

MEASLES COMPLICATIONS IN CHILDREN AT THE VIETNAM NATIONAL CHILDREN'S HOSPITAL 2019 AND SOME RELATED FACTORS

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ABSTRACT

Objectives: To identify the rate of measles complications at Vietnam National Children's Hospital in 2019 and a number of related factors.

Subjects and methods: A descriptive cross-sectional study conducted on 719 children under 16 year old who were suffered from measles treated at the hospital from 01/01/2019 to 31/12/2019. Data on age, gender, disease onset, medical history, measles vaccination, clinical and paraclinical character were collected from their medical records. Data analysis was run by SPSS 16.0. **Results:** Complications were defined on 82.48% patients. The most common complication is pneumonia (72.46%), followed by diarrhea (29.35%), otitis media (6.12%), croup (1.67%)... The complication rate was inverse to the patient age and seen more in patients with recent hospitalization history. The unvaccinated group has a complication rate higher than the vaccinated one (85.96% vs 53.13%). **Conclusions:** The measles complication rate at Vietnam National Children's Hospital is very high, especially with pneumonia. The factors associated to the complications are age, recent hospitalization and measles vaccinated history.

Keywords: Measles, measles complications.

1. INTRODUCTION

Measles is one of the most dangerous acute infectious diseases circulating in Vietnam as well as globally, caused by the measles virus, which is transmitted mainly through the air - by contact with saliva droplets or mucus from the nose and throat of the sick person. It occurs at all ages but is most common in young children and easily epidemic, and is one of the leading causes of death in young children due to many dangerous complications. Common complications in the respiratory system are pneumonia (can be caused

by measles virus or superinfection), croup, otitis media... Common complications according to the previous medical literature in the nervous system are encephalitis, HC Guillain - Barré, cross-sectional myelitis... Common digestive complications are diarrhea, mouth ulcers... in addition corneal ulcers, malnutrition, noma, tuberculosis... [1].

According to the WHO report as of September 30, 2019, it is recorded a total of 423,963 cases of measles in all regions and territories. The most affected regions in the first 9 months of 2019 include: Africa with 186,010 cases, Europe with

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97,527 cases, Southeast Asia with 67,604 and the Western Pacific region with 49,396 cases. In Vietnam, the measles epidemic appeared in the last months of 2018 in some northern and southern provinces and spread across the country in 2019. From the beginning of 2019 to the end of October 2019, it is recorded over 35,000 cases of Roseola nationwide with suspected measles, 03 fatal cases (Hoa Binh, Son La and Ha Nam) and nearly 10,000 cases of measles confirmed by testing. Measles occurs in all 63 provinces/ cities across the country, in which there are provinces / cities with a high number of cases of Roseola / suspected measles such as Hanoi, Ho Chi Minh City, Dak Lak_ [2]. Faced with the sudden increase in the number of measles hospitalizations in 2018 and from the beginning of 2019 to the present, coupled with the cyclical nature of the measles epidemic every 4-5 years, on the other hand realizing the importance of the Measles complications as the main cause of death in patients, we conducted this study with the following two goals:

1. *Determine the complication rate of measles in children at the Vietnam National Children's Hospital in 2019.*

2. *Comment on a number of factors related to complications of measles in children.*

2. STUDY SUBJECTS AND METHODS

2.1. Study subjects

All patients under 16 years old with measles are inpatient at the Vietnam National Children's Hospital from January 1, 2019 to December 31, 2019.

2.2. Study Methods

2.2.1. Study design

Descriptive cross-sectional study.

2.2.2. Diagnostic standards

* Confirmed diagnosis when there are clinical signs of suspicion of measles such as fever, cough, conjunctivitis, runny nose, respiratory tract inflammation and measles-like rash; accompanied by at least 1 of the following testing standards:

- PCR positive measles

- IgM positive measles

* Exclusion criteria:

- Patient is diagnosed with measles but then transferred to hospital or family asked to stop treatment.

- The patient's family did not agree to participate in the study.

2.2.3. Steps to study

Patients admitted to the hospital are examined, received clinical signs and monitored by the Center for Tropical Diseases; The tests were carried out in subclinical departments at the Vietnam National Children's Hospital according to the general protocol of the hospital and recorded in the medical records according to regulations. The medical records of all patients who were eligible to be enrolled in the study will be used to collect research information in the sample. The collected data were entered into the computer and analyzed by medical statistical software.

2.2.4. Study variables

- The rate of general complications

Identify specific complications according to the diagnostic criteria of the 2016 "Pediatric textbook" (10), including the following complications:

+ Pneumonia

+ Croup

+ Otitis media

+ Diarrhea

+ Encephalitis, myocarditis

+ Corneal ulcer

+ HC Guillain-Barré

+ Transverse myelitis

+ Mouth ulcers

+ Noma ...

- Some factors related to complications include:

+ Age: Compare by age groups, under 9 months, from 9 months to under 24 months, from 2 - 5 years old and over 5 years old.

+ Gender: Compare by men and women

+ History of hospitalization within 2 weeks before measles infection: Compare with group with no history of hospitalization and group with history of hospitalization within 2 weeks before measles infection.

Measles vaccination status: Compare the group that has not had measles vaccination with 1 vaccination and 2 vaccinations.

+ Time of year: Compare the complication rate by months in the year.

2.2.5. Data processing

Data processing uses SPSS 16.0 software.

Calculate the mean, the standard deviation for continuous variables. Calculate the frequency and percentage (%) for discrete variables. Compare the continuous variables by the T student test, the discrete variables use the chi square test or the Fisher test. The difference was statistically significant when $p < 0.05$.

3. STUDY RESULTS

During the study period, 719 children with measles were identified as eligible for the study.

3.1. General characteristics of study subjects

Table 1. Age and gender distribution of study subjects (n = 719)

Characteristics		n	%
Age	Less than 9 months	327	45.48
	From 9-24 months	280	38.94
	From over 2 years old to 5 years old	57	7.93
	Over 5 years old	55	7.65
Gender	Male	437	60.78
	Female	282	39.22

Comment: The age group under 9 months accounts for the highest rate at 45.48%, followed by the age group from 9-24 months - 38.94%. The age group from 2-5 years old accounts for 7.93% and over 5 years old is 7.65%. Male children account for 60.78%, which is higher than that of female (39.22%). The male/female ratio is 1.55/1.

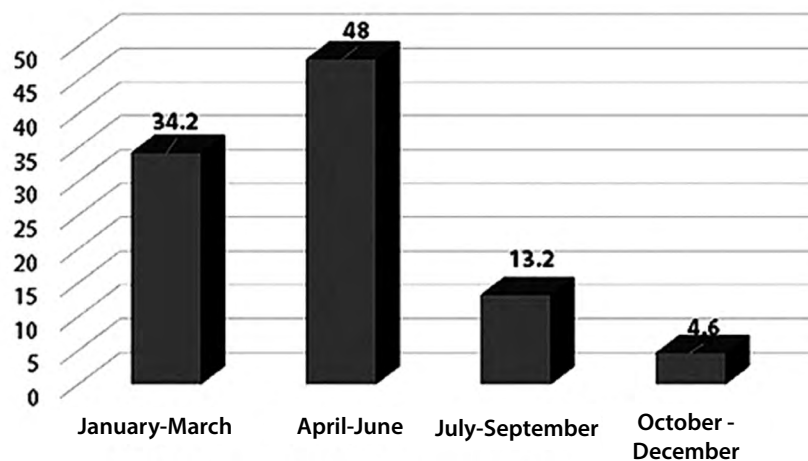


Figure 1. Time to get measles in a year

Comments: The most infected time is from April - June, accounting for 48%, The least infected time is in October-December with the rate of 4.6%. The rate of disease in January-March is 34.2%, in July - September it is 13.2%.

Table 2. History of vaccination/exposure to measles and disease (n = 719)

History	Yes n (%)	No n (%)	Don't remember n (%)
Contact with measles patient	256 (35,61)	12 (1,67)	451 (62,73)
Measles vaccination	32 (4,48)	641 (89,65)	42 (5,87)
Hospitalization for 2 weeks before onset of measles symptoms	239 (33,24)	480 (66,76)	

Comments: The majority of patients or family members do not remember a history of contact with measles patients (62.73%). The proportion of patients exposed to measles was 35.61%, only 1.67% confirmed no contact with measles patients.

The rate of not vaccinated against measles is 89.65%, only 4.48% have been vaccinated, 5.87% of patients do not remember whether they have been vaccinated or not; 33.24% of patients are hospitalized for 2 weeks prior to symptom onset.

Complications rate

Table 3. Overall complication rate (n = 719)

Complications	Frequency (n)	Percent(%)
With complications	593	82.48
Without complications	126	17.52
Total	719	100

Reviews: The rate of patients with complications is 82.48%

Table 4. Ratio of complications (n = 719)

Complications	Frequency (n)	Percent(%)
Pneumonia	521	72.46
Croup	12	1.67
Otitis media	44	6.12
Diarrhea	211	29.35
Other	5	0.7

Comments: The most common complication is pneumonia accounting for 72.46%, followed by diarrhea accounting for 29.35%, otitis media accounting for 6.12%, Croup accounting for 1.67%. There were no cases of encephalitis, myelitis, myocarditis and a noma.

3.2. Several factors related to complications

Table 5. Relationship by age group

Gender	Disease form				p
	With complications		Without complications		
	n	%	n	%	
Less than 9 months	291	88.99	36	11.01	<0.05
From 9-24 months	245	87.5	35	12.5	
From over 2 years old to 5 years old	31	54.39	26	45.61	
Over 5 years old	26	47.27	29	52.73	

Comment: The complication rate decreased gradually as the age group increased, the highest rate in the under 9 months old group had a complication rate of 88.89%, followed by the 9-24 month age group, the complication rate was 87.5%, group 2-5 years old complication rate is 54.39% and over 5 years old group is 47.27%. The difference is statistically significant with $p < 0.05$.

Table 6. Relationship by gender

Gender	Disease form				p
	With complications		Without complications		
	n	%	n	%	
Male	357	82.15	78	17.85	>0.05
Female	234	82.98	48	17.02	

Comments: There was no difference in the rate of complications in the two genders ($p > 0.05$).

Table 7. Relationship with history of hospitalization for 2 weeks prior to measles infection

History of hospitalization for 2 weeks prior to measles infection	Disease form				p
	With complications		Without complications		
	n	%	n	%	
Yes	220	92.05	19	7.95	<0.05
No	373	77.71	107	22.29	

Comments: Children hospitalized within 2 weeks before getting measles had a complication rate of 92.05% higher than the other group (77.71%). The difference is statistically significant with $p < 0.05$.

Table 8. Relationship with measles vaccination status

Measles vaccination status	Disease form				p
	With complications		Without complications		
	n	%	n	%	
Yes	17	53.13	15	46.88	<0.05
No	551	85.96	90	14.04	
Don't remember	25	54.35	21	45.65	

Comments: There are differences in complication rates in subjects with or not vaccinated against measles. The unvaccinated group had a complication rate of 85.96%, higher than that of the vaccinated group (53.13%). The difference is statistically significant with $p < 0.05$.

4. DISCUSSION

4.1. General characteristics of current measles patients

Measles age and its complications are closely related to the measles vaccination. When the measles vaccine is not yet in use, about 95-98% of children have had measles by the time they reach the age of 18, the highest incidence falls among children aged 5-9 years and epidemics are often concentrated in primary schools. The reason is that the disease is highly contagious and most children in this age group are not immune to measles. Meanwhile, children at a younger

age get measles mainly through infection from siblings - children who have attended school [3]. After the measles vaccine was introduced, the incidence of measles by age group has changed dramatically. Due to the success of the expanded immunization program, the majority of preschool-age children already have immunity to measles if they have received two full doses of the measles vaccine, so the disease tends to increase in the younger age group. (from birth to 4 years old). David H. Sniadack studied 7,948 measles cases in Vietnam from October 2008 to January 2010, the results showed that the age group with the highest incidence was from

1-4 years old (329/1,000,000), followed by the age under 12 months (318/1,000,000). Children from 5 to 9 years old have the 4th incidence (162/1,000,000) after the age group from 20-24 months [4].

In our study, the group of children under 2 years old accounts for 84.42%; Especially, the age group under 9 months accounts for 45.48% of the cases; The group of children over 2 years old accounts for only 15.58% of the total number of infected children. The high incidence of the disease in children under 9 months of age (which is not yet vaccinated) may be related to the lack of antibodies to the measles virus in mothers. These mothers, mostly between the ages of 20 and 30, may have been vaccinated with a measles vaccine under the Extended vaccination program and then did not get measles, it is possible that maternal antibody levels are not protective enough for their babies after birth. Further studies are needed on this issue to reach final conclusions.

The proportion of children who were not vaccinated or have no history of vaccination accounts for 95.52% of the total number of patients in this study. The low vaccination rate in the study group may be related to information about post-vaccination incidents that have occurred scattered across the country in recent years. Therefore, it is necessary to promote communication and education on health, improve people's understanding of the benefits of vaccination, and at the same time inspect and review the quality of vaccines, the preservation process and training for medical staff at the grassroots level about injection procedures and management of common complications.

Regarding gender, the results of this study show that boys account for 60.78%, higher than that of girls (39.22%). Research by David H. Sniadack [4], the incidence of male diseases is slightly higher than that of female (51% versus 49%); of Wang, the incidence in male is 57.6%,

in female, is 42.4%, but in children <1 year old, the rate of male is 67%, and female is 33%. The author argues that this difference is related to social factors rather than biological factors [5].

Complications and mortality rates among children with a history of hospitalization within 2 weeks before getting measles were both higher than those with no history of hospitalization. Children hospitalized within 2 weeks before getting measles had a complication rate of 92.05% higher than the other group (77.71%). The difference is statistically significant with $p < 0.05$. This may be due to these children being exposed to a child with a secondary illness in a narrow, overcrowded environment; high viral exposure intensity; and in a highly contagious stage. It is also possible that children get measles when their resistance is weak because they have or have just recovered from another disease, increasing the complication and mortality rate.

Measles is a very distinct seasonal disease. The disease usually occurs in the winter-spring when the temperature is low and the humidity is high, suitable for the activity of the measles virus. In recent studies on measles epidemic in northern Vietnam, the disease usually occurs around the end of December and early January and increases rapidly and peaks around February and March, then decreases rapidly in summer [4], [6]. In our scientific study, the first case appeared in October 2018, then sporadically a few hospitalizations per month. By January 2019, there started to see a rapid increase in a number of hospital admissions peaked in April 2019, then continued until May and June. At this time, the weather began to be hot, but the number of hospitalizations remained high. This may be due to the very high number of inpatient measles patients in March, April 2019, while the number of beds is limited, overloaded and shared leading the concentration of the virus in the room is very high. The density of patients is high making the epidemic spread strongly.

4.2. Complications rate

In our study, the clinical manifestations of the disease are relatively typical, the proportion of patients without fever accounts for about 2.92%, these patients have only manifestations of rash, respiratory pneumonia, cough and positive. 99.58% of patients have a typical measles rash, but only 7 children developing an atypical rash. The rate of measles patients at Vietnam National Children's Hospital with complications is very high to 82.48%; of which the most common complications are pneumonia accounting for 72.46%, followed by diarrhea accounting for 29.35%, otitis media accounting for 6.12%, bronchitis accounting for 1.67%.

Monfort L's study [7] in children with measles during the 2006-2007 outbreak in Barcelona showed that acute otitis media was the most common among measles complications at a rate of 20.4%, followed by pneumonia (15.3%). Study by Hoang Thi Thu [8] on patients with measles outbreak in 2014 at the National Hospital for Tropical Diseases recorded 54.7% of patients with complications. Acute diarrhea has the highest incidence (63.8%), mainly in adults and pregnant women (72.6% and 72.7%). Pneumonia is the second most common complication (31.3%), more common in children than adults (65.3% versus 9.2%), especially in children under 1 year old. In our opinion, since the Vietnam National Children's Hospital is a large center, milder cases have been treated in outpatient clinics and only those with severe complications or new serious illnesses, or undergoing treatment and infected with measles ... recently hospitalized, so the rate of complications in our study is much higher than in other studies.

4.3. Related factors

The complication rate decreased gradually as the age group gradually increased, was highest in the group under 9 months old with the complication rate 88.89%, followed by the group 9-24 months with the complication rate

87.5%, group 2 -5 years old with a complication rate of 54.39% and the group of over 5 years old with a complication rate of 47.27%. The difference is statistically significant with $p < 0.05$. This may be because in children under 2 years old the immune system is often not yet complete - especially in children <6 months old, protective antibodies mainly originated from the mother will be increasingly reduced - so when getting measles is easier to weaken, the possibility of superinfection with pathogenic microorganisms - especially pneumonia - is higher. This result is also consistent with the study of other authors. According to study by Hoang Thi Thu (2015), the age group under 1 year has a risk of complications 2.2 times higher than that of other age groups ($p < 0.01$) [8].

The results of this study also showed that the rate of complications in male was higher than that of female; The ratio Male/Female is 1.55/1. However, there was no difference in the rate of complications in the two genders ($p > 0.05$). In the previous medical literature on measles, male were often reported to have a higher mortality rate than female. However, recent studies on the overall mortality rate for complicated measles cases have not found any clear difference between the genders [3].

There was a statistically significant difference in the complication rate among those who had or had not been vaccinated: the unvaccinated group had a complication rate of 85.96% higher than the vaccinated group (53, 13%). According to the medical literature and many other studies, it is found that in patients who have been vaccinated against measles, if there are complications, there will also be milder symptoms than in patients who have not been vaccinated.

5. CONCLUSION

Complications rate on measles patients treated at the Vietnam National Children's Hospital is very high, up to 82.48%. The

most common complication was pneumonia accounting for 72.46%, followed by diarrhea 29.35%, otitis media 6.12%, croup 1.67%. There were no other serious complications such as encephalitis, spinal cord inflammation, Guillain - Barré syndrome, corneal ulcer ... The rate of complications was inversely proportional to the patient's age: highest in the under 9 month group of age 88, 89%, followed by the 9-24 month group 87.5%, the 2-5 year old group 54.39% and the over 5 year old group 47.27%. Children hospitalized for 2 weeks before getting measles had a complication rate of 92.05%, higher than the other group. The group of people who are not vaccinated against measles has a complication rate of 85.96%, higher than that of the vaccinated group (53.13%).

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