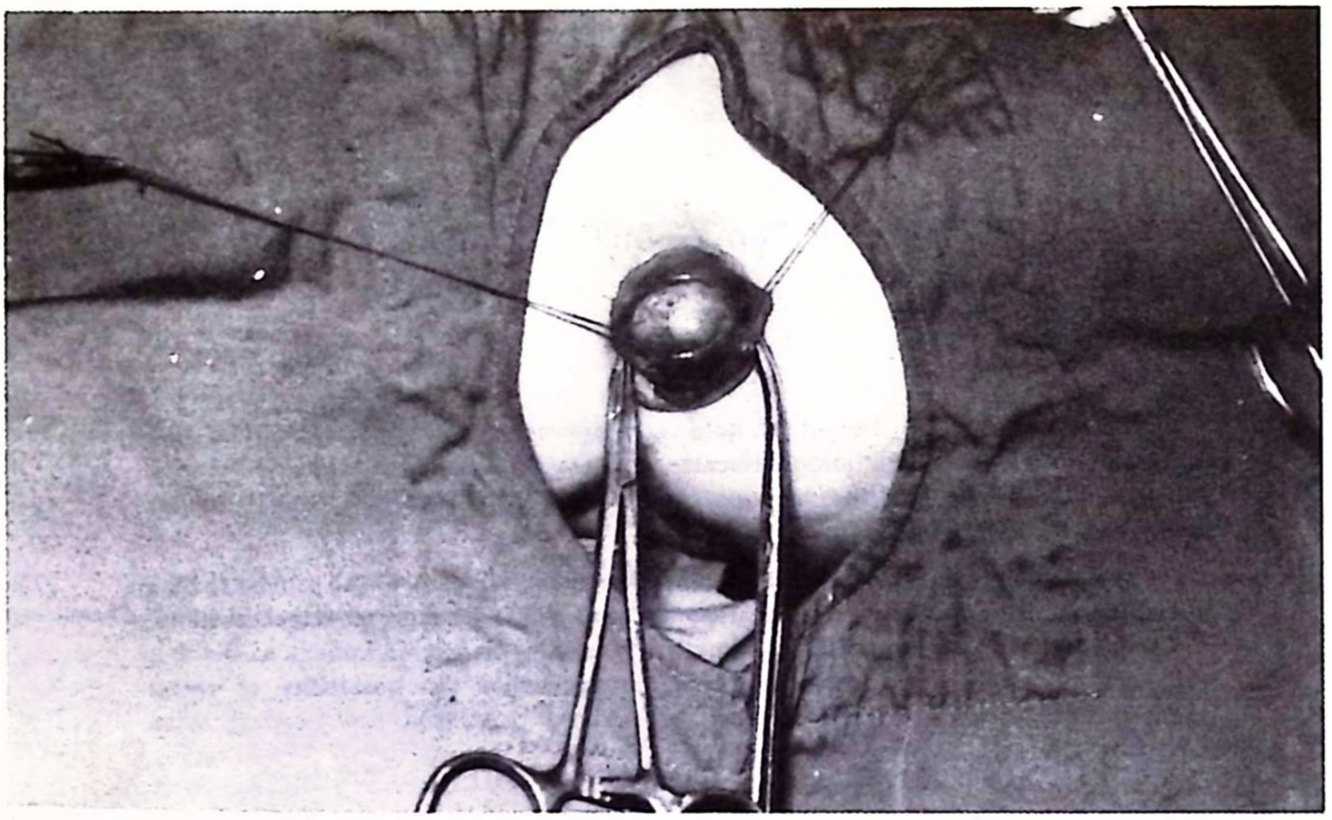

Fig. 1: Photograph of the mass protruding through the anus taken during surgery.

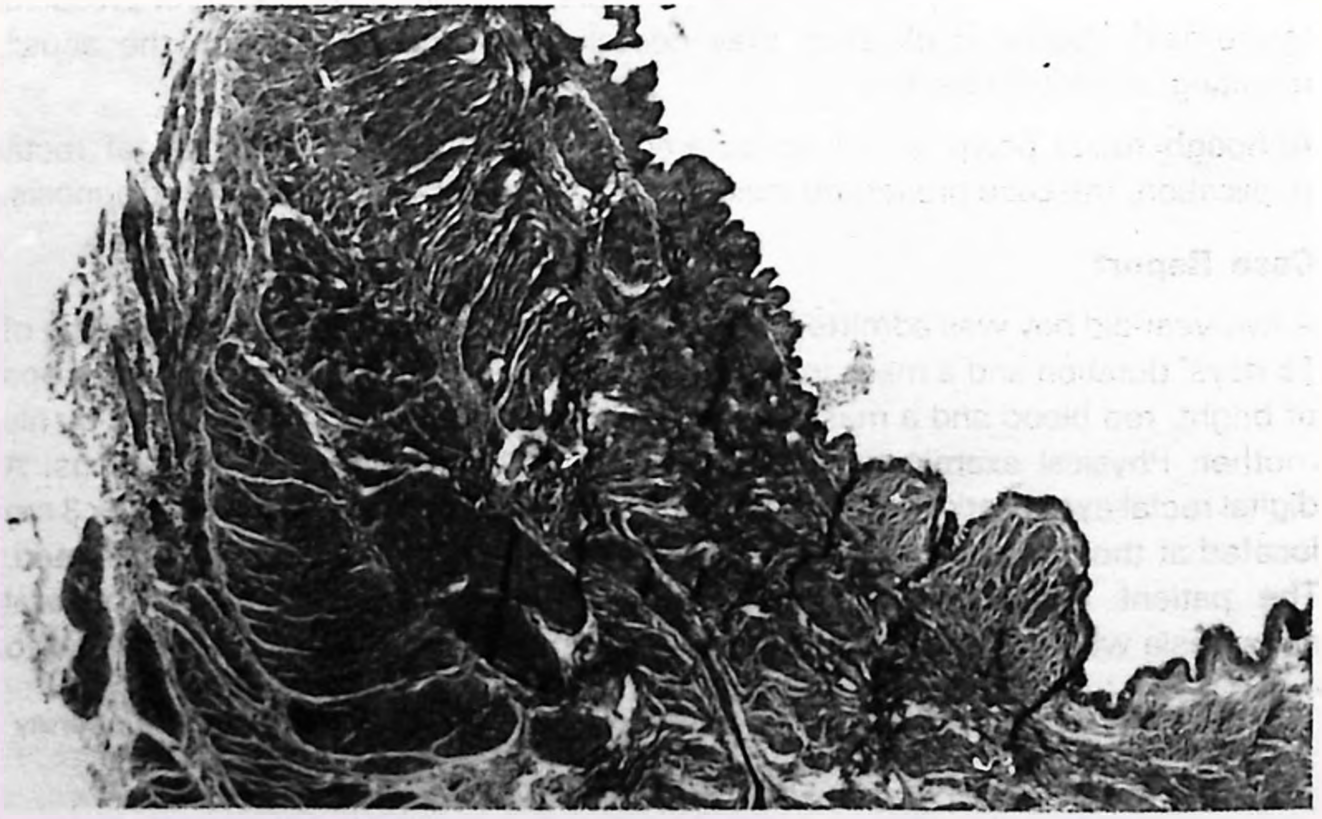

Fig. 2: Microscopic findings show that the wall of the cystic mass is composed of both rectal mucosa and muscular layers (H.E × 30).

be intact during the examination, but a mass bulging into the rectum was detected four cm above the dentate line. The mass was eased out of the anal canal, the mucosa was incised and a cystic mass located in the submucosal region was excised (Fig. 1). Pathological examination revealed that the wall of the spherical cystic mass which measured 2 × 2.5 × 2.5 cm consisted of nonstriated muscle layers and rectal mucosa diagnostic of rectal duplication (Fig. 2). The postoperative recovery was uneventful, and the child did well during the first postoperative year.

Discussion

Juvenile polyps are common causes of rectal bleeding occurring between the ages of two and six[5]. This disorder occurs in one percent of preschool and school-aged children[6]. Rectal examination in painless hematochesia may be sufficient in arriving at a diagnosis for a majority of polyps located in the rectum[7].

The history of rectal bleeding and a prolapsing mass in our patient was suggestive of this disorder because juvenile polyps can prolapse through the anus, and in general, prolapsing masses are usually diagnosed as juvenile polyps.

The polypoid mass palpated during rectal examination was erroneously considered to confirm the existence of juvenile polyp.

The diagnosis of juvenile polyp is usually straightforward if palpated during digital rectal examination in a child with painless rectal bleeding, and if rectal duplication is not considered in the differential diagnosis. However, the case presented reveals that smaller cystic duplications of the rectum can mimic rectal polyps such as those encountered in our patient. Therefore, we suggest that cystic duplications should also be considered in the differential diagnosis of rectal polyps.

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ANNOUNCEMENTS

MEETINGS

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VALENCIA, 22 - 24 OCTOBER 1992

CONGRESS '92 OF THE EUROPEAN SOCIETY FOR SOCIAL PEDIATRICS (ESSOP)
Theme: Health Promotion in Action

Inquiries to: Organizing Secretariat
Natalia Cerni
Prensa Congreso Pediatría Social
IVESP Juan de Garay, 21
VALENCIA 46017, SPAIN

ANTALYA, 25 - 29 OCTOBER 1992

FIRST INTERNATIONAL CONGRESS ON ADOLESCENCE DISORDERS AND NEW APPROACHES

Inquiries to: Congress Secretariat
Prof. Sevim Dinçer Cengiz, MD
Meşrutiyet Caddesi 3/12
ANKARA, TURKEY

LONDON, 13 NOVEMBER 1992

ADAPTATION TO EXTRAUTERINE LIFE (SYMPOSIUM)

Inquiries to: Symposium Secretary
RPMS Institute of Obstetrics and Gynaecology
Queen Charlotte's and Chelsea Hospital
Goldhawk Road
LONDON W6 OXG, ENGLAND

LONDON, 25 NOVEMBER 1992

THE DEATH OF A CHILD (SYMPOSIUM)

Inquiries to: Symposium Secretary
RPMS Institute of Obstetrics and Gynaecology
Queen Charlotte's and Chelsea Hospital
Goldhawk Road
LONDON W6 OXG, ENGLAND

LONDON, 30 NOVEMBER - 4 DECEMBER 1992

NEONATAL COURSE FOR SENIOR PAEDIATRICIANS

Inquiries to : Symposium Secretary
RPMS Institute of Obstetrics and Gynaecology
Queen Charlotte's and Chelsea Hospital
Goldhawk Road
LONDON W6 OXG, ENGLAND

SAMOS, 27 MAY - 1 JUNE 1993

SEVENTH INTERNATIONAL CLINICAL GENETICS SEMINAR ON DYSMORPHOLOGY AND THE GENETICS OF CARDIOVASCULAR DISORDERS

Inquiries to : Dr. C. Bartsocas
Dept. of Pediatrics
"P. & A. Kyriakou" Children's Hospital
ATHENS GR - 11527, GREECE

AN AEGEAN CRVISE ON THE ARCADIA, 2 - 6 SEPTEMBER 1993

19th ANNUAL MEETING OF THE INTERNATIONAL STUDY GROUP OF DIABETES IN CHILDREN AND ADOLESCENTS (ISGD)

Inquiries to : Dr. C. Bartsocas
Dept. of Pediatrics
"P. & A." Kyriakou Children's Hospital
ATHENS GR - 11527, GREECE

İZMİR, 24 - 27 OCTOBER 1993

XXI CONGRESS OF THE UNION OF MIDDLE EASTERN AND MEDITERRANEAN PEDIATRIC SOCIETIES (UMEMPS)

Inquiries to : Organizing Secretariat
Dr. Atilla Büyükgebiz
Dept. of Pediatrics
Dokuz Eylül University, Hospital
P.O. Box 4
BALÇOVA, İZMİR 35330, TURKEY

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