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REVIEW ARTICLE

Influenza A H1N1 2009 (Swine Flu) and Pregnancy

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Abstract The Influenza A H1N1 pandemic (A H1N1) occurred between June 2009 and August 2010. Although the pandemic is now over, the virus has emerged as the predominant strain in the current seasonal influenza phase in the northern hemisphere. The A H1N1 influenza is a novel strain of the influenza A virus and is widely known as swine flu. The virus contains a mixture of genetic material from human, pig and bird flu virus. It is a new variety of flu which people have not had much immunity to. Much has been learnt from the Pandemic of 2009/2010 but the messages about vaccination and treatment seem to be taken slowly by the clinical profession. Most people affected by the virus, including pregnant women, suffer a mild viral illness, and make a full recovery. The median duration of illness is around seven days. This influenza typically affects the younger age group i.e. from the ages of 5–65 years. Current experience shows that the age group experiencing increased morbidity and mortality rates are in those under 65 years of age. Pregnant women, because of their altered immunity and physiological adaptations, are at higher risk of developing pulmonary complications, especially in the second and third trimesters. In the United Kingdom, twelve maternal deaths were reported to be associated with the H1N1 virus during the pandemic and clear avoidable factors were identified (Modder, Review of Maternal Deaths in the UK related to A H1N1 2009 influenza (CMACE). www.cmace.org.uk, 2010). The pregnancy outcomes were also poor for women who were affected by the virus with a fivefold increase in the perinatal mortality rate and threefold increase in the preterm delivery rate (Yates et al. Health Technol Assess 14(34):109–182, 2010). There continues to be a low uptake of the flu vaccine and commencement of antiviral treatment for pregnant women.

Keywords A H1N1 influenza · Swine flu · Pregnancy · Antiviral drugs · Vaccines

Introduction

Although the outbreak of influenza A H1N1 2009 appeared first in Mexico in April 2009, this was followed by a growing number of cases reported across the globe. The outbreak of the novel A H1N1 virus (swine flu) was

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declared a global pandemic by the World Health Organisation (WHO) from 11 June 2009 until 10 August 2010. These pandemics happen when a new influenza virus, to which the population has little or no immunity emerges and starts to spread. Unlike seasonal influenza, high rates of disease due to a pandemic virus may occur throughout the year. Swine flu is a novel strain of the influenza A virus affecting humans and contains segments of genes from pig, bird and human influenza viruses.

The WHO classifies the spread of infections such as influenza in terms of phases. Phase 6 or a global pandemic is declared when the infection is characterized by human-to-human spread of the virus with community level outbreaks in at least two WHO regions, meaning that there is widespread global transmission.

The influenza A virus has been responsible for three global pandemics in the last century: the Spanish Flu in 1918, Asian Flu in 1957 and the Hong Kong Flu in 1968. These pandemics were responsible for a large number of fatalities, the Spanish Flu being the most severe and caused severe pneumonias, particularly among pregnant women (Table 1). A recently published epidemiological study about cohorts born in and around the pandemic estimated that the individuals born had a >20% excess cardiovascular disease at 60–82 years of age, relative to those born without exposure to the influenza epidemic, thus suggesting that prenatal exposure to even uncomplicated maternal influenza may have lasting consequences later in life [3].

The 1918 pandemic was associated with a high maternal mortality rate of 27% and also associated with high rates of spontaneous miscarriage and preterm labour. In the 1957 pandemic, a 20% maternal mortality rate was reported and increased incidences of birth defects such as neural tube defects and cardiac abnormalities were reported.

Although we are now in the post pandemic phase, the A H1N1 virus has now emerged as the predominant strain of virus in the seasonal influenza season that is currently affecting the northern hemisphere. Current experience in the United Kingdom shows that the population below the age of 65 years are worst affected by the complications of the flu and that the deaths associated with the flu are predominantly associated with the H1N1 virus. From October 2010 to early January 2011, 50 deaths were reported by the Health Protection Agency. Forty-five of these people died with the H1N1 (2009) strain and 5 with Influenza B. The majority were under 65 years of age and five were under the age of five [4].

The Influenza Virus

Every year, we experience an outbreak of the seasonal flu during the winter months. It affects around 5–15% of the population and most of the complications and deaths tend to affect the elderly population. The swine flu virus, however, typically affects the younger population, i.e. from 5 to 65 years. Most will experience a mild illness and make a full recovery. Children and young adults appear to be most susceptible to clinical infection with the highest incidence in 5–9 and 10–14 year olds, with a smaller number of cases in adults older than 50 years of age (born before 1957). The low number of cases seen in those aged over 50 is thought to be due to previous exposure in this age group to similar strains of H1N1 that circulated between 1918 and 1957. The median duration of illness is estimated at 7 days. However, people who are in the at risk group such as those with underlying medical conditions e.g. chronic respiratory disease, asthma, diabetes, chronic heart disease, chronic renal disease, chronic liver disease, morbidly obese, those who are on medication to suppress their immune system and children under the age of 5 years. Pregnant women are all at higher risk of developing complications should they catch the infection. The illness may be complicated by bronchitis, or viral or secondary bacterial pneumonia.

This virus is an Orthomyxovirus. This is an enveloped virus with the characteristic spike-like viral glycoproteins called Haemagglutinin and Neuraminidase, hence their description of H1N1, H5N1 etc. depending on the type of H or N antigens.

Haemagglutinin is an antigenic glycoprotein which causes erythrocytes to clump together. It is responsible for

Table 1 Characteristics of previous pandemics in the twentieth century

Pandemic	"Spanish flu" 1918	"Asian flu" 1957	"Hong Kong flu" 1968
Strain	A(H1N1)	A(H2N2)	A(H3N2)
Year	1918–1919	1957–1958	1968–1969
Likely origin	Not known (1st cases in Europe & US)	China	China
Estimated deaths			
Global	20–40 million	1 million	1–4 million
UK	250,000	33,000	30,000 (Eng & Wales)
Groups most affected	20–40 years	School children & elderly	Elderly

the binding of the virus to the cell that is being infected. Neuraminidase (also called sialidase) are glycoside hydrolase enzymes. They assist in the mobility of new virus particles through infected cells and in the budding from the host cells.

The influenza virus is known for its ability to mutate. This new strain appears to be a result of reassortment of human influenza and swine influenza viruses, in all four different strains of subtype H1N1. Reassortment is the mixing of genetic material of a species into new combinations in different individuals. This process has been responsible for some of the major genetic shifts experienced in previous pandemics. This novel strain of the H1N1 Influenza A subtype is a result of a mixing of the virus from humans, birds and pigs.

Clinical Features of Swine Flu

The typical symptoms of swine flu are a sudden fever of at least 38°C and sudden cough with at least one other symptom of chills, lethargy, dehydration, headache, sore-throat, coryza, diarrhoea, vomiting, abdominal pain, myalgia or arthralgia. Gastro intestinal symptoms (vomiting and diarrhoea) have also been reported more often with H1N1 than with seasonal flu (Table 2A).

The likelihood of infection with pandemic H1N1 2009 influenza is strongly influenced by age; the young are at most risk and those aged >60 years at least risk. Approximately 60% of patients with confirmed H1N1 2009 influenza virus infection are aged 16–64 years. However, case fatality increases with age especially those with associated co-morbidities, the young children <5 years of age [5] and pregnant where it is also high (Table 2B).

Table 2 Symptoms and risk groups

(A) Swine flu symptoms
Highly contagious during the first 5 days of illness
High Fever, usually above 38°C
Cough, sore throat
Headaches, aching muscles
Chills and shiver despite fever
Exhaustion on fatigue
Diarrhea or a stomach upset—has been a particular feature of Pandemic A
(B) Risk groups
Age < 5 years, socially deprived, underlying medical problems
16–64 years age group with associated co-morbidities (cardiac disease, renal disease)
Diabetes
Immunosuppression from cytotoxic drugs or auto immune disease, Asthma
Morbid Obesity
Pregnancy

In the UK, the first case of Influenza A H1N1 was confirmed on 27th April 2009. The first wave of the pandemic in UK started in July 2009 with the second wave from September 2009 and carrying on over the winter months. The vast majority of patients in the first wave in the UK experienced mild illness with 50% of patients recovering within 7 days of symptom onset and a further 25% within 10 days. The *main symptoms* reported were fever, fatigue, dry cough, sore throat and headache. However, severe gastrointestinal disease (nausea, vomiting, diarrhoea, abdominal pain) has been a feature of H1N1 infection in children and adults requiring admission [6, 7].

Complications of swine flu in the general population appear similar to seasonal influenza. Myocarditis has been observed, usually associated with a marked tachycardia. The prognosis is unclear, though influenza-related myocarditis usually has a good prognosis for recovery.

As with seasonal influenza, neurologic complications such as seizures and encephalitis, with altered mental state, can occur. The prognosis for patients with isolated neurological symptoms which can be optimised without requirement for ICU admission appears good. The initial symptoms of rapidly-lethal infections such as meningitis, encephalitis and bacteraemia can resemble those of influenza [8].

Although in the majority of cases of H1N1 2009 influenza affects the upper respiratory system, the most common complication is that of influenza-related pneumonia. This has occurred in 40% of hospitalised patients in the United States, usually with bilateral infiltrates apparent in the chest X-ray [9, 10]. Amongst patients with H1N1 influenza admitted to ICUs in New Zealand and Australia, 49% had viral pneumonitis or ARDS and 20% had secondary bacterial pneumonia. The most common bacterial pathogens reported included *Streptococcus pneumonia, S. pyogenes, Staphylococcus aureus*, *S. mitis and Haemophilus influenzae* [11].

General Principles of Management [12]

Infection Control

The virus is highly contagious and is contracted by aerosol transmission from inhaling the droplets from an infected person coughing and sneezing, and also touching the nose and mouth after being in contact with contaminated surfaces. The best way to reduce the risk of spreading the virus is to observe good respiratory hygiene by covering the mouth and nose with a piece of tissue paper when coughing and sneezing and disposing of it immediately. In addition, it is important to observe good hand hygiene by washing

Table 3 Principles of management

General
Natural history—self limiting in a majority of patients
Good respiratory hygiene, Good hand hygiene
Patient suspected with swine flu should be managed in isolation and barrier nursed
Anti-viral treatment
Oseltamivir (Tamiflu)—oral capsules
Zanamir (Relenza)—inhaler
Vaccines
Seasonal influenza vaccine incorporating the A H1N1 (trivalent vaccine) is safe during pregnancy

hands frequently with soap and water. There is no evidence to show that the risk is reduced by avoiding crowded places as long as these good hygiene measures are observed. Naturally, if anyone is down with the flu, they should avoid going to crowded places themselves (Table 3).

There is no evidence that face masks are effective in reducing the risk of catching or spreading the virus and are not recommended for use by the general population. They are only effective for use in a healthcare setting. In most clinical situations, a patient admitted to hospital with suspected swine flu or its complication, they will be managed in isolation and barrier nursed. Healthcare professionals should don a plastic apron and surgical face masks, observing strict hygiene measures. The respirator masks (FFP 3 masks) should only be used when potentially aerosol generating procedures are used e.g. in ventilated patients or those using nebulisers.

Patients suffering from the following symptoms are more likely to be admitted to the Intensive Care Unit

These are:

- dyspnoea (strongly predictive of both death and ICU requirement), respiratory rate >30 per minutes
- requirement for supplemental oxygen (strongly predictive of ICU care and death)
- pneumonia on admission (strongly predictive of significant complications after admission—including ICU multi-organ support and death)
- tachycardia (the higher the pulse the greater the chances of ICU care being required)
- altered conscious level

Effects on Pregnancy

It is commonly thought that a pregnant woman's immunity is suppressed. In pregnancy, there is modification of the immune system to prevent rejection of the fetus and placenta. It is thought that the cell mediated immunity is modified by an increased in the production of T-helper cells as opposed to T-killer cells to reduce the risk of rejection. There appears to be a tendency towards humoral immunity. As the virus replicates intracellularly, the ability to fight off an infection is reduced. It is known that infections such as chicken pox get worse in pregnancy, particularly in the later half of pregnancy, but this is due to the risk of pneumonitis from local spread to the respiratory system of the virus and also the mechanical effects of the enlarged uterus on the diaphragm and the respiratory system. There is no evidence that Human Immunodeficiency Virus (HIV) or tuberculosis get worse in pregnancy. Hence, there is no evidence to suggest that pregnant women are at increased susceptibility of catching the flu virus [13].

However, due to the modification in their immune systems to accommodate their developing fetus and adaptations in their body as a result of the hormonal and physical changes, they are at greater risk of developing complications should they acquire the illness. The enlarging uterus presses on the diaphragm and together with changes in the lungs such as reduced tidal volume, congestion and localized oedema, make the woman more prone to complications such as pneumonia and Adult Respiratory Distress Syndrome (ARDS). Recent reports have shown that the percentage of hospitalised cases requiring transfer to ICU within each gestational band is similar (27, 25, 24%); and the death rate amongst hospitalised patients within each gestational age group is also remarkably uniform (10, 6, 9%). This may imply that outcome in severely ill pregnant women is independent of gestational age after severe illness is established [14].

The United Kingdom Experience

There is still much to learn about the virus. Studies from the USA showed that pregnant women with swine flu were four times more likely to be hospitalised for complications compared to the non-pregnant population. In separate studies pregnant women are over represented in the group of patients admitted to hospital requiring Level 2 (High Dependency Care) or Level 3 care (Critical/Intensive Care). Observations from the USA, Canada and Australasia showed that pregnant women formed between 7 and 9% of admissions to Intensive Care Units (ICU).

In the United Kingdom, the United Kingdom Obstetric Surveillance System (UKOSS), working with the Department of Health and Health Protection Agency, collected information on pregnancies reported to be affected by A H1N1 from 221 of the 223 (99%) obstetric units in the UK during the pandemic. UKOSS assessed the data on morbidity in pregnancy. The Centre for Maternal and Child

Enquiries (CMACE) on the other hand, collected data on maternal deaths affected by A H1N1.

Morbidity

UKOSS was able to obtain complete data on 241 women admitted to hospital with confirmed A H1N1. During that period, there were 314,135 maternities, representing an incidence of 7.7 hospitalised cases per 10,000 maternities. Twenty percent (1.6 per 10,000 maternities) of these women were admitted to the Intensive Care Unit.

Only 2% of women admitted had received the A H1N1 vaccine but it has to be noted that the vaccination programme in the UK was rolled out after the peak of the hospital admissions in the series.

Sixty percent of the hospitalised women commenced antiviral treatment within 48 h of onset of their symptoms

Risk Factors for Hospitalization (Table 4)

Obesity and delay in treatment in antiviral treatment were significant factors associated with admission to ICUs. Treatment with antiviral agents within 2 days of onset of symptoms was associated with an 84% decrease in the odds of admission to an ICU.

As for pregnancy outcomes, a three fold increase in preterm delivery and a five fold increase in stillbirth rate was observed.

Mortality

Between 1 April 2009 and 13 January 2010, 12 maternal deaths in the United Kingdom and 1 maternal death in the Republic of Ireland with confirmed A H1N1 were reported to the Centre for Maternal and Child Enquiries (CMACE). Eight of the maternal deaths were investigated in detail by CMACE through their confidential enquiry panel.

As in the observations noted by UKOSS, Black and ethnic Minority (BME) women were over-represented (4/8). Clinical co-morbidities such as asthma, paraplegia, previous stroke and stroke were present. Obesity was found to be a risk factor for severe morbidity and mortality. Smoking did not appear to be a risk factor although both studies noted them to be a factor in the younger women.

Clear avoidable factors were noted and they are:

- Delayed admission to hospital and/or consideration of the likelihood of A H1N1 infection in the differential diagnosis;
- Delayed confirmation of A H1N1; wrong swabs used or inappropriate storage/carriage to laboratory;
- Lack of clear clinical leadership in overall case management (1 case);
- Delay in administering antiviral medication.

Table 4 Indications for hospitalization

Pregnant women with swine flu are four times more likely to be hospitalized
There is 3× increase risk of preterm delivery, 5× increase in still birth rate and increased risk of maternal death
Risk factors
Younger maternal age, Obesity, Asthmatic, other co-morbidities including Diabetes and heart disease
Black or other ethnic minorities
Delay in start of treatment with Anti-viral treatment
Risk factors for ICU admission
High fever > 38°C
Dyspnoea (Respiratory rate > 30/min)
Requirement of supplemental oxygen
Pneumonia on admission
Tachycardia
Altered conscious levels

Clinical Management of Pregnant Women Admitted with H1N1 Influenza A [12]

Pregnant women admitted with respiratory complications should be managed jointly between the obstetric and medical teams. An assessment needs to be made with respect to the best place to manage the woman. There should be early involvement of obstetric anaesthetists, respiratory physicians and haematologists and a clear management plan needs to be set out from the outset.

Women requiring more respiratory support may be best managed in the Respiratory Unit with close input by the obstetric and midwifery teams. If a woman is in labour, she would be best managed in the Delivery Unit with input from the Respiratory team and the Obstetric Anaesthetic team. Following delivery, she may need to be transferred to the clinical area that would be best to provide expert care for her.

It is important to bear in mind that pregnancy related pathologies such as chorioamnionitis, severe urinary tract infections, group A and B streptococcus infections and even malaria may present with similar symptoms. Careful clinical assessment is of vital importance in order not to miss an important infection. The patient needs to be carefully monitored with the modified early warning scores, taking into account the pregnancy. Complications of obstetric problems such as pre-eclampsia, venous thromboembolism and pulmonary embolism have also to be excluded.

The most common complication of A H1N1 influenza is pneumonia. The plan of management in such cases has been summarized in Table 5.

Table 5 Clinical management of women admitted with pneumonia secondary to H1N1 infection

Early involvement of obstetric anesthetist, respiratory physician, hematologist and a microbiologist
Rule out other associated pregnancy related complications such as chorio-amniotis, severe urinary tract infection, malaria etc.
Exclude complications of pregnancy: such as Pre-eclampsia, venous thromboembolism and PE.
Be prepared to deal with: DIC, post viremia encephalitis
Anti microbial therapy should be based upon bacteriological sensitivities-be cautious with the use of Augmentin in women with ruptured membranes
The anti viral treatment should be started ASAP
Maternal pyrexia should be treated with paracetamol
Consider antenatal steroids for preterm labour

Complications must be recognized and treated appropriately. In order to treat pneumonia effectively, ***the antimicrobial therapy*** should be based on bacteriological sensitivities. However, pending bacteriological confirmation, co-amoxiclav (Augmentin) is the recommended empiric antibiotic. In penicillin sensitive patients, Clarithromycin is a suggested alternative. Co-amoxiclav is not contraindicated in pregnancy. In situations where there is preterm prelabour rupture of membranes concomitant with pneumonia, the use of co-amoxiclav is not recommended because of the increased risk of necrotizing enterocolitis observed in the ORACLE study. An alternative antibiotic such as piperacillin is recommended and the microbiologist should be involved in management discussions. In addition, antiviral treatment should be started on clinical grounds whilst awaiting test results. It is also important to treat maternal pyrexia with paracetamol and not Non Steroidal Anti Inflammatory Drugs (NSAID). Epidemiological studies have linked uncontrolled maternal pyrexia to miscarriage and fetal abnormalities such as neural tube and cardiac defects. Maternal pyrexia is also a recognised risk factor for preterm delivery. The importance of control of maternal pyrexia with regular and effective doses of paracetamol and hydration should be emphasised.

Antenatal Corticosteroids

Current obstetric practice is to administer corticosteroids e.g. 2 doses of betamethasone or dexamethasone 12 or 24 h apart to promote fetal lung maturity in situations of threatened pre-term labour or where a decision is made to deliver the fetus prematurely for maternal or fetal reasons. The effects on the maternal immune system from a single course of corticosteroids are unclear but the evidence does not suggest that it results in sufficient immuno-suppression to cause maternal harm or exacerbation of infection.

The administration of corticosteroids is important for the promotion of fetal lung maturity, and the benefits outweigh the risks. Recent evidence suggests that repeated (rescue) doses of corticosteroids may be beneficial for fetal reasons, but studies have also shown that these may lead to maternal secondary adrenal insufficiency and fetal complications. The practice of repeated (rescue) doses of corticosteroids is not recommended.

The use of high dose steroids for the treatment of pulmonary complications is not recommended by ICU specialists for fear of immune suppression and prolonged viral shedding.

Decision for Delivery

Most mothers with symptoms of influenza in labour will be able to tolerate labour with adequate pain relief and hydration. In most cases, the decision to deliver will be made for an obstetric indication. In the event of a critically ill woman close to term, it is not unusual to deliver her baby, usually by caesarean section, to help with mechanical ventilation of the lungs to improve her recovery. This should be done once her clinical condition is stabilised and other potential complications such as coagulopathy have been excluded or corrected.

As indicated above, most of the respiratory complications have been shown to occur in the second and third trimesters. There may be situations where a preterm baby needs to be delivered in order to improve the outcome for ventilation of a very ill mother. The decision is made in conjunction with the obstetric, critical care and neonatal teams. The pregnant woman should be informed but if unable to participate in clinical decision making, the partner or close relatives should usually be involved in discussions. In order to improve the outcome for the premature infant, corticosteroids (in accordance with the guidance above) should ideally be administered at least 24 h prior to delivery. It is unlikely that pregnancies in the 1st or early second trimesters will need to be terminated unless it is felt that continuation of the pregnancy will be detrimental to the woman's condition. There may be occasions where a woman who is booked for elective caesarean section becomes symptomatic at the time of the planned procedure. If possible, it would be advisable to commence her on antivirals and to delay the procedure by about 5 days, to allow her to recover, in order not to increase her risks of respiratory complications, and also to reduce the risk of spread to other patients and staff. In severe cases of respiratory complications where the woman has developed Adult Respiratory Distress Syndrome (ARDS) and where she is not responding to mechanical ventilation, she may have to be considered for Extra Corporeal Membrane Oxygenation (ECMO). This is highly

specialized treatment and the decision is made by the Intensive Care specialists. As above, it may not always be necessary to terminate a pregnancy in the first or early second trimesters as there is no benefit in doing so for maternal ventilation. It is of vital importance to maintain the maternal physiology in the best possible state in order to allow the satisfactory progress of the pregnancy. There is now more capacity for ECMO treatment in the UK and more pregnant women are being referred to ECMO units for treatment. It is vitally important that the obstetric teams in the ECMO units are jointly involved in the mother's care and good communication is essential.

Post Natal Period

Women in the postnatal period are probably at lower risk of respiratory complications because the effects of the gravid uterus on the lungs have been removed. However, they may still experience similar complications if they are infected and there is a risk of transmission to the newborn infant. They should observe the same strict hygiene measures and be offered antiviral medication i.e. oseltamivir if clinically indicated. Mothers should be encouraged to breastfeed. Breast feeding is important and should be continued as long as possible.

The benefits of breastfeeding are significant and are two-fold: (i) it gives babies the most appropriate nutrition for health and promotes attachment between mother and baby and (ii) colostrum is rich in antibodies which will help to protect the baby from many infections. Women who are breastfeeding and have symptoms of influenza should be treated with an antiviral medicine. The preferred medicine is oseltamivir, as for other adults. However, if a baby is born and breastfeeding is started while the woman is taking zanamivir, she should complete the course of zanamivir; it is not necessary to switch to oseltamivir.

If the woman is too tired to breastfeed, she should be encouraged to express her breast milk in order to feed her baby. She should get help with breastfeeding and her baby should be with her as much as possible. She should observe strict hygiene measures to avoid spread of the virus to her baby.

Antiviral Treatment

The two types of antiviral drugs known to be effective against the swine flu virus are oseltamivir (Tamiflu®) and zanamir (Relenza®). They are neuraminidase inhibitors and act by preventing the virus from budding and escaping from the host cells. Oseltamivir is given in the form of oral capsules and zanamivir is given as an inhaler (Diskhaler). The safety of these antiviral drugs in pregnancy has been looked at from experience with their usage in seasonal flu in some countries and from recent data from Canada. Although *oseltamivir* has been shown to cross the placenta and breast milk in small amounts, no adverse effects on the fetus or pregnancy have been recorded. As *zanamivir* acts in the respiratory tract with no absorption into the blood stream, it is recommended as first line treatment of swine flu in pregnancy in the United Kingdom. However, if the woman is unable to tolerate the inhaler e.g. if she has severe asthma or is admitted to hospital with complications such as pneumonia, oseltamivir is the recommended drug for treatment. The benefits of antiviral treatment are most noticeable if it is commenced within 48 h of symptom onset but recent experience with hospitalised patients reveals that antivirals given more than 48 h after symptom onset also confer benefit.

Treatment with antivirals should be started on clinical grounds whilst awaiting test results. Waiting for confirmatory tests will only lead to a delay in commencement of treatment. Clinical judgement should be exercised in the initiation of treatment. A negative test does not necessarily exclude H1N1 influenza as the sensitivity of rapid influenza diagnostic tests can range from 10 to 70% for 2009 H1N1 virus.

Pre or post exposure prophylaxis with antivirals has been shown to be effective in preventing the development of the influenza infection. Unlike in treatment after symptoms, prophylaxis may inhibit the development of immunity and prolonged or repeated prophylaxis may predispose to development of resistance. Prophylaxis is only recommended for very high-risk individuals for whom prompt treatment may not avoid the development of severe disease. Most pregnant women do not require prophylaxis.

Vaccines

In the United Kingdom, the vaccination programme was launched in October 2009. Healthcare workers were the first group to be offered the vaccine. Following this, at risk groups, pregnant women and children between 6 months and 5 years were invited to be vaccinated.

It is of no doubt that any programme to vaccinate pregnant women will raise concerns and controversy. New vaccines cannot be tested on pregnant women but the experience on its safety has been drawn from data from seasonal flu vaccines. The swine flu vaccine is similar to the seasonal flu vaccine in many respects. The vaccine contains the inactivated (killed) H1N1 virus which is developed from the bird flu H5N1 virus—a virus to which most people have no immunity. The inactivated virus will not cause any harm to the fetus or mother and active

immunity will develop. The antibody response to vaccines in pregnant women has been shown to be as effective as those who are not pregnant.

The reluctance to be vaccinated is mainly due to worries about the side effects. Experience from the 2009/2010 pandemic confirmed the safety profile of the vaccine. Over 350 million doses of the vaccine were administered worldwide during the pandemic with no adverse long term effects noted in both the pregnant and non pregnant populations [15].

In the UK, the seasonal influenza vaccines for 2010 have incorporated the A H1N1 strain as part of the trivalent vaccine. In spite of the proven safety profile, until the end of December 2010, the uptake of the vaccine in the younger population who are at risk, including pregnant women, remained low with less than 50% uptake [4]. Communication strategies have been stepped up to promote the value of the vaccine and to heighten awareness of the severity of complications affecting the younger at risk population.

Conclusion

Although we are now experiencing the post pandemic phase, the A H1N1 virus has emerged as the predominant virus in the current seasonal influenza season affecting Europe and the UK, with significant morbidity and mortality rates affecting the younger population and pregnant women. Most people who catch swine flu experience mild symptoms and make a full recovery. However, pregnant women are more likely to develop life-threatening complications should they catch the flu. It is important for pregnant women seek medical advice early and are started on antiviral treatment, ideally within 48 h, but they can also be effective up to 7 days. If, in spite of treatment, they do not get better, they must contact their doctor or midwife. It is vitally important to treat any fever in pregnancy with paracetamol and drinking plenty of fluids.

Strict hygiene measures are effective in preventing the spread of the infection. Vaccines are the most effective way to avoid catching the virus and pregnant women should consider taking up the offer of vaccination against swine flu.

References

1. Modder J. Review of maternal deaths in the UK related to A H1N1 2009 influenza (CMACE). www.cmace.org.uk (2010).
2. Yates L, Pierce M, Stephens S, et al. Influenza A/H1N1v in pregnancy: an investigation of the characteristics and management of affected women and the relationship to pregnancy outcomes for mother and infant. Health Technol Assess. 2010;14(34):109–82.
3. Mazumder B, Almond D, Park K, et al. Lingering prenatal effects of the 1918 influenza pandemic on cardiovascular disease. J Dev Orig Health Dis. 2009;10:1–9. doi:10.1017/s2040174409990031.
4. Weekly influenza report. Health Protection Agency UK. http://www.hpa.org.uk/NewsCentre/NationalPressReleases/2011PressReleases/110106Weeklyflureport6January2011/.
5. Jamieson DJ, Honein MA, Rasmussen SA, et al. H1N1 2009 influenza virus infection during pregnancy in the USA. Lancet. 2009;374:451–8. doi:10.1016/S0140-6736(09)6134-0.
6. HPA clinical notes. http://www.hpa.org.uk/HPA/Topics/InfectiousDiseases/InfectionsAZ/1242949541960.
7. Vaillant L, La Ruche G, Tarantola A. Epidemiology of fatal cases associated with pandemic H1N1 influenza 2009. Eur Surveill 2009;14(33):pii = 19309.
8. Centers for Disease Control and Prevention (CDC). Neurologic complications associated with novel influenza A (H1N1) virus infection in children—Dallas, Texas, May 2009. MMWR Morb Mortal Wkly Rep. 2009;58(28):773–8.
9. Jain S, Kamimoto L, Bramley AM, et al. Hospitalized patients with 2009 H1N1 influenza in the United States, April–June 2009. N Engl J Med. 2009;361:1935–44. doi:10.1056/NEJMoa0906695.
10. Kumar A, Zarychanski R, Pinto R, et al. Critically ill patients with 2009 influenza A (H1N1) infection in Canada. JAMA. 2009;302:1872–9. doi:10.1001/jama2009.1496.
11. The ANZIC Influenza Investigators. Critical care services and 2009 H1N1 influenza in Australia and New Zealand. N Engl J Med. 2009;361:1925–34.
12. Clinical management guideline for pregnancy. http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_107770.
13. Stirrat GM. Pregnancy and immunity. BMJ. 1994;308:1385–6.
14. Siston AM, Rasmussen SA, Honein MA, et al. Pandemic 2009 influenza A (H1N1) virus illness among pregnant women in the United States. JAMA 2010;303(15)1517–25.
15. Meeting of the Strategic Advisory Group of Experts on immunization, April 2010—conclusions and recommendations. Weekly Epidemiological Report, World Health Organization. 2010:85;197–212.