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Research Article

Study on Seroprevalence of IgG Antibody of Varicella-Zoster Virus in Pregnant Mothers, Neonates and Children of Six Months Old

Selina Yasmin[1,2,3]*

[1]*Senior Lecturer, Department of Microbiology, Sylhet Women's Medical College, Sylhet, Bangladesh*

[2]*Principal and Head of Microbiology, Sylhet MAG Osmani Medical College, Sylhet, Bangladesh*

[3]*Resident Surgeon, Department of Otolaryngology and Head-Neck Surgery, Sylhet MAG Osmani Medical College Hospital, Sylhet, Bangladesh*

***Corresponding Author:** Selina Yasmin, Senior Lecturer, Department of Microbiology, Sylhet Women's Medical College, Sylhet, Bangladesh.

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Abstract

This was a cross sectional and observational study, conducted in the Department of Microbiology, Sylhet MAG Osmani Medical College, Sylhet in collaboration with Department of Obstetrics and Gynaecology and Paediatrics in-patients and out-patient Department of this hospital during the period from July 2010 to June 2011 with a view to explore the Varicella-Zoster virus (VZV) immune status in pregnant mother and neonates up to six months post birth. For this purpose, 60 pregnant women, 60 new born babies and 60 infants aged six months were selected. After selection 5 ml of venous blood from pregnant mothers, 3ml of cord blood from newborn babies and 5 ml venous blood from infant aged six months. Immunoglobulin G antibodies to VZV in the sera were measured with a commercially available enzyme-linked immunosorbent assay (ELISA) test (VZV IgG; Human, Germany).

The mean age of the pregnant woman was 28.8 (SD ± 4.7) years. The sex of new born babies and children aged six months was identical [29 (48.3%) male vs 31 (51.7%) male; p = 0.715]. There were 49 (81.7%) pregnant mothers, 47 (78.3%) new born babies and 6 (10.0%) infants aged six months were seropositive to VZV IgG. The seropositivity of pregnant mothers and new born babies were almost similar (p = 0.648); but the seropositivity to VZV in infant aged six months were significantly lower than that of pregnant mothers and new born baby (p < 0.001 each).

In conclusion, a significant proportion of the Bangladeshi pregnant mother is susceptible to varicella and infant aged six months is highly susceptible to varicella.

Keywords: *Seroprevalence; IgG Antibody; Varicella Zoster Virus (VZV)*

Introduction

Varicella is a very contagious and vaccine preventable disease, occurring mostly during childhood, as a consequence of primary infection of varicella zoster virus (VZV). Although it usually presents a benign course, it may cause complications, especially in high risk individuals. Higher morbidity and mortality occurs among adults. The risk of complications may be increased in pregnant women and neonates [1,2].

When mothers have experienced varicella or received VZV vaccination, infants are considered protected during the first months of life by passive transfer of maternal anti- VZV antibodies [3]. The antibody titer in the newborn has been shown to be proportional to the level

in the mother [4]. However, passive immunity declines rapidly, and the exact duration and extent of protection remain uncertain. In other countries, some studies have shown that maternal antibodies were no longer detectable at 6 months [5],or even as early as 4 months [6].

In 1995, the United States of America introduced the VZV vaccine to their National Immunization Program which was followed by several other countries in the western world. The epidemiology of VZV infection in these countries had changed drastically with the introduction of the vaccine. The incidence of varicella fell by 90%, mortality from varicella declined by 66%, and rates of hospitalization for varicella decreased by 80% after introduction and routine use of the vaccine. In most of the countries in the South Asian region, the VZV vaccine is not included in the National Immunization Programs at present. At present, the immunity to the disease is acquired by contracting the natural infection in a large proportion of the population [7-9].

Serological tests for VZV-IgG antibody are the mainstay of detecting susceptible persons [10], but seropositivity of VZV-IgG antibody may vary from one country to another [11-14].

To date published data in Bangladesh on seroprevalence rate of VZV antibody in pregnant women, new born babies and children aged six months is not available. So this study was designed to explore the VZV immune status in pregnant mother and neonates up to six months post birth.

Materials and Methods

This cross sectional and observational study was conducted in the Department of Microbiology, Sylhet MAG Osmani Medical College, Sylhet in collaboration with Department of Obstetrics and Gynaecology; and Department of Paediatrics of this hospital during the period from July 2010 to June 2011 in objective to explore the Varicella-Zoster virus (VZV) immune status in pregnant mothers, neonates and childrens of six months age. Pregnant women of gestational age at least 37 weeks; newborn babies of same mother born and at least 2500gm birth weight; Infants aged six months were included in this study. Pregnant women born in abroad, previous immunization against Varicella-Zoster virus (VZV), transfusion of blood products during 6 months preceding serum collection, suspected varicella infection or presence of exanthem of unknown etiology at time of serum collection were excluded from the study.

A pre-designed study protocol was approved by the institutional ethical committee of Sylhet M.A.G Osmani Medical College, Sylhet before commencement of the study and informed written consent was taken from each of the participant before taking any interview.

After selection 5 ml of venous blood from pregnant mothers, 3 ml of cord blood from newborn babies and 5 ml venous blood from infant aged six months was collected. After collection, blood sample was processed immediately at room temperature by centrifugation at 2000 rpm for 10 minutes and were taken in eppendorf tube with proper labeling. Serum was separated and was stored at -20°C degree until further analysis. Immunoglobulin G antibodies to VZV in sera were measured with a commercially available enzyme-linked immunosorbent assay (ELISA) test (VZV IgG; Human, Germany) in the Department of Microbiology, Sylhet MAG Osmani Medical College, Sylhet.

Data were analyzed with the help of SPSS (Statistical Package for Social Sciences) Version 16.0. Quantitative data were presented as mean and standard deviation; and comparison was done between the groups by "Z" test or ANOVA. Qualitative data were analyzed by frequency and percentage, and comparison was performed by chi square (χ^2) test and regression analysis. A probability value (p) of < 0.05 was considered statistically significant.

Results

Age distribution of the pregnant women

The age of the pregnant women ranged from 20 to 36 years with the mean age of 28.8 (SD ± 4.7) years. Figure 1 showed the distribution of the age group of the pregnant women. Maximum pregnant women [21 (35.0%)] were in the age between 25 to 29 years, followed

by 19 (31.7%) pregnant women were in the age between 30 to 34 years; 11 (18.3%) pregnant women were in the age between 20 to 24 years and 9 (15.0%) were 35 years or above.

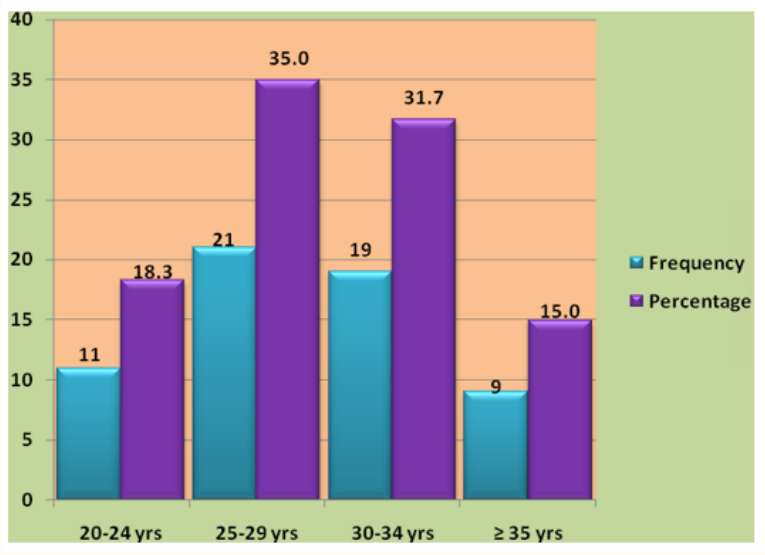

Figure 1: *Distribution of the pregnant women based on age group (n = 60).*

Distribution of VZV IgG level among different groups

The VZV IgG level in pregnant women ranged from 0.15 to 2.3 IU/ml with the mean of 1.0 (SD ± 0.6) IU/ml. The VZV IgG level in new born babies ranged from 0.16 to 2.7 IU/ml with the mean of 1.3 (SD ± 0.7) IU/ml. The VZV IgG level in infants at 6 months age ranged-from 0.12 to 1.63 IU/ml with the mean of 0.4 (SD ± 0.4) IU/ml. The overall VZV IgG level was differed statistically significant among the groups ($p < 0.001$). The VZV IgG level was significantly more in new born babies than that of pregnant women ($p = 0.013$). The VZV IgG level was significantly lower in infants aged six months than that of pregnant women ($p < 0.001$) and that of new born babies ($p < 0.001$). Table 1 showed the distribution of VZV IgG level among different groups.

Distribution	VZV IgG (iu/ml)			*p value
	Pregnant women (A) (n = 60)	New born babies (B) (n = 60)	Infants aged six months (C) (n = 60)	
Mean	1.0	1.3	0.4	A vs B 0.013 A vs C < 0.001 B vs C < 0.001
Standard deviation	± 0.6	± 0.7	± 0.4	
Range	0.15 to 2.3	0.16 to 2.7	0.12 to 1.63	Overall < 0.001

Table 1: *Distribution of VZV IgG level among different groups.*

**: ANOVA test was done to analyse the data.*

Distribution of seropositivity of VZV in pregnant mother and new born babies

Distribution of seropositivity VZV in pregnant mother and new born babies was shown in table 2. Forty nine (81.7%) pregnant mothers and 47 (78.3%) new born babies were seropositive for VZV. The seropositivity of both groups were almost similar ($p = 0.648$).

Seropositivity	Pregnant women (n = 60)	New born babies (n = 60)	*p value
Seropositive	49 (81.7)	47 (78.3)	0.648
Seronegative	11 (18.3)	13 (21.7)	
Total	60 (100.0)	60 (100.0)	

Table 2: *Distribution of seropositivity VZV in pregnant mother and new born babies.*
**: Chi-Square (χ^2) test was done to analyse the data.*
Figure in the parenthesis indicates corresponding percentage.

Distribution of seropositivity of VZV IgG in pregnant mother and infant aged six months

Distribution of seropositivity VZV IgG in pregnant mother and infant aged six months was shown in table 3. Forty nine (81.7%) pregnant mothers and Six (10.0%) infant aged six months were seropositive for VZV IgG. The seropositivity against VZV i infants aged six months were significantly lower than that of pregnant mother ($p < 0.001$) (Table 4).

Seropositivity	Pregnant women (n = 60)	Infant aged six months (n = 60)	*p value
Seropositive	49 (81.7)	6 (10.0)	<0.001
Seronegative	11 (18.3)	54 (90.0)	
Total	60 (100.0)	60 (100.0)	

Table 3: *Distribution of seropositivity VZV IgG in pregnant mother and infant aged six months.*
**: Chi-Square (χ^2) test was done to analyse the data.*
Figure in the parenthesis indicates corresponding percentage.

Seropositivity	New born babies (n = 60)	Infants aged six months (n = 60)
Seropositive	47 (78.3)	6 (10.0)
Seronegative	13 (21.7)	54 (90.0)
Total	60 (100.0)	60 (100.0)

Table 4: *Distribution of seropositivity against VZV in new born babies and infants aged six months.*

Forty seven (78.3%) new born babies and six (10.0%) infants aged six months were seropositive against VZV. The seropositivity against VZV in infants aged six months were significantly lower than that of new born babies ($p < 0.001$).

Distribution of seropositivity of infants aged six months against VZV according to sex

Three (9.7%) male and Three (10.3%) female infants aged six months were seropositive against VZV. The seropositivity against VZV of both groups were almost similar ($p = 1.000$). Distribution of seropositivity of infants aged six months against VZV according to sex was shown in table 5.

Seropositivity	Male (n = 31)	Female (n = 29)	*p value
Seropositive	3 (9.7)	3 (10.3)	1.000
Seronegative	28 (90.3)	26 (89.7)	

Table 5: *Distribution of seropositivity of infants aged six months against VZV according to sex.*
**: Fisher' Exact test was done to analyse the data.*
Figure in the parenthesis indicates corresponding percentage.

Validity of previous history of chickenpox and seropositivity

In this study, sensitivity and specificity of previous history of chickenpox and seropositivity was 87.8% and 81.8% respectively. Positive and negative predictive values were 95.6% and 60.0% respectively. This indicated that 95.6% of cases had seropositive who had previous history of chickenpox and 60.0% of cases had seronegative who had previous no history of chickenpox.

Previous history of chickenpox	Seropositivity		Total
	Positive	Negative	
Positive	43	2	45
Negative	6	9	15
Total	49	11	60

Table 6: *Cross tabulation of previous history of chickenpox and seropositivity.*
Sensitivity = 87.8%, Specificity = 81.8%, Positive predictive value (PPV) = 95.6%, Negative predictive value (NPV) = 60.0%.

Figure 2 showed the distribution of pregnant women by previous history of chickenpox. Previous history of chickenpox was present in 45 (75.0%) and absent in 15 (25.0%) pregnant women.

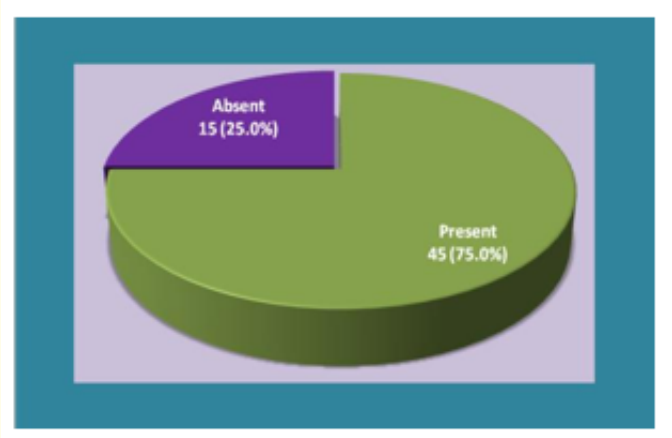

Figure 2: *Distribution of pregnant women by previous history of chickenpox.*

Discussion

In this study the age of the pregnant women ranged from 20 to 36 years with the mean age of 28.8 (SD ± 4.7) years. This result was almost similar to the study of Talukder., *et al*. [13] that mean age of the Bangladesh-born pregnant women was 26 (SD ± 5) years.

Maximum pregnant women [21 (35.0%)] were in the age between 25 to 29 years, followed by 19 (31.7%) pregnant women were in the age between 30 to 34 years; 11 (18.3%) pregnant women were in the age between 20 to 24 years and 9 (15.0%) were 35 years or above.

The current study showed that 29 (48.3%) were male and 31 (51.7%) were female among the new born babies whereas 31 (51.7%) were male and 29 (48.3%) were female among the infants aged six months. There was no significant difference between the groups in relation to gender ($p = 0.715$); suggesting the gender of new born babies and infants aged six months were well matched.

The VZV IgG level in pregnant women in this study ranged from 0.15 to 2.3 with the mean of 1.0 (SD ± 0.6). The VZV IgG level in new born babies ranged from 0.16 to 2.7 with the mean of 1.3 (SD ± 0.7). The VZV IgG level in infants at six months age was between 0.12 to 1.63 with the mean of 0.4 (SD ± 0.4). The overall VZV IgG level among pregnant women, new born and infant was statistically significant ($p < 0.001$). The VZV IgG level was significantly higher in new born babies than that of pregnant women ($p = 0.013$). The VZV IgG level was significantly lower in infants aged six months than that of pregnant women ($p < 0.001$) and that of new born babies ($p < 0.001$). In this regards Pinquier., *et al*. [6] found a rapid decline in the level of anti-VZV maternal antibodies during the first few months of life, with a substantial decrease even between the birth to one month and one to two month groups. The percentage of infants with anti-VZV antibody titers above the threshold considered to be protective decreased drastically, from 83% between birth and 3 months to 1% between 6 and 9 months and after 4 months, most infants seemed no longer to be protected by maternal anti-VZV antibodies.

In this study 49 (81.7%) pregnant mothers and 47 (78.3%) new born babies were seropositive for VZV. The seropositivity of both groups were almost similar ($p = 0.648$).

This result was consistent with the study of Saha., *et al*. [13] (2002) that 83.0% (62/75) of neonates were seropositive among their series of Bangladeshi neonates. Sharifi and Ghanjin [15] found in an Iranian study that the seropositivity rate of females of reproductive age was 80.9% in 15 - 39 years group; which was in agreement with the present study. But seroepidemiological studies carried out in pregnant women in other developed countries demonstrated higher seropositivity as opposed to the present study [1,16-19]. Dayan., *et al*. [1] studied the prevalence of antibodies in 2807 women aged 15–49 years attending public health-care settings in four cities in Argentina (Buenos Aires, Salta, Mendoza and Rosario) and in one rural area. The overall seroprevalence of varicella-zoster antibodies was 98.5% (95% CI 98.0 - 98.9) ranging from 97.2% in central Buenos Aires to 99.3% in southern Buenos Aires and Salta. Alanen., *et al*. (2005) [18] studied the prevalence of antibodies in Finland, obtaining a prevalence of 95%. Karunajeewa., *et al*. [6] studied the prevalence of antibodies in 308 women attending an antenatal clinic at a Melbourne obstetric hospital and found a prevalence of 94%. Plans., *et al*. [19] found the prevalence of varicella-zoster antibodies in pregnant women in Catalonia (Spain) was 96.1%. Seroepidemiological studies carried out in pregnant women of undeveloped tropical countries have observed a lower prevalence of varicella-zoster antibodies than those in developed countries. A seroepidemiological study carried out in 7980 pregnant women from various regions of the world found a prevalence of antibodies of 93.1% in women born in Western European countries and 80.3% in women born in Asia and Africa ($p < 0.001$) [17]. A polish study conducted on blood samples collected over nine years period found overall seroprevalence estimate, adjusted for sampling design for the age group 1 - 19 was 76.6% (95% CI: 74.6% - 78.7%). Here seroprevalence correlated closely with age ($p < 0.0001$) and reached 95% and 98% among 18 and 19 year age groups respectively [20]. These results could be explained by a lower varicella- zoster transmission among children and adults in tropical countries [20-23]. Given the poor socioeconomic condition contributing malnutrition, overcrowding, poor personal hygiene, low literacy rate and rudimentary or overburdened public health care facilities-the reason behind lower VZV transmission among children in developing countries remained unexplained.

In the present study 47 (78.3%) new born babies and 6 (10.0%) infants aged six months were seropositive to VZV. The seropositivity against VZV in infants aged six months were significantly lower than that of new born babies ($p < 0.001$). This result was similar to the study of Saha., *et al*. [13] that there was a sharp decline in antibody positivity in infants beyond the neonatal period, reaching as low as 19% in those aged 7 - 12 months (10/52).

In this study, sensitivity and specificity of previous history of chickenpox and seropositivity was 87.8% and 81.8% respectively. Positive and negative predictive values were 95.6% and 60.0% respectively. This indicates that 95.6% of cases have seropositive who had previous history of chickenpox and 60.0% of cases have seronegative who had previous no history of chickenpox. This result was correlated with the study of Dashraath., *et al*. [25] that the sensitivity, specificity, positive and negative predictive values of a self-reported history of varicella for serologically confirmed immunity were 87.2%, 83.2%, 94.3% and 67.1% respectively.

Conclusion

In conclusion, a significant proportion of the Bangladeshi pregnant mother is susceptible to varicella and infant aged six months is highly susceptible to varicella. Further baseline serosurvey will be required encompassing different geographical regions of the country for formulating a vaccination strategy against VZV which is scientifically sound and economically viable. Due to curious nature of lower transmission rate of VZV during early childhood in tropical countries our children remain vulnerable to increased VZV related complications when contracted the same in later life. Any vaccination strategy must have to take into account this epidemiological variability of our country.

Bibliography

1. Dayan GH., *et al*. "Varicella seroprevalence and molecular epidemiology of varicella-zoster virus in Argentina, 2002". *Journal of Clinical Microbiology* 42 (2004): 5698-5704.

2. Lafer MM., *et al*. "Prevalence of IgG Varicella Zoster Virus antibodies in the Kuikuro and Kaiabi indigenous communities in Xingu national park, Brazil, before varicella vaccination". *The Revista do Instituto de Medicina Tropical de São Paulo* 47.3 (2005): 139-142.

3. Asano Y., *et al*. "Placental transfer of IgG subclass-specific antibodies to varicella-zoster virus". *Journal of Medical Virology* 26 (1988): 1-6.

4. Van Der Zwet WC., *et al*. "Neonatal antibody titers against varicella-zoster virus in relation to gestational age, birth weight, and maternal titer". *Pediatrics* 109 (2002): 79-85.

5. Gershon AA., *et al*. "Antibody to varicella-zoster virus in parturient women and their offspring during the first year of life". *Pediatrics* 58 (1976): 692-696.

6. Pinquier D., *et al*. "Prevalence of Anti-Varicella-Zoster Virus Antibodies in French Infants under 15 Months of Age". *Clinical and Vaccine Immunology* 16.4 (2009): 484-487.

7. Ayres KL., *et al*. "Humoral immunity following chickenpox is influenced by geography and ethnicity". *Journal of Infection* 61 9(2010): 244-251.

8. Agampodi SB., *et al*. "Incidence and effects of Varicella Zoster Virus infection on academic activities of medical undergraduates - a five-year follow-up study from Sri Lanka". *BMC Infectious Diseases* 10 (2010): 117.

9. Shapiro ED., *et al*. "Effectiveness of 2 doses of varicella vaccine in children". *The Journal of Infectious Diseases* 203.3 (2011): 312-315.

10. Christiansen D and Barnett ED. "Comparison of varicella history with presence of varicella antibody in refugees". *Vaccine* 22 (2004): 4233-4237.

11. Migasena S., *et al*. "Seroprevalence of varicella-zoster virus antibody in Thailand". *International Journal of Infectious Diseases* 2.1 (1997): 26-30.

12. Akram DS., *et al*. "Seroepidemiology of Varicella-zoster in Pakistan". *Southeast Asian Journal of Tropical Medicine and Public Health* 31.4 (2000): 646-649.

13. Saha SK., *et al*. "Seroepidemiology of varicella-zoster virus in Bangladesh". *Annals of Tropical Paediatrics* 22 (2002): 341-345.

14. Talukder Y S., *et al*. "The seroepidemiology of varicella zoster virus among pregnant Bangladeshi and white British women in the London Borough of Tower Hamlets, UK". *Epidemiology and Infection* 135 (2007): 1344-1353.

15. Sharifi Z and Ghanjin SE. "The Seroepidemiology of Varicella Zoster Virus (VZV) in different age groups in Tehran, Iran". *Iranian Journal of Allergy, Asthma and Immunology* 4.2 (2005): 95-98.

16. Karunajeewa H., *et al*. "Seroprevalence of varicella-zoster virus, parvovirus B19 and Toxoplasma gondii in a Melbourne obstetric population: implications for management". *The Australian and New Zealand Journal of Obstetrics and Gynaecology* 41 (2001): 23-28.

17. Knowles SJ., *et al*. "Susceptibility to infection rash illness in pregnant women from diverse geographical regions". *Communicable Disease and Public Health* 7 (2004): 344-348.

18. Alanen A., *et al*. "Seroprevalence, incidence of prenatal infections and reliability of maternal history of varicella zoster virus, cytomegalovirus, herpes simplex virus and parvovirus B19 infection in South-Western Finland". *An International Journal of Obstetrics and Gynaecology* 112 (2005): 50-56.

19. Plans P., *et al*. "Prevalence of varicella-zoster antibodies in pregnant women in Catalonia (Spain). Rationale for varicella vaccination of women of childbearing age". *An International Journal of Obstetrics and Gynaecology* 114 (2007): 1122-1127.

20. Siennicka J., *et al*. "Seroprevalence of varicella-zoster virus in Polish population". *Przeglad Epidemiologiczny* 63.4 (2009): 495-499.

21. Venkitaraman AR., *et al*. "Measurement of antibodies to varicella-zoster virus in a tropical population by enzyme-linked immunosorbent assay". *Journal of Clinical Microbiology* 20 (1984): 582-583.

22. Leikin E., *et al*. "Seronegativity to varicella-zoster virus in tertiary care obstetric population". *Obstetrics and Gynecology* 90 (1997): 511-513.

23. Mandal BK., *et al*. "Adult susceptibility to varicella in the tropics is a rural phenomenon due to the lack of previous exposure". *The Journal of Infectious Diseases* 178.1 (1998): S52-54.

24. Lee BW. "Review of varicella zoster seroepidemiology in India and Southeast Asia". *Tropical Medicine and International Health* 3 (1998): 886-890.

25. Dashraath P., *et al*. "Seroepidemiology of Varicella and the Reliability of a Self- reported History of Varicella Infection in Singapore Military Recruits". *ANNALS Academy of Medicine Singapore* 36.8 (2007): 636-641.

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