Seroprevalence of Anti- Rubella Antibody Among Pregnant Women in Al-Turbah City Taiz Governorate, Yemen.

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Abstract:

Background: Infection with the rubella virus during pregnancy, especially during the first trimester, can result in congenital rubella syndrome (CRS). Like in many other developing countries, rubella surveillance is not well-established in Yemen. Therefore, this study was conducted with the objectives of estimating the seroprevalence and potential risk factors associated with acquiring rubella infection among pregnant women in Al-Turbah City.

Methods: A cross-sectional study was conducted involving 90 Pregnant women attending antenatal clinics in four main hospitals and health centers in Al-Turbah City. Demographic data, obstetric characteristics, and blood samples were collected and analyzed for rubella specific antibodies (IgG and IgM) using the Enzyme-Linked Immunosorbent Assay [ELISA] technique.

Results: The study revealed that, the prevalence of anti-rubella IgG was 81(90.0%) and anti-rubella IgM was 4 (4.4%). There was no statistically significant association between rubella seropositive and all the socio-demographic characteristics (P>0.05).

Conclusion: Observation, Although the protection rate (anti rubella IgG) was high, the cases of miscarriage and disabilities remained elevated. This suggests that while vaccine coverage or natural immunity is present, there are other factors and reasons that contributed to cause miscarriages and disabilities in newborns.

1.Introduction

Infection with the rubella virus during pregnancy, especially during the first trimester, can result in congenital rubella syndrome (CRS). [1]

The rubella virus belongs to the genus Rubivirus within the family Matonaviridae. Prior to 2018, it was classified as part of the family Togaviridae. (2) Rubella, commonly referred to as German measles or three-day measles, is a contagious viral infection caused by an enveloped, positive-stranded ribonucleic acid virus, usually causing a benign systemic illness resembling a mild case of measles. [3,4]

Transmission of postnatal rubella occurs mainly through the respiratory route via inhalation of respiratory droplets. Patients are most contagious during the time of appearance of the rash. The virus spreads quickly when an infected person coughs or sneezes, and commonly occurs in children and young adults, Rubella can also be transmitted from infected pregnant women to their unborn babies, that's the danger. (5,6) Primary implantation and replication in the nasopharynx are followed by spread to the lymph nodes. Subsequent viremia occurs, which in pregnant women often results in infection of the placenta. Placental virus replication may lead to infection of fetal organs. 7

In 1914, it was first suspected that rubella was caused by a filterable virus, which was confirmed in 1938 by infecting children with rubella virus using

filtered nasal washings from acute cases. However, it was not until 1941 that the Australian ophthalmologist Norman Gregg.first reported the association between congenital cataracts and rubella contracted during the first trimester of pregnancy. This report was the earliest recognition that an environmental exposure, and specifically a virus, could cause birth defects. The rubella virus was subsequently isolated in tissue culture in 1962.(4)

Rubella virus infection is a leading cause of vaccine-preventable birth defects, known as congenital rubella syndrome (CRS). (7) Congenital rubella infection (CRI) has outcomes including miscarriage, stillbirth, abortion, congenital rubella syndrome (CRS) or asymptomatic infection in the infant. The clinical manifestations of CRS encompass cardiac, cerebral, ophthalmic and auditory defects. The risk of congenital defects varies from 10% to 90%depending on the gestational age of the fetus at the time of infection. The occurrence of rubella earlier in gestation, particularly during the first 12weeks, increases the risk of more severe outcomes.(5) From just before conception and acquired in the early months of pregnancy, rubella infection may cause multiple fetal defects in up to 90% of cases. (3)

Epidemiological surveys in the world indicate that the immunity levels to Rubella virus in different communities are related to age, socioeconomic status,

climate, as well as population size and density. Rubella occurs worldwide with a seasonal distribution, peaking in late winter or early spring. [8]

Congenital rubella syndrome represents a global public health issue, with over 100,000 cases reported annually worldwide among newborns. [6] According to the World Health Organization (WHO) estimates, in Eastern Mediterranean Region (EMR) between 1996 and 2008, the average CRS incidence was 50 <100 per 100,000 live births. [9]

The pathology of CRS in the infected fetus is well defined, with almost all organs susceptible to infection; however, its precise pathogenesis remains poorly delineated. In fetal tissues, infections with rubella virus have diverse effect, ranging from no obvious impact to cell destruction.[10-15] The fetal defects observed in congenital rubella syndrome are likely secondary to vasculitis resulting in tissue necrosis without inflammation. Another possible mechanism is direct viral damage of infected cells. Studies have demonstrated that cells infected with rubella in the early fetal period have reduced mitotic activity. This may be the result of chromosomal breakage or due to production of a protein that inhibits mitosis. Regardless of the mechanism, any injury affecting the fetus in the first trimester (during the phase of organogenesis) results in congenital organ defects. A hallmark of fetal infection is its persistent nature, continuing throughout fetal development in utero and for up to 1 year after birth. [7,15] The

clinical manifestations of CRS apparent at birth including thrombocytopenic purpura intrauterine growth retardation, congenial heart disease psychomotoric retardation, defects in the eye (cataract, glaucoma, retinopathy), hearing loss, and hepatomegaly and/or splenomegaly. Nearly 80% of CRS children show some type of neural involvement, particularly neuro-sensory hearing loss.[16,17,18]

Epidemiological surveys in the world indicate that the immunity level to Rubella virus in different communities is related to age, socioeconomic status, climate, as well as population size and density. Rubella occurs worldwide with a seasonal distribution. Rubella seropositivity rates in different countries range between 54.1% and 95.2%.[17]

The prevalence of rubella antibody was 92% in Saudi Arabia,18 94.6% in Iran.19>90% in several African countries,[19-,21] And >89.5% in Turkey. [17]

Unfortunately, the epidemiology of Rubella virus in pregnant women resident in Yemen is not fully understood, as there is a lack of published data about the prevalence of Rubella virus among pregnant women in Yemen in general and in Al-Turbah City in particular. Therefore, the significance of this study lies in conducting a comprehensive study to determine the prevalence rates and identify the potential factors contributing to the transmission of the Rubella virus among pregnant women in Al-Turbah City Taiz governorate in Yemen.

This study aims to achieve the modest goal regarding the prevalence of rubella virus among pregnant women.

2. Material and methods

The study is a cross-sectional descriptive study. conducted in Al-Turbah City Taiz governorate, Yemen, under the oversight of Department Medical Laboratories, Faculty of Medical and Health Sciences- Taiz University - Al-Turbah Branch. Pregnant women seeking antenatal medical care were invited to participate in the study. Informed consent was obtained from all participants prior to enrollment, and individuals were informed of their right to withdraw at any time without affecting their medical care. Socio-demographic and clinical data were collected from each participant using a structured questionnaire, including age, vaccination status, occupation, residence, gestational trimester, education level, parity, history of abortion, history of malformed children, and history of stillbirth. Venous blood samples (2-5ml) were collected aseptically and following clotting serum was separated by centrifugation at 3,000 revolutions per minute (rpm) for five minutes, and transferred into clean Eppendorf tube, and the serum was stored at -20 C^{o} for up to 30 days.[10,11] All specimens were subjected for determination Anti-Rubella IgG and Anti-Rubella IgM antibodies by ELISA using Anti-Rubella IgG (Rubella IgG) Test System, (6325-300, Moonblind Inc. USA) and Anti-Rubella IgM (6425-300, Moonblind

Inc. USA) according to manufacture's instructions. Absorbance values were measured using a microplate reader (ELx800, BioTek Instruments, Inc., USA).

3. Statistical Analysis:

Data were analyzed using IBM SPSS Statistics software version 20.0. Bivariate analyses were conducted using $\chi 2$ test for categorical variables to evaluate the determinants of rubella infection in Al-Turbah City and values of ($P<0.05$) were considered as statistically significant while ($P>0.05$) was considered statistically non-significant.

4. Results

During the study period, 90 pregnant women were enrolled in this study with a mean age of 26.7 (SD) ±6.1 years.

Out of the 90 pregnant women, 81/90 (90.0%) had anti-rubella IgG Ab, 4/90 (4.4%) had anti-rubella IgM Ab, and 5/ 90 (5.5%) were susceptible to infection. On other hand, it was found statistical insignificance (*P*-value=0.756//X^2=0.1), in the rate of anti-rubella IgG Ab among patient resident rural 58/64 (90.6%) and 23/26 (88.5%) resident urban area.

As seen in table1, our study demonstrated that, the rate of IgG among all classes of education was around (90%) with no statistical significance in the difference of prevalence of anti-rubella IgG anti-rubella IgM Ab among them.

Our study demonstrated that, the rate of abortion was high 38/ 90 (52.8%) among pregnant women while the rate of rubella infection (IgM) among them was found low seen in the table in regarding the rate of newborn malformation it was found that out of total 90 pregnant women 3/ 90 (4.2%) of newborn were malformed with an account anti-rubella IgG and anti-rubella Ig M among them 100.0% and zero respectively.

Recent study reveal that, out of total 41/90 (46.1%) participant pregnant women had rubella vaccine with rate of immunity (anti-rubella IgG) among them was 40/41(97.6%) against rubella virus.

However, among the 4 pregnant women (4.4%) who were seropositive for anti-rubella IgM, 2 (50.0%) acquired the infection during the first trimester. Overall, the present study demonstrated no statistically significant association between the seroprevalence of either anti-rubella IgG or IgM antibodies and any socio-demographic characteristics.

Table 1. prevalence rubella virus among pregnant women in relation to demographic characteristics

Variable	Total N=90		Positive IgG N =81(90.0%)		X^2	***P***	Positive IgM N =4 4.4%)		X^2	***P***
	N	%	N	%			N	%		
Age										
15-25	46	51.1	43	93.5	1.3	0.528	2	4.3	1.5	0.482
26-35	36	40.0	31	86.1			1	2.8		
>35	8	8.9	7	87.5			1	12.5		
Residence										
Rural	64	71.1	58	90.6	0.1	0.756	3	4.7	0.03	0.861
Urban	26	28.9	23	88.5			1	3.8		
Trimester										
first	28	31.1	25	89.3	1.2	0.541	2	7.1	0.7	0.701
second	28	31.1	24	85.7			1	3.6		
third	34	37.8	32	94.1			1	2.9		
Education level										
Illiterate	13	14.4	12	92.3	1.6	0.649	1	7.7	0.4	0.940
Primary	29	32.2	27	93.1			1	3.4		
Secondary	24	26.7	22	91.7			1	4.2		
University	24	26.7	20	83.3			1	4.2		
Occupation										
Student	5	5.6	4	80.0	0.6	0.745	0	0.0	1	0.636
Employee	11	12.2	10	90.9			0	0.0		
Housewife	74	82.2	67	90.5			4	5.4		
Number of pregnant										
First	18	20.0	16	88.9	0.5	0.754	0	0.0	1.6	0.439
2 to 4	42	46.7	37	88.1			3	7.1		
>4	30	33.3	28	93.3			1	3.3		
Vaccination										
Yes	41	45.6	40	97.6	13.8	0.001	1	2.4	1	0.940
No	3	3.3	1	33.3			0	0.0		
Unknown	46	51.2	40	87.0			3	6.5		
Abortion										
Yes	38	52.8	35	92.1	0.6	0.580	2	5.3	0.01	0.909
No	34	47.2	30	88.2			2	5.9		
Stillbirth										
Yes	11	15.3	10	90.9	0.01	0.939	1	9.1	0.3	0.578
No	61	84.7	55	90.2			3	4.9		
newborn malformation										
Yes	3	4.2	3	100	0.34	0.561	0	0.0	0.2	0.668
No	69	95.8	62	89.9			4	5.8		

N: Number// % : percent // X^2 : chis square // P: Probability

4. Discussion

Our study revealed that 81 pregnant women (90.0%) were positive for anti-rubella IgG antibodies, which is in agreement with studies conducted in Saudi Arabia (91.6%) [18], Morocco (90.2%) [33], and another region in Yemen (89.2%)[34]. This rate is higher than those reported in other studies from Morocco (85.9%) [35], Sudan (65.3%) [36], and Nigeria (37.3%) [37]; however, higher IgG prevalence rates were reported by Abdul Jalel *et al*. (97.7%) [38] and Honarvar *et al*. (96.0%)[39].

Our study showed that the frequency of anti-rubella IgM among pregnant was 4(4.4%) which was in consent with that carried out in India (4.66%, 4.65),[40,41] and more than similarly studies contacted in Hodadah-Yemen (2.0%), [34] Sudan (3.4%),[36] and Ethiopia (2.1%).[5] and elsewhere had high IgM prevalence rate was reported by Akele, *et al* (12%),[42] and Al-Marzoqi, *et al* (53.9%).[43]

Regarding rural versus urban residence, Al-Thobhani et al. (34) reported an approximately similar prevalence pattern, with no statistically significant difference (P = 0.35) in IgG rates between rural (89.1%) and urban (92.1%) participants, aligning with our current findings. Additionally, Belefquih et al. (33) reported a comparable IgG seroprevalence rate (92.1%) among subjects aged 36–45 years.

Our study demonstrate that, indeed high rate of abortion38 (52.8%) but rubella infection (IgM) among participant was low with an account of IgM 2(5.3%) compare to 35(92.1%)had anti-rubella IgG. several studies reported similar observations were reported elsewhere in Yemen,[34] and Southern Ethiopia.[5]Increasing in the rate of abortion, stillbirth and disabilities in our study could be related to other causative agent such as infections caused by Toxoplasma gondii, Cytomegalovirus (CMV), and Herpes simplex virus, Zika virus, varicella-zoster etc.. [24] Where the prevalence of Anti-Cytomegalovirus (IgG) among pregnant women in AL-Turbah City was (68.8%)[25] compared to (27.8%)[26] of women had toxoplasmosis. In addition to other factors such as societal habit, feeding and poverty level which could play an important role in the rate of abortion, stillbirth and defects.

5.Conclusion:

The prevalence rate of anti-rubella IgM was 4.4%, indicating a low level of acute or recent infection among the study population. Conversely, the high seroprevalence of anti-rubella IgG (90.0%) demonstrates a robust level of baseline immunity within the community. However, despite this high protective rate, the rates of miscarriage and congenital disabilities remained elevated. This finding suggests that while rubella immunity is prevalent, these adverse obstetric outcomes are likely driven by other underlying etiologies or infectious agents

rather than vaccine failure alone. Furthermore, there was no statistically significant association between demographic characteristics and rubella infection, which further highlights the potential role of unmeasured environmental, clinical, or socio-economic risk factors.

6. Recommendations:

More comprehensive studies needed to get modest goal regarding rubella and other causative agent.

Acknowledgements

We would like to express our sincere gratitude to the members of the Department of Medical Laboratories, Faculty of Medical and Health Sciences, Taiz University (Al-Turbah Branch), for their unwavering support, guidance, and encouragement throughout this work. Special thanks are also extended to the medical and nursing staff at Khalifa Hospital in Al-Turbah City for their vital assistance in specimen collection, as well as to all the pregnant women who kindly consented to participate in this study.

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project submitted to department of medical laboratory, Faculty of medical and health sciences Taiz university AL-Turbah branch as a part of fulfillment requirement for obtaining of bachelor degree in medical laboratories.

الملخص:

الخلفية: قد تؤدي الإصابة بفيروس الحصبة الألمانية أثناء الحمل، وخاصةً خلال الثلث الأول منه، إلى متلازمة الحصبة الألمانية الخلقية. وكما هو الحال في العديد من الدول النامية، فإن نظام ترصد الحصبة الألمانية في اليمن غير مُنظّم بشكل كافٍ. لذا، أُجريت هذه الدراسة بهدف تقدير الانتشار المصلي وعوامل الخطر المحتملة للإصابة بالحصبة الألمانية لدى النساء الحوامل في مدينة التربة.

المنهجية: كانت الدراسة دراسة مقطعية شملت 90 امرأة حاملًا، يراجعن عيادات رعاية ما قبل الولادة في أربعة مستشفيات ومراكز صحية رئيسة في مدينة التربة. جُمعت البيانات الديموغرافية والخصائص التوليدية وعينات الدم، وخضعت للفحص للكشف عن الأجسام المضادة النوعية للحصبة الألمانية (IgG وIgM) باستخدام تقنية المقايسة المناعية الإنزيمية المرتبطة (ELISA).

النتائج: كشفت الدراسة أن نسبة انتشار الأجسام المضادة IgG للحصبة الألمانية بلغت 81 حالة (90.0%)، بينما بلغت نسبة انتشار الأجسام المضادة IgM للحصبة الألمانية 4 حالات (4.4%). لم تُلاحظ أي علاقة ذات دلالة إحصائية بين وجود الأجسام المضادة للحصبة الألمانية وأيّ من الخصائص الاجتماعية والديموغرافية (P>0.05).

الخلاصة: على الرغم من ارتفاع معدل الحماية (الأجسام المضادة IgG للحصبة الألمانية)، إلا أن حالات الإجهاض والإعاقات كانت مرتفعة، مما قد يشير إلى عدم فعالية اللقاح، ولكن هناك عوامل وأسباب أخرى ساهمت في حدوث الإجهاض والإعاقات لدى المواليد الجدد.