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MEASLES IN PARAGUAY: EXPERIENCE OF THE HOSPITAL OF INFECTIOUS AND TROPICAL DISEASES OF ASUNCION[1]

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In recent years Paraguay has experienced several measles epidemics prompting rises in the numbers of cases admitted to Asunción's Hospital of Infectious and Tropical Diseases. This article describes the hospital's clinical experience with measles over the past 10 years and points out the gravity of the situation that continues to confront measles patients in many parts of the world.

Introduction

Measles is the most widespread and contagious of the eruptive diseases of childhood. We have been investigating the disease since the 1968 epidemic in our country and have confirmed once again that it tends to afflict young children from poor socioeconomic backgrounds severely, producing high incidence of pulmonary complications and serious gastrointestinal disorders leading many times to a fatal outcome.

From 1968 to 1977 four major measles epidemics occurred in Paraguay, and during that period severe forms of the disease and all major complications were observed at the Hospital of Infectious and Tropical Diseases of Asunción—which admits patients from the capital, as well as from nearby towns and other parts of the country. These observations have provided the clinical basis of our experience with hospital measles—including its complications and role as a cause of death.

Despite under-registration of the disease, notification of which is compulsory, epidemiologic data clearly show a considerable rise in measles mortality during these cyclical epidemics. At the present time, when international health agencies are placing special emphasis on measles eradication in various parts of the world, it is our hope that children in Paraguay will soon receive the benefits of intensive vaccination efforts directed against the disease.

The hospital's limited capacity of 30 beds has made it necessary to admit only serious measles cases, primarily those with pulmonary, gastrointestinal, or cephalic complications. Of the 305 patients discussed in this article—all of whom were admitted between 1 January 1967 and 31 December 1976—86.5 per cent came from Asunción and nearby towns, the remainder coming from other parts of the country.

Roughly 85 per cent of the Asunción children were from outlying districts generally inhabited by families of low socioeconomic status. Most such families live in inadequate and overcrowded housing characterized by low standards of environmental and personal hygiene. These factors promote chronic malnutrition and infectious diseases, especially among children under 5 years of age.

Epidemiologic Considerations

Measles is a highly contagious disease caused by a paramyxovirus whose only reservoir is the human patient. Babies are

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protected by maternal antibodies up to 6 months of age. The disease strikes virtually everyone in infancy or early childhood, the average annual incidence being almost identical to the national birth rate. The overall epidemiologic profile depends on population density, existing levels of immunity, and social conditions.

Measles is endemic in urban areas, where the disease tends to strike at an especially early age. In general, the less favorable the prevailing socioeconomic conditions, the lower the average age at which children are attacked. Overall, the incidence of urban measles tends to show a seasonal increase at the end of winter (September) and in the spring (September-December).

In rural areas, measles tends to occur in occasional epidemics resulting from sporadic introduction of the virus into the community. Such outbreaks may take place at intervals of 2 years, 3 years, or even more in the case of isolated communities. This pattern naturally tends to increase the sick patients' average age.

The lethality of measles varies according to the patient's socioeconomic level. Measles mortality in developed countries is on the order of one or two people per 10,000 cases (*1*); whereas in tropical Africa estimated measles mortality is on the order of 7 to 10 *per cent*, and it can run as high as 25 per cent in some villages during epidemics. During the civil war in Nigeria measles mortality soared to some 50 per cent as a result of extreme malnutrition (*2*).

In countries where endemic malnutrition is a complicating factor, measles is a principal cause of death among children 1 to 4 years of age, and it may indeed be responsible for 25 per cent of the deaths in this age group.

According to Armengaud, cited by Bastin (*1*), the mortality rate among hospitalized measles cases in black Africa may be as high as 29 per cent. In addition, of course, the disease also ranks as an important cause of death among young children in many other parts of the world—including Latin America (*3*).

Results

Of the 305 measles cases observed at our hospital from 1968 to 1977, 249 occurred during four major epidemics. These epidemics ran from October 1967 to December 1968, from October 1970 to November 1971, from July 1973 to November 1974, and from June 1976 through early 1977. In nonepidemic periods sporadic cases, totaling 46 in all, were admitted to the hospital from time to time.

As may be noted, the four major epidemics cited were separated by periods of 88, 80, and 76 weeks, during which measles followed its normal endemic course. This pattern matches that described by Allwood (*3*), who reported that urban measles in El Salvador occurred at regular intervals separated by periods of 80 to 130 weeks, the length of time depending upon the birth rate and consequent re-emergence of high proportions of susceptible children in the wake of the last previous outbreak. Reported measles mortality rates in Paraguay for the period 1962-1975 are shown in Table 1.

Although the reporting of measles cases is compulsory in Paraguay, the numbers of cases actually reported, as shown in the table, are unrealistically low. On the basis of observations made in El Salvador during epidemic years, Allwood (*3*) has estimated that for every measles case that is reported 20 are not. During the 1967-1968 epidemic in Paraguay 5,431 measles cases were reported. If Allwood's rule of thumb is applied, multiplying this figure by 20 we come up with an estimate of 108,620 cases during this epidemic. In any event, since the estimated 1968 population of children under 4 years of age in Paraguay was 348,934, it is clear that there was a significant underregistration of cases.

As shown in Table 2, 77 per cent of the measles patients seen at the hospital were

Table 1. Measles morbidity and mortality in Paraguay, per 100,000 inhabitants, 1962-1975.

Year	Morbidity		Mortality	
	No. of cases	Rate per 100,000 inhabitants	No. of deaths	Rate per 100,000 inhabitants
1962	1,442	158.1	47	5.1
1963	555	55.5	13	1.3
1964	740	71.8	14	1.3
1965	975	91.9	24	2.3
1966	340	31.1	14	1.3
1967	1,359	120.7	72	6.4
1968	4,072	351.3	361	31.1
1969	205	17.2	10	0.8
1970	1,649	134.1	67	5.4
1971	4,230	334.1	339	26.7
1972	279	21.3	21	1.6
1973	336	25.0	24	1.7
1974	2,601	185.7	146	10.0
1975	140	9.6	9	0.6

Source: Department of Biostatistics, Ministry of Public Health and Social Welfare of Paraguay.

Table 2. Distribution by age of measles cases and deaths among patients admitted to the Hospital of Infectious and Tropical Diseases of Asunción, 1967-1976.

Age groups	Cases		Deaths	
	No. of cases	% of total cases	No. of deaths	% of total deaths
0 - 5 mo.	2	0.65	0	0
6 - 11 mo.	38	12.4	13	22.8
1 yr. - 1 yr. 4 mo.	59	19.3	14	24.5
1 yr. 5 mo. - 1 yr. 11 mo.	43	14.0	11	19.2
2 yr. - 2 yr. 4 mo.	41	13.4	5	8.7
2 yr. 5 mo. -2 yr. 11 mo.	14	4.5	3	5.2
3 yr. - 3 yr. 4 mo.	36	11.8	7	12.2
3 yr. 5 mo. - 3 yr. 11 mo.	2	0.6	0	0
4 yr. - 18 yr.	70	23.0	4	7.0
Total	305	99.6	57	99.6

Source: Hospital of Infectious and Tropical Diseases, Asunción, Paraguay (1967-1976 data).

children under 4 years of age. The youngest patient was 4 months and 20 days old, while the age of the oldest was 18 years. The age groups most affected spanned the period from 6 months to 2 years and 4 months of age.

With regard to sex, there was a slight predominance of male cases. According to the 1972 census, 50.8 per cent of all children 0 to 4 years of age were male.

Regarding the impact of measles on the mortality of children 1 to 4 years of age, Table 3 presents data on the most common causes of death in that period. The role of measles, especially during major epidemics, is very clear. That is, during 1968, 1971,

Table 3. Principal causes of death among children 1 to 4 years of age in Paraguay, 1964-1974, showing the numbers of deaths attributed to each cause.

Causes	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Tuberculosis (all forms)	10	13	9	10	10	8	12	10	7	7	13
Enteric disease	249	286	339	346	536	342	416	483	293	284	352
Diphtheria	10	5	10	8	5	5	10	9	11	10	7
Tetanus	5	6	10	6	5	5	5	3	4	2	1
Measles	6	17	7	50	218	2	34	208	10	19	95
Pneumonia and bronchopneumonia	113	175	137	179	288	151	179	291	202	151	256
Intestinal parasitosis	17	27	30	31	31	27	23	13	9	35	38
Anemia, avitaminosis, and other deficiency diseases	37	34	54	38	49	27	49	127	92	91	37
Nonmeningococcal meningitis	12	19	23	19	43	27	26	28	30	21	27
Other causes[a]	456	483	629	482	596	377	442	573	352	408	541
Total:	915	1,065	1,248	1,169	1,781	971	1,196	1,745	1,010	1,028	1,367

Source: Department of Biostatistics, Ministry of Public Health and Social Welfare of Paraguay (1964-1974 data).

[a]Includes causes such as influenza, poliomyelitis, whooping cough, accidents, and causes of an ill-defined or indeterminate nature.

Table 4. Principal causes of death among children 1 to 4 years of age in Paraguay, 1964-1975, showing death rates per 100,000 inhabitants in this age group.

Causes	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Tuberculosis (all forms)	3.8	4.8	3.3	3.5	3.4	2.7	3.9	3.2	2.2	4.3	7.7	4.6
Enteric disease	96.0	107.4	124.1	123.4	182.2	115.7	137.1	55.1	92.9	174.7	207.7	188.0
Diphtheria	3.8	1.9	3.6	2.8	1.7	1.6	3.2	2.8	3.4	6.1	4.1	1.7
Measles	2.3	6.3	2.5	17.8	75.7	0.6	11.2	66.8	3.1	11.7	56.1	1.1
Pneumonia and broncho-pneumonia	43.5	65.7	50.1	63.7	100.0	50.0	58.9	93.3	64.0	92.9	151.0	109.9
Intestinal parasitosis	6.5	10.1	10.9	11.0	10.7	9.1	7.5	4.1	0.9	21.5	22.4	11.4
Anemia, avitaminosis, and other deficiency diseases	14.2	12.7	19.7	13.5	17.0	9.1	16.1	40.7	29.1	55.9	23.0	14.8
Nonmeningococcal meningitis	4.6	7.1	8.4	6.7	14.9	9.1	8.5	8.9	9.5	12.9	15.9	17.7
Other causes[a]	177.5	184.5	234.3	174.5	213.2	130.7	147.9	186.6	115.2	243.5	318.8	227.4
Total:	352.2	400.2	456.9	416.9	618.8	328.6	394.3	461.5	320.3	623.5	806.7	576.6

Source Department of Biostatistics, Ministry of Public Health and Social Welfare of Paraguay (1964-1975 data).

[a]Includes causes such as influenza, poliomyelitis, tetanus, whooping cough, accidents, and causes of an ill-defined or indeterminate nature.

and 1974 measles was the third leading cause of death after enteric diseases and pulmonary (bronchopneumonia and other types of pneumonias) infections. It is also interesting to note that the number of deaths from pneumonia and bronchopneumonia and from enteric diseases also peaked in these years. This pattern is understandable because, as will be discussed later, the two leading causes of death among measles patients are pulmonary infections and metabolic disorders occasioned by enteric disease.

Table 4 complements Table 3, presenting mortality figures (deaths per 100,000) for the principal causes of death among children 1 to 4 years of age.

During the epidemic year 1968, when death resulted from 361 of 4,072 reported measles cases, the measles fatality rate was 8.8 per cent. In two other epidemic years (1971 and 1974), the respective measles fatality rates were 8 and 5.6 per cent.

Clinical Considerations

Before reviewing the clinical features of hospitalized measles cases, it is worth examining some information about the health status of our hospital's infant and young child patients; for it is this that makes it easy to comprehend the frequent complications and often fatal outcome of measles in these patients.

As previously mentioned, most children admitted to the Hospital of Infectious and Tropical Diseases come from economically deprived neighborhoods on the outskirts of Asunción. Many of these children suffer from both quantitative and qualitative malnutrition. We found, for example, that of the 305 patients studied, 173 (56.7 per cent) had a deficient nutritional status, a fact that manifested itself very obviously in 42 cases.

Another indicator of these children's precarious health status was their history of prior vaccination. On the basis of a survey of 215 relatives of measles patients, it was concluded that 60 per cent of the children admitted had received no vaccinations of any kind; 20.5 per cent had received one or more doses of DPT, many without completing the course of vaccination; 14 per cent had received a dose of Sabin oral vaccine; and 5.5 per cent had received BCG.

Symptoms

Pediatric measles patients admitted to the hospital have tended to present classical symptoms. After an incubation period of 10 to 11 days the disease produces fever and oculorespiratory catarrh, normally accompanied by vomiting and especially diarrhea. Adenopathies, particularly cervical adenopathies, are common. During periods of epidemic measles the disease should be diagnosed at this stage.

Three or four days later the phase of the disease is demonstrated by the appearance of exanthema. In the absence of complications, the lesions and the fever disappear in another three or four days, signalling the end of the disease. The child has lost weight and will remain weak for a number of days.

Urban measles of tropical and subtropical areas tends to occur in children under 3 years of age—often ones debilitated by protein-calorie malnutrition, parasitosis, and anemia. In our area the attacks are frequently complicated by viral and bacterial infections such as diphtheria, salmonellosis, and shigellosis, which contribute to the gravity of the situation.

Respiratory complications that appear after the third day are due, in most cases, to secondary bacterial infections, those that produce staphylococcal pneumonia being especially serious. Early stridulous laryngitis is usually mild and rarely requires tracheotomy.

Many patients were admitted to the hospital because of a dramatic respiratory picture characterized by polypnea, respiratory complaints, intercostal retraction, and in some

cases cyanosis. In most instances this picture was the result of bronchitis at the eruptive stage or capillary bronchitis, and in most cases the problem disappeared within 24 hours. These "obstructive" forms of the disease have always been considered severe manifestations.

Specific Complications

a) Bacterial pneumonia is the most common complication after enteric disease. Its symptoms are accentuated fever, onset of polypnea, nasal fluttering, and dyspnea. The latter symptom accompanies polypnea and intercostal retraction.

In all, 28 per cent of the measles patients admitted had bacterial pneumopathies. Symptomatologies and pulmonary radiologic findings varied widely. Measles bronchitis and capillary bronchitis are revealed radiologically by symmetrical swelling of the pulmonary hila and accentuation of the pulmonary bronchiovascular network. These typical pictures of uncomplicated measles are not pathological (*1*).

b) The type of staphylococcal pneumonia seen most often is that characterized by the formation of ampullae or bullae, frequently accompanied by spontaneous pneumothorax. However, staphylococcal pneumonia can also take the form of purulent pleurisy. Overall, 12 cases of staphylococcal pneumonia have been observed among 74 patients with presumably bacterial pneumonias.

c) The serious complications of mediastinal and cervicofacial emphysema were observed in 5 of the 305 patients (1.6 per cent). Such emphysema is characterized by the sudden onset of great breathing difficulty. The diagnosis is easy when subcutaneous emphysema occurs at the level of the neck and upper chest. One case of pneumothorax was observed accompanying mediastinal emphysema. The prognosis for this complication is favorable despite the complexity of the picture.

Serres at al. (*4*) have found pneumomediastinum to be a common complication of measles in tropical areas, affecting 1.53 per cent of the cases studied. This complication is seen during the eruptive stage in children under 3 years of age and is sometimes accompanied by pneumopathy. Its first sign is subcutaneous cervicofacial emphysema, the presence of which can be confirmed by radiology.

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In general, secondary pulmonary infections are commonly associated with serious gastrointestinal problems.

d) Diarrhea commonly occurs as a manifestation of measles during the invasive period. It should be considered a serious complication because of the risks it poses—immediate risk of death from acute dehydration or edematous encephalopathy and subsequent risk of death from aggravated malnutrition.

Our findings support the assertion of Urrutia and Mata (*5*) that diarrhea and pneumonia are the most common complications of measles. Diarrhea was observed in 123 (40.3 per cent) of the 305 hospitalized children, its severity being directly related to the patients' size and nutritional status. It was the most common complication of measles and was the second leading immediate cause of death after pneumonia (as well as being an aggravating factor of pneumonia), accounting for 33.3 per cent of mortality. Bloody stools were observed occasionally, suggesting the existence of secondary *Shigella* or *Salmonella* infections.

e) Neurologic complications were less frequent, occurring in only 7 per cent of the cases. No bacterial meningitis or cerebral thrombophlebitis was observed. Children with electrolyte disorders presented neurologic pictures that were very similar to measles encephalitis and hard to distinguish from it. Such encephalopathy may be ag-

gravated by the anoxia that accompanies pneumonia.

f) Few cases of otitis media were seen, probably because of the antibiotic protection many patients received before admission. On the other hand, the lack of observed cases could also have been due to inadequate ear examinations.

g) The exanthema of measles may take on a purpuropetechial character as a result of thrombocytopenia. One patient with normal platelets and serious diarrheal problems aggravated by parasites developed hemorrhagic skin lesions during convalescence. This child was suffering from severe malnutrition.

h) Two additional complications that can be very dangerous are ulcerative keratitis, that can lead to blindness, and herpetic gingivostomatitis, that when accompanied by disseminated herpes and encephalitis is nearly always fatal. These problems were diagnosed in 0.65 and 1.96 per cent, respectively, of the 305 hospitalized patients.

i) In addition, diphtheria accompanied measles in 2.62 per cent of the observed cases; there was one case of measles associated with whooping cough; and one child died of respiratory problems resulting from acute poliomyelitis.

Concluding Remarks

Measles continues to be a serious disease in Paraguay. In epidemic periods, following enteric disease and bronchopneumonia and other types of pneumonias, it has been the third leading cause of early childhood mortality, producing death rates of 31.1 per 100,000 inhabitants of all ages in 1968 and 26.7 in 1971 (see Table 1). There has also been a parallel rise during epidemic years in the mortality caused by enteric disease and bronchopneumonia, two of the leading complications of measles.

Of the 305 measles patients admitted to the Hospital of Infectious and Tropical Diseases, 57 died. Table 2 shows the number of deaths and the proportion of total deaths for various age groups.

As can be seen, mortality was highest between the ages of 6 months and 2 years. Of the 57 patients who died, 38 (66.6 per cent) were in this age group. It was found that pneumopathies were the immediate cause of death in 64.9 per cent of the cases, and that in 33 per cent death was directly attributable to disorders caused by enteric disease.

These percentages clearly indicate that children died most often from problems involving bacterial pulmonary infections. However, in many cases the two leading causes (pneumopathies and enteric diseases) combined to produce the fatal outcome. Some children also died from encephalopathies attributable to hemodynamic disorders arising from a combination of malnutrition, diarrhea, and dehydration—disorders impossible to differentiate from cases of true measles encephalitis.

SUMMARY

Measles, the most widespread and contagious of the eruptive childhood diseases, constitutes a serious health threat in Paraguay and many other underdeveloped countries. In fact, during epidemic periods measles has been the nation's third leading cause of early childhood mortality, being surpassed only by pulmonary and enteric diseases.

Since 1967, sporadic measles epidemics in Paraguay have led to parallel increases in the number of severe measles cases admitted to the Hospital of Infectious and Tropical Diseases in Asunción. Study of 305 measles patients admitted to the hospital from 1967 through 1976 shows that most of them (60 per cent) were under 2 years 4 months of age, and that 77 per

cent were below 4 years of age. Most of these children also came from neighborhoods with precarious socioeconomic conditions, and 56.7 per cent were observed to suffer from chronic malnutrition.

The most frequent complication found among these hospitalized cases was diarrhea, a serious problem capable of causing death through acute dehydration, edematous encephalopathy, or aggravated malnutrition. Bacterial pulmonary complications, whether or not associated with problems secondary to diarrhea, were the most frequent cause of death. Overall, death claimed 57 of the patients studied, producing a death rate of 18.6 per cent.

In view of strong evidence of the health threat posed by measles in Paraguay, and in view of the emphasis now being placed by international health agencies on eradication of measles in many parts of the world, it is to be hoped that children in Paraguay will soon receive the benefits of intensive vaccination efforts directed against this disease.

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