

## CLINICAL CHARACTERISTICS AND OUTCOMES AMONG ADULT PATIENTS WITH MEASLES AT HOSPITAL FOR TROPICAL DISEASES

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### ABSTRACT

**Introduction:** Measles is an acute infectious disease which occurs in children and adults who are not immune to measles. However, adult patients with measles often have more severe symptoms than children. **Objectives:** Description of the clinical and subclinical features, complications, and some related factors to complications of adult patients with measles. **Methods:** A cross-sectional study was conducted on patients aged  $\geq 16$  years with clinical symptoms suspected of measles and positive test result of serological immunoglobulin M for measles. **Results:** From October 2018 to May 2020, 294 patients meeting the inclusion criteria were enrolled. The average age was  $29 \pm 6$ . The sex ratio from male to female was 1:1.06. The most common clinical manifestations were high temperature, rash, and severe cough. About three-fourths of patients had elevated liver enzymes. Nearly one-third of adult patients with measles developed complications, including bronchitis (57.6%) and pneumonia (27.2%). Having a fever when the rash disappeared, a productive cough, and increased leukocytes were associated with the complication rate of measles ( $p < 0.001$ ). **Recommendation:** Adult patients with measles had a high rate of complications, which were commonly bronchitis, pneumonia, and preterm birth in pregnant women. The proportion of complications in patients with

persistent fever, productive cough, and increased leukocytes was higher than in the remaining groups.

**Keywords:** measles, complications, adult patients.

### I. INTRODUCTION

Measles is an acute infectious disease caused by the measles virus [8]. The virus is spread from person to person when an infected person breathes, coughs or sneezes, thereby having a highly contagious probability and easily leading to epidemics in unvaccinated areas. Measles could run a benign course with several characteristic symptoms such as high fever, cough, coryza, conjunctivitis, presence of Koplik spots and maculopapular rash. However, some people may suffer from severe complications, including pneumonia and encephalitis, which can result in death.

Measles is now an endemic disease globally, most common in children aged 2 – 6 [8]. Nevertheless, the proportion of adult patients with measles has increased considerably in recent years. In 2000, the Northern part of Vietnam recorded an estimated 7172 measles cases. The percentage of measles cases in children under five years of age, children aged 5 – 9 years, children aged 10 – 15 years and patients older than 15 years accounted for 18%, 36%, 39% and 39%, respectively [7].

Adult patients with measles often have more severe symptoms than children. About 1/3 of adults with measles develop

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respiratory complications, including pneumonia, which can be fatal or result in unrecoverable sequelae [8] [6] [4]. However, recent detailed data analyzing the clinical characteristics of adult patients with measles infection are limited. Therefore, we conducted this study to investigate the demographic, clinical characteristics, and biochemical parameters of adult patients with measles. In addition, we determined the percentage of complications and several related factors to complications among these patients.

## II. MATERIALS AND METHODS

**2.1 Study design:** Case series report, retrospective.

**2.2 Sample size:** 294 hospitalized patients diagnosed with measles who were admitted to the Hospital for Tropical Diseases from 10/2018 to 05/2020.

**2.3 Inclusion Criteria:** (1) all patients  $\geq$  16 years old with compatible clinical features who were managed at the Department of Internal Medicine A, Department of Intensive Care And Poisoning Control, and Department of Viet-Anh Infection; (2) positive serum IgM antibody for measles.

**2.4 Data collection:** Age, gender, occupation, address, comorbidities, nutritional status, pregnancy, source of exposure, vaccination status, signs and symptoms, leukocyte count (leukocytes and lymphocytes), platelet count, and transaminases (AST, ALT).

The complications of measles include respiratory complications (bronchitis, pneumonia, ear infection), keratitis, severe dehydration diarrhoea (metabolic acidosis, severe hypokalemia defined serum potassium level  $<$  2,5 mmol/l or cardiac arrhythmia or

respiratory muscles paralysis), encephalitis, and obstetric complications (miscarriage, premature birth, stillbirth).

**2.5 Data collection tools:** The information was collected by questionnaire and medical records.

**2.6 Measurements:** Venous blood samples of suspected measles cases were confirmed at a reference laboratory located in Ho Chi Minh City Preventive Health Center, using serological test for serum immunoglobulin M (IgM) antibodies specific for measles.

**2.7 Data analysis:** The SPSS 22.0 software was used for statistical analyses. Categorical variables were expressed as frequencies (percentages). Continuous variables with normal distribution were reported as mean values (standard deviation, SD), whereas non-normally distributed data were presented as median values (interquartile range, IQR). Chi-square or Fisher's exact test were used for categorical variables and Mann-Whitney or t-test for continuous variables. A two-sided p-value of  $<$  0.05 was considered statistically significant.

**2.8 Ethical consideration:** Ethical approval was achieved by the ethics committee in the biomedical research Hospital of Tropical Disease, Decision No. 47/HĐĐĐ November 11, 2019.

## III. RESULTS

In the collection period, 294 adult patients with measles enrolled in the study. Most patients were young, with 192 (63%) aged 25 – 35 and only 3 (1%) being  $>$  45 years old. The sex ratio from male to female was 1:1.06, with 143 males (48.6) and 151 female (51.3%) being included (Table 1).

Table 1. Socio-demographic characteristics of participants (N = 294)

Characteristics	Frequency (n)	Percent (%)
<b>Age (Mean ± SD), year</b>	29 ± 6	
<b>Gender</b>		
Male	143	48,6
Female	151	51,3
<b>Occupation</b>		
Employees	121	41,1
Students	15	5,1
Homemakers	18	6,1
Sellers	25	8,5
Freelancers	27	9,2
Other	88	30,0
<b>Residence</b>		
Ho Chi Minh City	197	67,0
Other	97	33,0
<b>Comorbidities (n = 22)</b>		
Chronic hepatitis	10	45,5
Gestational diabetes mellitus	3	13,6
Diabetes	2	9,1
Asthma	2	9,1
Cardiovascular Disease	1	4,5
Other	4	18,2
<b>Nutritional status</b>		
Malnutrition	42	14,3
Normal	143	48,6
Overweight – Obesity	109	37,1
<b>Pregnancy (n = 151)</b>		
Yes	28	18,5
No	123	81,5
<b>Source of exposure</b>		
Yes	17	5,8
No	277	94,2
<b>Vaccination status</b>		
Yes	1	0,3
No	67	22,8
Unknown	226	76,9

Of the adult inpatients, 22 (7.5%) had underlying diseases, including chronic hepatitis, which accounted for 45.5%. There were 151 patients (51.4%) having nutritional issues, most commonly obesity (37.1%). Among the 151 women, 28 (18.5%) were pregnant. Seventeenth (5.8%) cases had exposure to the source of infection. Sixty-seven (22.8%) and 226 (76.9%) subjects reported no measles vaccination and unknown vaccination status, respectively

(Table 1).

In the prodromal period, all 294 patients suffered from fever, while 293 (99.7%) and 289 (98.3%) patients developed cough and conjunctivitis. In the illness period, all 294 patients had a fever and generalized rash. Another common symptom was Koplik spots (79.3%). In the convalescence period, dry cough (99.7%) was the main clinical symptom (Table 2).

**Table 2. Clinical and laboratory features of participants (N = 294)**

Characteristics	Frequency (n)	Percent (%)
<b>Clinical features</b>		
<b>Prodromal period</b>		
Fever	294	100,0
Cough	293	99,7
Conjunctivitis	289	98,3
Runny nose	212	72,1
Sore throat	145	49,3
Diarrhea	113	38,4
Headache, joints, and muscle pain	68	23,2
<b>Illness period</b>		
Fever	294	100,0
Rash	294	100,0
Cough	293	99,7
Productive cough	140	47,6
Conjunctivitis	289	98,3
Koplik spots	233	79,3
Diarrhea	113	38,4
Headache	24	8,2
<b>Convalescence period (n = 291)</b>		
Fever	44	15,1
Cough	290	99,7
Productive cough	10	3,4
<b>Laboratory features</b>		
<b>Leukocytes (K/<math>\mu</math>l) (n = 286)</b>		
< 4	40	14,0
4 – 12	236	82,5
> 12	10	3,5
<b>Lymphocytes (K/<math>\mu</math>l) (n = 286)</b>		
< 1	235	82,2
$\geq$ 1	51	17,8
<b>Platelet (K/<math>\mu</math>l) (n = 286)</b>		
< 100	7	2,4
$\geq$ 100	279	97,6
<b>ALT (U/L) (n = 216)</b>		
< 40	50	23,1
40 – 200	93	43,1
> 200	73	33,8
<b>AST (U/L) (n = 216)</b>		
< 40	29	13,4
40 – 200	145	67,2
> 200	42	19,4

Laboratory results were summarized in Table 2. Among 286 patients having complete blood count results, the proportion of patients with normal leukocytes count (82.5%) and platelets count (97.6%) was high, with median 5,9 (4,7 – 7,2) K/ $\mu$ l and

174 (140 – 208) K/ $\mu$ l respectively; 235 (82.2%) patients were observed the decreased lymphocytes count, with median 0,6 (0,4 – 0,9) K/ $\mu$ l. Among 216 patients undergoing the liver transaminases test, 73 (33.8%) had high ALT levels.

**Table 3. Complications of adult patients with measles (N = 294)**

Characteristics	Frequency (n)	Percent (%)
<b>Complications</b>		
Yes	92	31,3
No	202	68,7
<b>Types of complications (n = 92)</b>		
Bronchitis	53	57,6
Pneumonia	25	27,2
Premature birth	8	8,7
Encephalitis	6	6,5

There were 92 (31.3%) measles cases that developed complications, including bronchitis, which was the most common (57.6%), followed by pneumonia (27.2%). Complications of encephalitis account for 6.5%, and eight (8.7%) pregnant women delivered prematurely (Table 3).

**Table 4. Related factors to complications of adult patients with measles (N = 294)**

Characteristics	Complication	Non-complication	p
	n (%)	n (%)	
<b>Gender</b>			
Female	49 (53,3)	102 (50,5)	0,67
Male	42 (46,7)	100 (49,5)	
<b>Age (Mean ± SD), year</b>	29,1 ± 5,6	29,2 ± 5,8	0,81
<b>Comorbidities</b>			
Yes	9 (9,8)	15 (7,4)	0,49
No	83 (90,2)	187 (92,6)	
<b>Malnutrition</b>			
Yes	9 (9,8)	33 (16,3)	0,14
No	83 (90,2)	169 (83,7)	
<b>Pregnancy (n = 151)</b>			
Yes	13 (26,5)	15 (14,7)	0,08
No	36 (73,5)	87 (85,3)	
<b>Fever in convalescence (n = 291)</b>			
Yes	29 (32,6)	15 (7,4)	< 0,001
No	60 (67,4)	187 (92,6)	
<b>Productive cough</b>			
Yes	75 (81,5)	65 (32,2)	< 0,001
No	17 (18,5)	137 (67,8)	
<b>Leukocytes, median (IQR), K/μL</b>	6,6 (5,2 – 8,4)	5,5 (4,5 – 6,7)	< 0,001
<b>Lymphocytes, median (IQR), K/μL</b>	0,64 (0,48 – 1)	0,59 (0,43 – 0,86)	0,053
<b>ALT &gt; 200 U/L (n = 216)</b>			
Yes	18 (25,7)	55 (37,7)	0,08
No	52 (74,3)	91 (62,3)	

Neither gender, age, underlying conditions nutritional status, nor pregnancy were significantly associated with the presence of complications. Patients with fever in the convalescence period and productive cough had a higher complication rate than the rest of the group (p < 0.001). Additionally, the median value of leukocytes in measles patients with complications was significantly higher than in the non-complication group (p < 0.001) (Table 4).

#### IV. DISCUSSION

The study shows that the mean age of measles patients admitted for treatment is  $29 \pm 6$  years old. This result was higher than the study of Cao Ngoc Nga, which reported an average age of 23 years [6]. The measles infection rate in males was equivalent to that in females (1:1.06), consistent with the study of Yasunaga H., which reported a male-to-female ratio of 1.1:1 [5]. Most patients live in Ho Chi Minh City, where there was a large outbreak during the 2018-2019 epidemic due to high population density, facilitating measles transmission. Additionally, the highest proportion of cases were among workers at 41.1%, while students only accounted for 5.1%. In contrast, the study by Cao Ngoc Nga found that the measles rate among students was 20.5% [6].

The research also shows that most measles patients (92.5%) do not have any underlying chronic diseases, consistent with the study of Song JY, where 88% of patients had no comorbidities [3]. The malnutrition rate in the study is 14.3%, higher than the study of Mahamud A., which reported 5.7% [2]. This difference is partly due to the different criteria and tools used to assess nutritional status in the two studies, which could influence the results. Furthermore, the proportion of pregnant women in the study (18.5%) is also higher than in Cao Ngoc Nga's study (10.3%) [6].

Our study indicates that only a person received single doses of measles vaccine. However, according to the study by Cao Ngoc Nga, the number of cases receiving a single dose of measles vaccination is higher, at 10.9% [6]. This difference may be because this is a retrospective study; information was collected by medical records, and most patients (76.9%) were not asked about

measles vaccination, so the study did not fully record it. Furthermore, 94.2% of patients in the study could not determine the source of infection, indicating a high likelihood of measles transmission in the community, especially in the prodromal period of the disease.

Regarding clinical features, all patients had a fever in the prodromal period. Dry cough (99.7%) and conjunctivitis (97.3%) were other common symptoms. This result is similar to a previous study by author Cao Ngoc Nga with cough and conjunctivitis symptoms at 98.7% and 87.2%, respectively [6]. During the illness period, all patients had rashes. Koplik's spots appeared from the end of the prodromal period. However, most patients were hospitalized during the illness and convalescence period, so Koplik's spots were mainly detected at this time, accounting for 79.3%, similar to the study of Giladi M. at 64.6% [1]. In the convalescence period, the percentage of patients still having a fever was 15.1%, possibly due to complications or coinfection.

Measles is a highly contagious viral disease, and thus most leukocytes are within normal limits (82.5%). However, decreased leukocyte count is also frequently observed in viral infections, accounting for 14% in this study and consistent with some previous studies [6] [1]. Most patients had low lymphocyte counts below  $1 \text{ K}/\mu\text{L}$  (82.2%) due to measles virus-induced immune suppression, similar to the studies by Cao Ngoc Nga and Giladi M. [6] [1]. In addition, the study indicated that over three-fourths of cases had elevated liver transaminases, including ALT levels exceeding five times the upper limit value, which was the highest proportion (33.8%). This result is also similar to the studies by Giladi M. and Cao Ngoc

Nga, with proportions ranging from 71% to 91% [6] [1].

The study also shows that the incidence of measles complications accounts for 31.3%, lower than the study by Cao Ngoc Nga and colleagues, with 67.9% [6]. Among patients having complications, bronchitis accounted for 18%, higher than Cao Ngoc Nga's study (10.3%) [6]; pneumonia was 8.5%, similar to Cao Ngoc Nga's study at 9.6% and Sunnetcioglu M. at 9% [6] [4]; encephalitis was 2%, consistent with the results in the studies of Sunnetcioglu M. (2%), Yasunaga H. (3.5%), and Mahamud A. (3%) [4] [5] [2]. In addition, the percentage of pregnant women having measles is 28.6%, similar to the study by Mahamud A. at 30% and Yasunaga H. at 32.3% [2] [5].

Factors including having a fever when the rash disappeared ( $p < 0.001$ ) and a productive cough ( $p < 0.001$ ) are associated with the proportion of measles complications. Measles patients often have a dry cough due to viral attacks on the respiratory mucosa, and thus the respiratory tract is easily damaged. Patients with productive cough, purulent sputum, and sputum discoloration often occur when there are bronchitis or pneumonia complications due to bacterial coinfection. Additionally, when comparing haematological and biochemical characteristics between the two groups, the results showed that the leukocyte count in measles patients with complications is higher than in the non-complicated group ( $p < 0.001$ ). This result may be because measles patients with complications often have increased leukocytes, leading to an elevated median white blood cell count in this target group.

The study is one of the few works that explore measles in adults. The research results provide information on the epidemiological, clinical, and paraclinical characteristics and common complications in adult patients with measles. However, our study also has some limitations. The retrospective design could be attributed to missing data, although the medical files were thoroughly reviewed, and the percentage of missing data was relatively low for almost all variables. Moreover, the study only recorded adults with measles who were hospitalized, so it may not accurately reflect all measles cases in the community.

## V. CONCLUSION AND RECOMMENDATION

Measles can spread quickly and widely in the community, especially in the prodromal period of the disease. Adults with measles have a high rate of complications, commonly including bronchitis, pneumonia, and premature birth in pregnant women. The complication percentage is higher in patients with a fever during convalescence, productive cough, and elevated leukocytes. It is recommended that healthcare professionals have a high degree of suspicion and become well-versed in the most typical signs, symptoms, and complications of measles in adult patients.

## REFERENCES

1. **Giladi M. et al.** "Measles in adults: a prospective study of 291 consecutive cases", *Br Med J (Clin Res Ed)*, 1987, 295(6609), pp. 1314.
2. **Mahamud A. et al.** "Risk factors for measles mortality among hospitalized Somali refugees displaced by famine, Kenya, 2011", *Clin Infect Dis*, 2013, 57(8), pp. 160-166.
3. **Song Joon Young et al.** "Epidemiologic and Clinical Features of Adult Patients with

- Measles During 2000 Epidemic", *Korean Journal of Infectious Diseases*, 2001, 33(6), pp. 443-447.
4. **Sunnetcioglu M. et al.** "Clinical and laboratory features of adult measles cases detected in Van, Turkey", *J Pak Med Assoc*, 2015, 65(3), pp. 273-276.
  5. **Yasunaga H. et al.** "Measles-related hospitalizations and complications in Japan, 2007-2008", *Intern Med*, 2010, 49(18), pp. 1965-1970.
  6. **Cao Ngọc Nga, Nguyễn Hoài Phong và Đỗ Anh Tuấn**, "Đặc điểm bệnh sởi trên bệnh nhân người lớn tại Bệnh viện Bệnh Nhiệt Đới", *Tạp chí Y học TP.HCM*, 2011, 15, tr. 522-529.
  7. **Nguyễn Văn Mẫn và Liên Huỳnh Phương**, "Bước đầu nghiên cứu công nghệ sản xuất vắc-xin sởi tại Việt Nam qui mô phòng thí nghiệm", *Trung tâm khoa học sản xuất vắc-xin sabin*, 2002, tr. 10.
  8. **Trần Đăng Khoa**, "Bệnh sởi", *Bệnh truyền nhiễm*, Nhà xuất bản Y học, 2020, tr. 260-276.