Introduction

Measles is a world-wide disease with a great variety of prevalence, severity and mortality rate.

In developed countries this disease is usually in a mild form with a low mortality rate and is no longer a public health problem.

Contrastingly, in developing countries measles is still one of the main child health problems. Not only is it a highly contagious disease but it also predispose children to ill health conditions. Morley (1967) through his intensive studies in Affrica has described vividly the clinical panorama of measles among children in whom malnutrition is prevalent.

Nutritional state, traditional beliefs, overcrowding, ineffective immunization programs, and measles virulency are factors which account directly or indirectly for the variation of clinical features.

Measles in Indonesia is endemic, but occasionally it becomes epidemic. Since immunization against measles has not been given yet, and malnutrition is still the main child health problem, this disease is still in its virgin from. Immunization programs will influence its clinical panorama, changing it into a milder form with a decline in the morbidity rate.

It is regretful that reports on this common disease in Indonesia are very poor and with unsatisfactory results. This study will show a clinical panorama of measles among hospitalized children under 5 years of age.

Material and methods

Two hundred and sixty one children under 5 years of age, admitted to Gunung Wenang Hospital with the diagnosis of measles, were evaluated. Age, sex nutritional status, complications, days of illness before the appearance of rash, liver measurements, and the outcome were recorded.

Nutritional states were grouped by using a modified Jeliffe standard :

- Body weight of 80% or more is considered to be normal.
- Body weight of 60 - 80% is considered to be underweight except for kwashioskor or marasmic kwashioskor.
- Severe malnutrition is defined as the body weight of 60% of the standard or less, or cases with a diagnosis of kwashioskor.

Liver measurements were grouped into nonpalpable, 1 - 2 cm, 2 - 4 cm, 4 - 6 cm and more than 6 cm below the costal arch.

Result

Age and sex distribution in relation to the nutritional status can be seen in table 1. (Appendix). Of the 46 infants under 1 year of age, 29 were males and 17 were females. In the age group of 1 - 2 years, there were 53 males and 47 females, whereas in the age group 2 - 5 years, males were 45 and females were 70.

The panorama of complications in relation to their nutritional status is shown in table 2 and 3 (Appendix).

Bronchopneumonia and gastroenteritis or a combination of both diseases were the most common complications occurring in measles, particularly in malnutrition cases and in infants under one year of age.

Encephalitis with or without accompanying disease was commonly seen in the age group of 1 - 2 years and 2 - 5 years.

Other complications occurring in measles were otittis media, bronchitis, bronchopneumonia with paralytic ileus, bronchopneumonia with myocarditis, diptheria, pyodermia, tuberculosis, tuberculous meningitis, purulent meningitis. Xerophthalmia with gastroenteritis, or pneumonia, and bronchitis associated with gastroenteritis.

The main underlying causes of death as seen in table 4, are bronchopneumonia, gastroenteritis, and encephalitis with or without accompanying diseases.

Liver enlargement were commonly found in complicated measles either in well nourished or in malnutrition cases. There was no relationship between liver sizes and nutritional status (Table 6).

Discussion

This study revealed that measles in Indonesia is indeed a serious disease in children under five years of age with a high complication rate of 72.8 per cent and with a high mortality rate of 12.3 per cent. The complication and mortality rate of measles were closely related to nutritional status and the age of the patients.

It is well recognised that measles in a malnourished child is more severe (Morley, 1969).

In this report all of the severe malnourished measles cases, and 77.9% of undernourished cases, suffered complications with a mortality rate of 30 per cent and 13.8 per cent respectively. However, in wellnourished cases 53.8 percent or in 49 out of 91 cases suffered from complication with a mortality rate of 2.2 percent.

The high complication and mortality rate in malnourished cases are related to the immunologic status of cases with measles, in which there are the synergistic effects of the impairment of humoral immunity, and depression of cellular immunity caused by measles virus and by severe malnutrition (Brown and Katz, et al., 1971, Geefhuysen et al., 1971).

Due to the impairment of the immunological status caused by measles virus not only does a secondary infection easily occur, but also a flare up of carrier diseases and silent tubercular disease.

Diphtheria is endemic in Indonesia and many children are in carrier status who are potentially to be infected. Nine out of 261 cases were associated with Diphtheria.

Regarding the age, complications occurred more frequently among children under the age of one year, either in well nourished or malnourished children.

It is apparent that the younger the children with malnutrition, the higher the mortality rate from measles will be. (Figure 1).

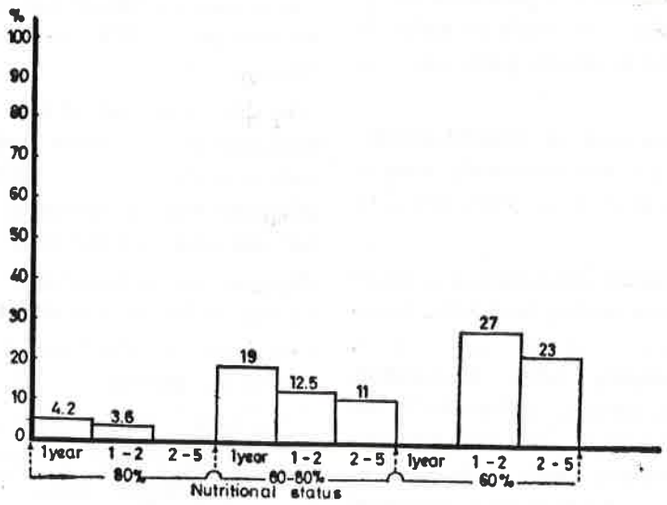

FIG 1 : *Mortality rates in relation to age grous and nutritional status.*

Thus, based on this finding, vaccination againts measles is recommended to be instituted before the age of one year.

But it should not be given to children less than six months of age, because of the interference with antigenic response considering the presence of circulating maternal antibodies (Freedman, 1968).

Dick et al. (1975) found that the administration of attenuated live virus measles vaccine to children over the age of 8 months provides optimal seroconversion with an acceptable small number of reactions.

Bronchopneumonia, gastroenteritis and central nervous system involvement were the most common complications with changes in percentage relative to age, and these diseases become more severe and life threatening in malnutrition (Table 4) (Appendix).

Bronchopneumonia with or without associating diseases is a major complication in malnutrition, in which 65% of these cases with severe malnutrition suffered from pneumonia. The mortality rate was 38.5 per cent or 10 out of 26 cases.

But in undernutrition or mild malnutrition, it was 50.3 per cent or 69 out of 130 cases with a mortality rate of 10 per cent. While in well-nourished cases, it was 32.9 per cent or 29 out of 91 cases, none of whom died.

Thus, improvement of the nutritional status and provision of a high caloric diet during illness are the important keys in reducing the prevalence of complications and mortality rates of measles in cases under five years of age.

Scrimshaw et al. (1969), found that simply augmenting the protein intake of the village children in Guatemala, reduced measles mortality by 66 per cent.

The improvement of the nutritional status of children under five years of age and environmental sanitation, are these activities besides immunization to tackle this disease which can be done by the community itself. Breast feeding should be maintained up to 2 years of age, since it can provide around 52 % of their total caloric needs.

Supplementary food should be improved to contain high calorie and more variations of food stuff.

Since it will take a long time to achieve a desired improvement of the nutritional status of all children, and since the measles itself will worsen the nutritional status, a country-wide immunization is strongly recommended in this country even though it is expensive.

Priority of immunization should be given to children living in underpreviledged environments such as poor environmentall sanitation, overcrowded housing, and in the community in which disadvantageous traditional beliefs exist.

Since measles is more severe in malnutrition, hospital admission is strongly advisable for these groups of children. Hospitalisation is necessary not only to prevent severe complication, but also to maintain a proper diet. In all cases, the parent, beleive that the child with measles must be kept in a room with poor ventilation in an attempt to prevent what is called "sinking measles", in which rash does not appeared, should be discouraged.

Advanced development of antibiotics and chemotherapy have been achieved recently, but from the above mentioned data the mortality rate of cases in severe malnutrition with pneumonia was high indeed. Pneumonia is caused not only by bacteria, but also by virus, particularly by adenovirus, causing an extremely serious condition with a high mortality and probability of serious lung damage in the survivers (Wagner and Marshall 1976).

It is found that there are no distinguished clinical symptoms, physicall findings, or laboratory data that are helpful in differentiating bacterial from non bacterial pneumonia (Olson and Hodges, 1975).

The institution of antibiotics and chemotherapy for prophylaxis in the preeruptive or eruptive phase in an attempt to reduce complication and mortality rate particularly in severe malnutrition should be considered before determining bacterial from non bacterial causes with their sensitivity to antibiotics and chemotherapy.

There are pros and cons concerning the use of antibiotics and chemotherapy for prophylactic purpose.

Weinstein (1955) from his study showed that chemotherapy had failed to prevent the bacterial complication. But on the other hand Karelitz et al. (1954) showed the advantage of using antibiotics for prophylactic purpose in reducing the complication rate.

The success of antibiotics in reducing complication rate depends a great deal on the choice of proper antibiotics, which are sensitive to the bacterial pathogens.

Forbes and Sheifele (1973) reported that the most common bacterial pathogens in their cases were gram negative and staphylococi, the majority of which were sensitive to kanamycin sulfate, and the remainder to gentamycin.

One out of 261 cases showed a profound hypokalemia with serum potassium of 3.1 meq/l and responded to potassium treatment.

Hypopotassemia developed through a change in potassium metabolism with a negative ballance of its metabolism during infection (Beisell, 1977). It is very interesting to conduct further study as to why hypopotassemia occurred only in one case, since metabolic changes of potassium occurs in all infectious diseases.

Congestive heart failure can be found due to severe pneumonia or to myocarditis caused by measles virus even though it is a very rare complication. Only one case in this report with pneumonia showed a frank heart failure associated with myocarditis.

Diarrhea with or without associating diseases occurred in more than a quarter of the 261 cases in this report.

Measles with diarrhea will be more severe and life threatening, if it is associated with pneumonia or encephalitis. Nine out of 43 cases (20.9%) with diarrhea associated with other diseases died, compared to the mortality rate of measles cases with diarrhea, but without other associating diseases.

The vast majority of measles with diarrhea in this report was associated with other complications, such as pneumonia, encephalitis, bronchitis, and otitis media.

The incidence of encephalitis in this report was low, however, it is really a serious complication with a high mortality rate 56 per cent or 9 out of 16 cases with evidence of brain disturbances died The mortality rate of cases with encephalitis in this report was similar to that reported by Yassin et al., (1969), but is much higher than that reported by Miller (1964), who found the mortality rate of 8.8% and 20% respectively.

Because of lack of facility for EEG, the real incidence of brain involvement was not known. Brain involvement may occur in a slight degree in which it does not show a clinical evidence of encephalitis. Gibbs et al., (1959) reported that 50% of their cases with measles showed some EEG abnormalities without a clinical evidence of encephallities.

Since the exact cause of encephalitis is unknown , many theories have been put forward.

Appelbaum et al., (1949) for example, based on autopsy findings considered that measles encephalitis which developed mostly between the 2nd and 6th post eruptive day was primarily an inflammatory disease of the central nervous system with a degeneration of myelin. But this theory can not be widely accepted, since the institution of high dose of gamma globulin does not reduce the prevalence and mortality rate of encephallitis caused by measles, eventhough it modifies the clinical course of measles (Greenberg et al., 1955).

And only a few cases of encephalitis apparently due to measles virus were found in immune suppressive treated children (Murphy and Vanis, 1975; Aicardi et al. 1977).

The most recently accepted theory is the allergic theory with inflammatory response within the central nervous system to measles virus, invading braincells during the viremic stage, and they live in those cells in an attenuated form.

Eight out of 17 cases (47%) showed that the clinical evidence of encephalitis occurred before the appearance of rash (Table 5), so that the brain cells are attacked during the very early stages of viremia.

Steroid is widely used in measles with CNS involvement. The efficacy of steroid in the treatment of measles cases with encephalopathy in this report is doubtful, since the mortality rate of cases with encephalopathy was indeed high. This scheme should be evaluated by conducting double blind studies. Measles itself and steroid suppress the immune system which lead to secondary infection either by bacteria or virus.

Eye damage was found in 5 out of 261 cases (2%). All of these 5 cases were preceded by conjunctivitis which might involve the conjunctival sac, leading to eye damage.

Vitamin A deficiency might be the most important countributing factor in the development of eye damage, since infections effect a serious change of vitamin A metabolism. The degree of malnutrition in this report seems not to be related to the development of eye damage since 3 of the 5 cases with eye damage were of mild malnutrition, and the remaining 2 were of severe malnutrtion.

All of those cases with the evidence of eye damage in this report were associated with severe infections, i.e. bronchopneumonia and gastroenteritis.

It is felt of course, that further studies are needed in an attempt to find out the role of vitamin A deficiency in the development of eye damage in measles cases.

Liver enlargements with the liver size of more than 2 cm below the costal arch were commonly found in complicated measles cases with poor nutrition as well as well-nourished ones. Thus, liver changes were found primarily in severe measles.

Liver changes might take the form of fatty degeneration, as reported by Williams and Osotimethin (1970) through their autopsy findings.

TABLE 1 : *Sex distribution in relation to age group and nutritional status.*

Nutritional	1 Year		1 — 2 Years		2 — 5 Years	
	Male	Female	Male	Female	Male	Female
80% — 100% (91)	20	4	15	13	14	25
60% — 80% (130)	9	12	28	18	27	36
60% (40)	—	1	10	16	4	9
Total	29	17	53	47	45	70

TABLE 2 : *Type of Comptications in Relation to age and Nutritional status.*

Type of Complication	1 Year (46)			1 — 2 Years (100)			2 — 5 Years (115)		
	80 - 100% (24)	60 - 80% (21)	60% (1)	80 - 100% (28)	60 - 80% (46)	60% (26)	80 - 100% (39)	60 - 80% (63)	60% (13)
Bronchopneumonia	25% (6)	28.6% (6)	—	10.7% (3)	30.4% (14)	50% (13)	25.6% (10)	39.7% (25)	30.8 (4)
Gastroenteritis	20.8% (5)	14.3% (3)	—	17.9% (5)	10.9% (5)	15.4 (4)	—	9.5% (6)	23.1 (3)
Encephalitis	4.2% (1)	—	—	36% (1)	4.3% (2)	—	2% (1)	3.2% (2)	—
Bronchopneumonia + gastroenteritis	16.7% (4)	19% (4)	100% (1)	7% (2)	17.4% (8)	11.5 (3)	2% (1)	63% (4)	—
Bronchitis	—	4.8% (1)	—	3.6% (1)	2.2% (1)	—	—	3.2% (2)	—
Otitis Media	29.2% (7)	—	—	—	—	—	—	4.8% (3)	—
Vit. A deficiency	—	—	—	—	2.2% (1)	—	—	1.6% (1)	15.4 2)
Diphtheria	—	—	—	3.6% (1)	22% (1)	3.8% (1)	5.1% (2)	1.6% (1)	15.4 (2)
Pyodermia	—	—	—	—	—	—	2% (1)	—	—

Type of Complication	1 Year (46)			1 — 2 Years (100)			2 — 5 Years		
	80 - 100% (24)	60 - 80% (21)	60% (1)	80 - 100% (46)	60 - 80% (28)	60% (26)	80 - 100% (39)	60 - 80% (63)	60% (13)
Tuberculosis	—	—	—	—	—	3.8% (1)	—	1.6% (1)	—
Tuberculous miningitis	—	—	—	—	—	—	—	1.6% (1)	—
Bronchopneumonia, gastroenteritis, otitis media	4.2% (1)	—	—	36% (1)	2.2% (1)	3.8% (1)	—	—	—
Purulent meningitis	—	4.8% (1)	—	—	—	—	—	—	—
Bronchitis, gastroenteritis	—	4.8% (1)	—	—	—	3.8% (1)	—	—	—
Bronchopneumonia, gastroenteritis, encephalitis	—	—	—	—	6.5% (3)	7.7% (2)	—	4.8% (3)	15.4 (2)
Bronchopneumonia, Diphtheria	—	—	—	—	2.2% (1)	—	—	—	—
Bronchopneumonia, Decompensatio cordis	—	—	—	—	2.2% (1)	—	—	—	—
Br. pn. + paralytic ileus	—	—	—	3.6% (1)	—	—	—	—	—

TABLE 3 : *Types of complications in relation to nutritional status.*

Type of complications	NUTRITIONAL STATUS			Total 261
	Well nourished 91	Under nutrition 130	Severe malnutrition 40	
Bronchopneumonia	20.9% (19)	34.6% (45)	42.5% (17)	31% (81)
Gastroenteritis	11% (10)	10.8% (14)	17.5% (7)	11.9% (31)
Encephalitis	3.3% (3)	3.1% (4)	—	2.7% (7)
Bronchopneumonia Gastroenteritis	7.7% (7)	12.3% (16)	10% (4)	10.3% (27)
Bronlhopneumonia, Gastroenteritis, Otitis Media	2.2% (2)	0.8% (1)	2.5% (1)	1.5% (4)
Bronchopneumonia, Gastroenteritis, Encephalitis	—	4.6% (6)	10% (4)	3.8% (10)
Bronchopneumonia + Decompensatio Cordis	—	0.8% (1)	—	0.4% (1)
Bronchopneumonia + Paralytic Ileus	1.1% (1)	—	—	0.4% (1)
Bronchopneumonia + Diphtheria	—	0.8% (1)	—	0.4% (1)
Bronchitis	1.1% (1)	3.1% (4)	—	1.9% (5)
Bronchitis + Gastroenteritis	—	0.8% (1)	2.5% (1)	0.8% (2)
Otitis Media	1.1% (1)	2.3% (3)	—	1.5% (4)

Type of complications	NUTRITIONAL STATUS			Total 261
	Well nourished 91	Under nutrition 130	Severe malnutrition 40	
Vitamin A deficiency	—	1.5% (2)	5% (2)	1.5% (4)
Diphtheria	3.3% (3)	1.5% (2)	7.5% (3)	3% (8)
Pyodermia	1.1% (1)	—	—	0.4% (1)
Tuberculosis	—	0.8% (1)	2.5% (1)	0.8% (2)
Tuberculous meningitis	—	0.8% (1)	—	0.4% (1)
Purulent meningitis	—	0.8% (1)	—	0.4% (1)

TABLE 4 : *The mortality rates in relation to types of complication and nutritional status*

Type of complications	NUTRITIONAL STATUS					
	Well nourished		Under nourished		Severe malnutrition	
	Number of cases	Mortality rate	Number of cases	Mortality rate	Number of cases	Mortality rate
Bronchopneumonia	19	—	45	11.1% (5)	17	41.2% (7)
Br. pneu. + gastroenteritis	10	—	14	7.1% (1)	7	—
Encephalitis	3	66.7% (2)	4	50 % (2)	—	—
Br. pn. + Gastroenteritis	7	—	16	31.2% (5)	4	25 % (1)
Br. pneumonia + Gastroenteritis + Otitis Media	2	—	1	—	1	—
Br. pneumonia + Dec. Cordis						
Br. pn. + Diptheria	—	—	1	—	—	—
Br. pn. + Paral Ileus	1	—	—	—	—	—
Bronchitis	1	—	4	—	—	—
Bronchitis + gastroenteritis	—	—	1	—	1	—
Otitis Media	1	—	3	—	—	—
Vitamin A deficiency	—	—	2	—	2	—
Diphtheria	3	—	2	—	3	—
Pyodermia	1	—	—	—	—	—
Tuberculosis	—	—	1	—	1	—
Tuberculous meningitis	—	—	1	100% (1)	—	—
Purulent meningitis	—	—	1	—	—	—

TABLE 5 : *The development of complications in relation to the appearance of rash.*

Types of complication	The development of complication			
	Before rash	Coincide	After rash	Total
Encephalitis	8	5	6	19
Gastroenteritis with or without associated diseases	37	18	17	72

TABLE 6 : *Liver sizes in complicated and non-complicated measles in relation to nutritional status.*

Body weight (standard)	Measles	Liver measurements (cm below the costal arc)					
		Not palpable	1 — 2	2 — 4	4 — 6	6	Total
80 - 100%	With complication 40	(17) 34.7%	(7) 14.3%	(16) 32.6%	(9) 18.4%	—	91
	Without complication 42	71.4% (30)	7.1% (3)	21.4% (9)	—	—	
60 - 80%	With complication 108	28.7% (31)	17.6% (19)	32.4% (35)	15.1% (16)		130
	Without complication 29	62.0% (18)	6.9% (2)	27.6% (8)	3.4% (1)	—	
60%	With complication 49	32.5% (13)	20.0% (8)	35.0% (14)	5.0% (2)	7.5% (3)	40
	Without complication (—)	—	—	—	—	—	
Total		109	39	82	28	3	261

Note : Liver enlargement were commonly found in complicated measles either in well-nourished or malnourished cases as seen in table 6.
There was no relationship between liver sizes and nutritional status.

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