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Review

The management of sexually transmitted infections in pregnancy

Sarah Allstaff MRCP,[a] **Janet Wilson** FRCP[b,*]

[a]Consultant in Genitourinary Medicine, Tayside Sexual and Reproductive Health Service, Ninewells Hospital and Medical School, Ninewells Avenue, Dundee DD1 9SY, UK
[b]Consultant in Genitourinary Medicine, Department of Genitourinary Medicine, Sunnybank Wing, Leeds General Infirmary, Leeds LS1 3EX, UK
[*]*Correspondence:* Janet Wilson. Email: janet˙d.wilson@leedsth.nhs.uk

Key content

- Sexually transmitted infections (STIs) have increased in the past decade in the UK in all age groups.
- Any woman with one STI is at higher risk for another and comprehensive STI testing should be recommended, including repeat HIV testing.
- Women under 25 years should be referred for chlamydia screening.
- In pregnancy, STIs should be managed in conjunction with genitourinary medicine colleagues.
- Pregnant women with STIs should receive public health interventions, including partner notification and advice on sexual abstinence during treatment and on safer sex.

Learning objectives

- To be able to describe the epidemiology of STIs.
- To be able to list the indications for screening and testing.
- To know about the evidence supporting treatment of STIs in pregnancy.

Ethical issues

- Should screening for chlamydia in pregnant women aged less than 25 years be part of routine antenatal screening rather than through a different screening programme?
- How can research on the pharmaceutical treatment of STIs in pregnancy be conducted safely?
- Should child protection measures be taken for neonates born to mothers at high risk for HIV infection, (e.g. from an area of high prevalence or who are found to have an STI such as syphilis in pregnancy) whose mothers decline HIV screening in pregnancy?

Keywords anogenital warts / bacterial vaginosis / *Chlamydia trachomatis* / genital herpes / gonorrhoea / syphilis / trichomoniasis

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Introduction

Sexually transmitted infections (STIs) and pregnancy are inextricably linked through their mutual prerequisite: unprotected vaginal sexual intercourse. In the last decade new diagnoses of STIs from genitourinary medicine clinics in the UK have risen by 153%;[1] however, in 2010 the rise flattened, with no increase in total infections between 2009 and 2010.[2] Although those aged under 25 years carry the largest burden of STIs, this increase applies to all age groups.

The spectrum of reproductive outcomes following STIs ranges from tubal factor infertility to congenital malformations and they can result in significant morbidity and mortality. The interaction between STIs and pregnancy is bidirectional and the physiological changes of pregnancy can alter the natural history of an STI. Treatment options in pregnant women can be limited and therapy must be efficacious in order to justify any potential risk to the pregnancy and fetus. The purpose of this review is to explore the interactions between STIs (excluding HIV) and pregnancy, indications for screening/testing and evidence to support current recommended treatments and follow-up (summarised in Table 1). Women undergoing termination of pregnancy have high prevalence and complication rates of STIs, but that topic is beyond the scope of this review.

Chlamydia trachomatis

More than 111 000 new diagnoses of chlamydia were made in women in England in 2010.[2] Most were in women aged less than 25 but there has been a 55% increase in chlamydia in women aged 25–34 in the last decade. Younger age and higher numbers of recent sexual partners are risk factors for chlamydia in pregnancy.[3] Approximately 70% of women are asymptomatic, which is not altered by pregnancy.

Complications of chlamydia are secondary to ascending infection. Prospective studies assessing associations between antenatal chlamydia, preterm birth, low birthweight and infant mortality show conflicting results. The largest study[4] shows an association between antenatal chlamydia and preterm rupture of membranes and low birthweight, but only in women with evidence of primary infection. However, culture was used to detect chlamydia and this is now known to have only 60–70% sensitivity, being better at detecting infections

Table 1. Screening tests, sites, indications and recommended treatment and follow-up of STIs in pregnancy.

	Screening/testing recommendations	Testing technology	Sites to sample	First-line treatment	Alternative/additional treatment	Indications for test of cure
Chlamydia	Inform women <25 years to attend local National Chlamydia Screening Programme centre (in England) Women >25 years: test if symptoms of infection or baby has ophthalmia neonatorum	NAAT	Endocervix *or* self-taken vulvovaginal swab	Azithromycin 1 g single dose	Erythromycin 500 mg b.d. for 14 days *or* erythromycin 500 mg q.d.s. for 7 days *or* amoxicillin 500 mg t.d.s. for 7 days	All pregnant women 5 weeks following completion of treatment (6 weeks following azithromycin)
Gonorrhoea	Test if symptoms of infection or baby has ophthalmia neonatorum	Culture *or* NAAT plus culture if positive	Endocervix plus pharynx and rectum (depending on sexual activity)	Ceftriaxone 500 mg intramuscular single dose with azithromycin 1 g stat *or* spectinomycin 2 g intramuscular single dose with azithromycin 1 g stat	Amoxicillin 3 g and probenecid 1 g oral single dose (**if regional prevalence of penicillin resistance <5%**) All should receive chlamydia treatment	In all cases at all affected sites. Three weeks following completion of treatment
Trichomonas vaginalis	Test if symptoms of infection	Culture *or* NAAT if available	Posterior fornix	Metronidazole 400 mg b.d. 7 days		If symptoms unresolved
Bacterial vaginosis	Test if symptoms of infection	Gram stain Amsel's criteria	Lateral vaginal wall	Metronidazole 400 mg b.d. 7 days Intravaginal treatment recommended for women who are breastfeeding	Metronidazole 0.75% gel o.d. vaginally for 5 days *or* clindamycin 2% cream o.d. vaginally for 7 days	If unresolved or recurrent symptoms

Table 1. Continued

	Screening/testing recommendations	Testing technology	Sites to sample	First-line treatment	Alternative/additional treatment	Indications for test of cure
Genital warts	Clinical diagnosis based on examination findings	N/A	N/A	Liquid nitrogen *or* trichloroacetic acid	Electrocautery *or* curettage	N/A
Genital herpes	Test if symptoms of infection	PCR Culture Serology	De-roofed vesicles Ulcers	**First episode or recurrent episode** Aciclovir 400 mg t.d.s. for 5 days *or* aciclovir 200 mg 5 times daily for 5 days **Suppressive treatment** Aciclovir 400 mg b.d. Aciclovir 400 mg t.d.s. (third trimester)		N/A
Syphilis	Screening routinely recommended for all women	EIA for IgG and IgM TPPA/TPHA VDRL/RPR	Serum	**Early syphilis in first and second trimester** Benzathine benzylpenicillin G, 2.4 mu intramuscular single dose *or* procaine penicillin 0.6 mu intramuscularly daily for 10 days **Early syphilis in third trimester** Benzathine benzylpenicillin G, 2.4 mu intramuscularly day 0 and 7 *or* procaine penicillin 0.6 mu intramuscularly daily for 10 days **Late syphilis** Benzathine benzylpenicillin G, 2.4 mu intramuscularly day 0, 7 and 14 *or* procaine penicillin 0.6 mu intramuscularly daily for 17 days	**Penicillin allergic** — consider desensitisation **Supportive management of Jarisch–Herxheimer reaction**	Monthly serology until delivered

b.d. = twice a day; EIA = enzyme immunoassay; N/A = not applicable; NAAT = nucleic acid amplification test; o.d. = once daily; PCR = polymerase chain reaction; q.d.s. = four times a day; RPR = rapid plasma reagin; t.d.s. = three times a day; TPHA = *Treponema pallidum* haemagglutination assay; TPPA = *Treponema pallidum* particle agglutination assay; VDRL = Venereal Disease Research Laboratory test

with higher organism load, such as in primary infection, but missing reinfections where the bacterial load is lower. More recent studies using newer diagnostic techniques show associations between chlamydia and preterm birth[5,6] and low birthweight;[7] they also suggest an increased risk of complications the earlier in the pregnancy the infection occurs.[8] There is some evidence that treatment of chlamydia in pregnancy reduces complications.[9] Up to 34% of women with chlamydia delivering vaginally will develop puerperal infection. Approximately 50% of neonates born to women with untreated chlamydia will develop ophthalmia neonatorum and about 15% will develop chlamydia pneumonitis.[10]

Although there is no national screening programme for the detection of chlamydia in pregnancy, the English National Chlamydia Screening Programme and the Scottish Intercollegiate Guidance Network both recommend screening of women under 25 years and following a change of sexual partner. The National Institute for Health and Clinical Excellence guideline[9] recommends that such women be referred to their local National Chlamydia Screening Programme service. Centers for Disease Control and Prevention (in the USA) guidelines[11] recommend chlamydia testing in all women at their first antenatal visit; however, there is no evidence to support the cost effectiveness of universal chlamydia screening in pregnancy in the UK.

Chlamydia testing should be performed in women with lower genital tract symptoms, intrapartum or postpartum fever and mothers of infants with ophthalmia neonatorum. Nucleic acid amplification tests (NAATs) are the gold standard for chlamydia detection because of high sensitivities and specificities. In symptomatic women, an endocervical sample can be obtained when a speculum examination is performed. Self-taken vulvovaginal swabs are as sensitive as endocervical samples for the detection of chlamydia so can be offered to asymptomatic women. First-void urine samples are less sensitive and will miss 10–20% of infections.[12]

Erythromycin, amoxicillin and azithromycin are effective treatments. However, a meta-analysis of randomised controlled trials[13] of these in pregnancy shows that they all have similar efficacy but that azithromycin has significantly fewer adverse events and better compliance. Azithromycin remains unlicensed for use in pregnancy, but a national audit of UK genitourinary medicine physicians reports that the majority treat pregnant women with azithromycin.[14] The Centers for Disease Control and Prevention guidelines[11] recommend azithromycin as first-line treatment for chlamydia in pregnancy.

Women who have chlamydia treated in pregnancy are at increased risk of a positive subsequent test[15] because of treatment failure or re-infection, hence the importance of public health interventions. A test of cure should be performed 5–6 weeks after completion of treatment and repeat screening in the third trimester is recommended.

Gonorrhoea

Although relatively uncommon in the UK, gonorrhoea remains concentrated in large urban areas. The median age of infected women is 20 years. Increased rates of pharyngeal infection are reported in pregnancy, possibly due to altered sexual behaviour.[16] Almost 40% of women with gonorrhoea are co-infected with chlamydia.

The effects of gonorrhoea on early pregnancy are unclear due to a lack of good studies. Prospective studies of effects later in pregnancy show gonorrhoea to be independently associated with increased risk of preterm rupture of membranes, preterm birth and low birthweight;[7,17] they also suggest an increased risk of complications the earlier in the pregnancy the infection occurs.[7] Gonorrhoea increases the risk of postpartum infection, which can be severe. Ophthalmia neonatorum occurs in up to 50% of exposed babies. Other sites can be infected; pharyngeal infection carries a higher risk of disseminated gonococcal infection.

Gonorrhoea testing should be performed on women with lower genital tract symptoms, intrapartum or postpartum fever and mothers of infants with ophthalmia neonatorum. NAATs are now increasingly used for detecting *Neisseria gonorrhoea* as they have higher sensitivity, but with some of them a lower specificity may result in a poor positive predictive value. To avoid false positive diagnoses, all NAATs should be confirmed by supplementary NAATs and by culture.[18] Knowledge of antibiotic susceptibility is important in guiding treatment due to widespread antimicrobial resistance: culture is needed for this.[18] Swabs should also be taken from the pharynx and rectum in women with genital gonorrhoea if the sexual history indicates these as sites of potential infection.

Treatment efficacy is not diminished in pregnancy. Amoxicillin with probenecid, spectinomycin, ceftriaxone and cefixime are equally effective,[19] but because of emerging high levels of resistance, penicillins are not recommended. Ceftriaxone with azithromycin is the recommended treatment for gonococcal infection at any genital or extragenital site. Due to recent concerns regarding the emergence of cephalosporin resistance, a test of cure is advised at all infected sites.[18] Therapeutic regimens should include chlamydia treatment due to the high rate of co-infection.

Trichomoniasis

This is the most common non-viral STI worldwide, but only 5400 diagnoses of *Trichomonas vaginalis* (*T. vaginalis*) were made in women in UK genitourinary medicine clinics in 2008.[1] It causes vulvovaginitis; however, 10–50% of women are asymptomatic. *Trichomonas vaginalis* is associated with

preterm birth and low birthweight.[20] Any association with puerperal infection is unclear because of the concurrent increase in anaerobic bacteria. Little neonatal morbidity is associated with maternal *T. vaginalis*.

Women with lower genital tract symptoms should be tested for *T. vaginalis* by microscopy and/or culture. NAATs for *T. vaginalis* are highly sensitive but are not yet widely available.

The nitroimidazoles are the most effective treatment for *T. vaginalis*. There is no evidence of teratogenicity with metronidazole use in pregnancy; however, the *British National Formulary* advises against high doses in pregnancy. In a Cochrane review of *T. vaginalis* treatment in pregnancy,[21] there was a 90% microbiological cure rate with metronidazole but there was no protective effect of treatment on pregnancy outcomes. However, the review concludes that it seems prudent to treat symptomatic women during pregnancy.[21] There are insufficient safety data for tinidazole in pregnancy and its use cannot be recommended. A test of cure is recommended if symptoms fail to resolve or if symptoms recur.

Bacterial vaginosis

About 15% of pregnant women have bacterial vaginosis; most are asymptomatic.[22] Bacterial vaginosis is associated with preterm rupture of membranes, preterm birth, low birthweight and postpartum infection, with an increased risk of complications the earlier in pregnancy the condition occurs.[23] The effects of treatment during pregnancy are inconsistent. Most trials excluded symptomatic women as they had received treatment for symptom control. A Cochrane review[22] shows that antibiotic treatment is effective at eradicating bacterial vaginosis regardless of regimen; however, overall, treatment does not reduce complications compared to no treatment or placebo. Subgroup analyses show:

- Trials including women with intermediate vaginal flora and bacterial vaginosis demonstrate a reduction in preterm birth with treatment.
- Detection and treatment of bacterial vaginosis prior to 20 weeks of gestation reduces preterm birth.
- Treating women with previous preterm birth reduces the incidence of preterm rupture of membranes and low birthweight.

Overall, there is no evidence to support screening and treating asymptomatic pregnant women for bacterial vaginosis. There is some evidence that screening women with previous preterm birth may be beneficial and more data are needed about the effects of detection and treatment early in pregnancy.

Women with lower genital tract symptoms and intrapartum or postpartum fever should be tested for bacterial vaginosis. The preferred diagnostic test is a Gram-stained vaginal smear, which is graded as normal, intermediate or bacterial vaginosis. Alternatively, the presence of a typical homogenous white discharge plus raised vaginal pH and positive amine whiff test fulfils Amsel's clinical criteria.

Whether antimicrobial treatment of bacterial vaginosis in pregnancy causes more harm than benefit has been debatable.[24] Most studies reporting a higher preterm birth rate in those given treatment compared with those receiving placebo included women who did not have bacterial vaginosis. Subgroup analyses show that women receiving antibiotics in the absence of bacterial vaginosis have higher rates of preterm birth. Bacterial vaginosis should, therefore, be confirmed before giving treatment, and antibiotics should not be given in the absence of an infection.

Anogenital warts

This is the most common viral STI in the UK and it presents most frequently in women aged 16–19.[1] Anogenital warts are caused by infection with low-risk subtypes of human papillomavirus (HPV), which is usually transient; however, pregnant women have higher rates of detectable HPV DNA compared with non-pregnant women, possibly secondary to altered maternal immunity.[25] Pregnant women are more likely to be symptomatic and anogenital warts can be extensive and rapidly enlarging.

Vertical transmission of HPV occurs in up to 1 in 80 cases[26] and can cause genital and laryngeal warts in infants. A rare complication of vertical transmission of low-risk HPV subtypes is recurrent respiratory papillomatosis, which occurs in approximately 4.3 out of 100 000 cases.[26] Although caesarean section has been shown to reduce the risk of this complication, it is rare compared with the frequency of maternal HPV infection, so operative delivery would not normally be advised.[26]

Treatment of anogenital warts in pregnancy does not reduce the risk of vertical transmission,[25] so no treatment is an option. However, treatment may improve symptoms and limit the extent of disease. Podophyllotoxin is contraindicated because of toxicity and there are insufficient safety data to support the use of imiquimod. Treatment options are limited to liquid nitrogen, trichloroacetic acid, electrocautery and curettage. Caesarean section can be considered for women with large warts that may obstruct labour or that cause extensive cervical disease.

Genital herpes

Approximately 50% and 25% of pregnant women are seropositive for herpes simplex virus type 1 (HSV-1) and HSV-2 antibodies, respectively, at the start of pregnancy.[25] Only 3–4% of seronegative women acquire the virus during pregnancy,[25] but this small number with primary HSV accounts for a large proportion of neonatal infections.[27] Primary HSV in pregnancy is associated with spontaneous

first-trimester miscarriage, preterm birth and low birthweight.[25] Recurrent HSV is not associated with these. There are no clear data on whether pregnancy increases herpes recurrence or asymptomatic viral shedding.

The incidence of neonatal HSV infection in the UK is 1 in 60 000 live births annually (1986–1991), which is lower than in many other Western countries.[28] Despite antiviral treatment, neonatal HSV causes death in up to 31% of infants and chronic disability in 83% of survivors.[27] The transmission risk from primary HSV infection is 40–50%.[25] This high level is secondary to maternal viraemia, absent maternal antibodies and extensive cervical involvement. Herpes simplex virus type 2 is detected in up to 15% of asymptomatic HSV-2 seropositive pregnant women at delivery; however, this asymptomatic shedding is responsible for less than 1% of neonatal infections and highlights the protective role of passive transfer of maternal antibodies.

Distinguishing primary from recurrent HSV can be difficult. Type-specific HSV antibody testing in pregnant women presenting with HSV helps distinguish women with primary infection (antigen detection in the absence of homologous antibody) from those with established infection (antigen detection in the presence of homologous antibody).

Acquisition of primary HSV in late pregnancy poses the greatest risk of transmission. Women within 6 weeks of the expected delivery date should be offered caesarean section.[28] For those in established labour, or who decline caesarean section, invasive procedures should be avoided and intravenous aciclovir given to both mother and neonate. Women who present with primary HSV in the first or second trimester should anticipate vaginal delivery. Although there is insufficient evidence to support suppressive aciclovir from 36 weeks, it may reduce HSV lesions at term and, therefore, the need to consider caesarean section. In the first and second trimester the standard dosage of aciclovir 400 mg twice daily is recommended but in the third trimester this should be increased to aciclovir 400 mg three times daily because of the altered pharmacokinetics of the drug in late pregnancy.[29]

The Royal College of Obstetricians and Gynaecologists[28] states that caesarean section is not indicated in women with recurrent HSV at the onset of labour, as the risks of transmission are small. The mode of delivery should be discussed with the woman and invasive procedures avoided. Aciclovir suppression from 36 weeks reduces HSV shedding and lesions at the onset of labour and, therefore, the need to consider caesarean section. Few recurrences at term result in neonatal infections, so the number needed to treat with suppressive therapy to prevent one case of neonatal herpes is high. However, this approach is likely to reduce the number of caesarean sections performed.

Aciclovir is unlicensed for use in pregnancy but there is substantial clinical experience regarding its safety and tolerability in pregnancy.

Syphilis

There was a rapid increase in infectious syphilis between 1999–2008 in the UK.[1] This was mainly in homosexual men; however, the prevalence also rose in women. Between 2009 and 2010 cases of infectious (primary, secondary and early latent) syphilis in females in England declined by 14%;[2] data from Scotland show a similar decline.[30] The uptake of antenatal syphilis screening in the UK in 2009 was 96% and 0.16% of tests were positive.[31] Diagnoses of congenital syphilis remain low due to effective antenatal screening.

Treponema pallidum causes syphilis and can be transmitted transplacentally at any stage of pregnancy. The risk of transmission is dependent on the stage of maternal infection and duration of fetal exposure. The transmission risk of early syphilis in pregnancy is up to 100% and 50% of these pregnancies will result in preterm birth or perinatal death. Ten percent of infants born to women with late infection will be affected.[32] Congenital syphilis is a multi-system infection which can result in stillbirth, neonatal death and long-term disability.

Diagnosis is by serology. Most cases of syphilis in pregnancy are detected through antenatal screening but syphilis must be considered in the differential diagnosis of women with genital ulceration in pregnancy and repeat syphilis testing should be performed. In the UK an enzyme immunoassay, which has high sensitivity and specificity, is used for screening. A positive enzyme immunoassay is confirmed by either a *T. pallidum* haemagglutination assay or *T. pallidum* particle agglutination assay. A non-treponemal test, either a Venereal Diseases Reference Laboratory test or reactive plasma reagin, is a quantitative assay used to monitor disease activity and treatment response.

Management of syphilis in pregnancy should involve obstetricians, genitourinary physicians and neonatologists.[33,34] The woman should be assessed clinically to establish the stage of infection and treatment instigated as soon as possible to limit fetal exposure. Where delivery occurs less than 30 days after completion of treatment, the neonate will require empirical treatment.[11,33] Penicillin is the treatment of choice. A Cochrane review[35] is inconclusive about the optimal regimen; however, guidelines suggest treating according to clinical stage and benzathine penicillin G is usually first-line treatment. A second dose of benzathine benzylpenicillin G is recommended when treating early syphilis in the third trimester due to lower serum levels of the drug and the risk of treatment failure.[33] Penicillin is safe in pregnancy except where there is penicillin allergy, for which the Centers for Disease Control and Prevention guidelines[11] recommend penicillin desensitisation, as alternative treatments have high failure rates.

The Jarisch–Herxheimer reaction can complicate up to 45% of syphilis treatments in pregnancy.[34] Uterine contractions, preterm labour and fetal heart rate decelerations can occur as a

result of maternal fever. Fetal monitoring of women receiving treatment after 26 weeks of gestation should be considered. Management of the Jarisch–Herxheimer reaction should be supportive and include antipyretics, but oral corticosteroids are not indicated.[34]

Monthly serology is required to monitor treatment response. Indications for further treatment of the mother postpartum include:

- presentation late in pregnancy and no documented evidence of previous treatment
- adequate treatment response not achieved
- Venereal Diseases Reference Laboratory/reactive plasma reagin serofast at a titre >1:8
- the use of a non-penicillin regimen.

All neonates should be assessed by a neonatologist and they should receive treatment if there is any evidence of congenital infection.

Conclusion

The prevalence of STIs has increased in all age groups in the UK. In pregnancy they should be managed in conjunction with genitourinary medicine physicians; management should include antimicrobial therapy, counselling, partner notification and safer sex advice. Pregnant women with STIs may require test of cure or repeat screening later in pregnancy and re-testing for blood-borne STIs, including HIV. Women can be reassured that, with appropriate intervention, neonatal complications are rare.

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