



# Antenatal Testing and Blood-Borne Viruses (BBVs)



This resource is for health professionals providing women with antenatal care, including midwives, general practitioners and obstetricians. It contains advice about recommended antenatal testing for the three major blood-borne viruses (BBVs): hepatitis B (HBV), hepatitis C (HCV) and human immunodeficiency virus (HIV). In addition, it provides information about the management of these BBVs during pregnancy and at delivery.

This is a document designed for nationwide use and is therefore necessarily broad. It is advisable to read this in conjunction with local policy and procedures regarding BBV testing and management in pregnancy.

**Further information on HBV, HCV and HIV is available on the Australasian Society for HIV Medicine (ASHM) website ([www.ashm.org.au](http://www.ashm.org.au)).**

# Hepatitis B Virus (HBV)

## Epidemiology in the Antenatal Population and Mode of Transmission

Chronic HBV affects more than 400 million people worldwide. In Australia, the seroprevalence in women of reproductive age has been reported at around 2%, and even higher in certain ethnic groups.<sup>1</sup> HBV is endemic in many of the countries of origin of culturally and linguistically diverse (CALD) communities in Australia, particularly those in South East Asia and North East Asia and accordingly, high rates of chronic HBV are seen in these communities within Australia. Aboriginal and Torres Strait Islander populations also have a higher prevalence of chronic HBV than the general population.<sup>2,3</sup>

HBV is transmitted by contact with infected blood or body fluids. HBV may be transmitted vertically from mother-to-child; horizontally through close contact usually in childhood; via blood exposure such as injecting drug use (IDU), unsafe tattooing and piercing and sexually.<sup>4</sup>

## Effect of HBV on Pregnancy

There are conflicting reports regarding whether HBV is associated with greater risk of obstetric or perinatal outcomes.<sup>5,6,7</sup> There is no evidence that acute HBV in pregnancy increases mortality or is teratogenic, but a higher incidence of low-birth weight and prematurity has been reported.<sup>8</sup> Hepatocellular carcinoma (HCC) is rare in pregnancy, but in the limited number of reports published on this, it has been associated with high-maternal mortality.<sup>9,10</sup>

## Effect of Pregnancy on HBV

Generally, pregnant women with chronic HBV remain stable during pregnancy but those with cirrhosis should be monitored for any deterioration. Advanced liver disease is uncommon in pregnancy, however if present, complications such as coagulation disturbances may create difficulties during pregnancy and delivery. A proportion of women will have hepatitis flares, most

**Table 1: Hepatitis B (HBV) Intervention Summary**

Recommendation for antenatal screening	Routine/universal screening
Risk of vertical transmission with no intervention	10% if HBeAg negative 90% if HBeAg positive
Recommended interventions proven to reduce vertical transmission	HBV Immunoglobulin and HBV vaccine to infant
Benefit of intervention	95% reduction in risk

commonly in the early postpartum period.<sup>11</sup> There are also limited data suggesting a higher than expected rate of e antigen (eAg) clearance in the months following delivery, possibly related to pregnancy induced immunological changes.<sup>12</sup>

## Mother-to-Child Transmission (MTCT)

Most mother-to-child transmission (MTCT) of HBV occurs during the process of labour and birth. The most important determinant of transmission is the presence of eAg. Without interventions, up to 90% of children born to HBV e antigen (HBeAg) positive women acquire the infection, compared to less than 10% of those born to HBeAg negative women. This can be reduced by up to 95% with administration of HBV immunoglobulin (HBIG) and HBV vaccine to the exposed infant.<sup>13</sup> Horizontal transmission (infection acquired in early childhood after delivery) is well recognised and has been attributed to father-to-child contact,<sup>14-16</sup> sibling contact,<sup>16,17</sup> and medical procedures such as intramuscular injections.<sup>17</sup>

## Antenatal HBV Screening

Universal screening for HBV is recommended by Australasian Society of Infectious Diseases (ASID)<sup>18</sup> and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG).<sup>19</sup> All pregnant women should be offered a test for HBV in pregnancy, regardless of previous testing or vaccination.

The recommended screening test for HBV is hepatitis B surface antigen (HBsAg). This should be offered at the first antenatal visit. Universal screening is preferred over selective screening, as a substantial number of cases will be missed with a selective approach.<sup>20</sup>

All women identified as infected with HBV during pregnancy should be referred to an infectious diseases specialist or hepatologist for information, advice and follow-up after delivery, as they may be at risk of long-term complications of cirrhosis, liver failure and hepatocellular carcinoma. This should be done as soon as the test result is available to ensure the pregnant woman has access



to expert advice and appropriate interpretation of additional investigations such as eAg, liver function tests and HBV viral load. It is crucial that pregnant women receive accurate and detailed information regarding the risk of HBV transmission to the infant, as well as possible interventions during pregnancy to reduce this risk, including antiviral therapy. It is also the responsibility of the health care professional to ensure sexual and/or household contacts receive counselling, testing, follow-up and vaccination, where required.

### **Interventions During Pregnancy, Delivery and Postpartum**

Infants born to hepatitis B surface antigen (HBsAg) positive mothers should be given HBIG preferably within 12 hours of birth, as its efficacy decreases markedly if administration is delayed beyond 48 hours.<sup>21</sup> This intervention should be discussed with the family during the pregnancy, so consent can be obtained prior to delivery. The first dose of HBV vaccine should be given at the same time as HBIG, but in the opposite thigh. Three subsequent doses of HBV vaccine should be given at two, four and either six or twelve months of age (depending on the combination vaccine used), so that the infant is given a total of four doses of HBV-containing vaccine.<sup>21</sup>

There are increasing data suggesting that women with a high viral load have an increased absolute risk of up to 8-9% of transmitting HBV to their infants, despite the use of HBIG and HBV vaccine.<sup>22</sup> In addition, antiviral therapy given in the last trimester of pregnancy has been demonstrated to reduce perinatal transmission in a randomised controlled trial.<sup>23</sup>

In one non-randomised trial there was a lower risk of HBV transmission in the group delivered by caesarean section.<sup>24</sup> These findings were not repeated in a subsequent study, which reported that caesarean

section does not reduce the incidence of immunoprophylaxis failure.<sup>25</sup> Most guidelines do not therefore recommend caesarean section as an intervention to reduce vertical transmission of HBV.

Standard precautions should be utilised when handling the baby. Delaying intramuscular injections until after the baby has been bathed to remove all maternal blood is generally recommended. Breastfeeding does not appear to increase the risk of HBV transmission to the infant and should not be discouraged.<sup>26,27</sup>

The newborn should be tested for HBsAg and hepatitis B surface antibodies (Anti-HBs), three to twelve months after the final dose of HBV vaccine.<sup>21</sup>

Women exposed to HBV during pregnancy should have urgent serology to test for immunity. Uninfected women who are anti-HBs negative should be given HBV vaccine and HBIG within 72 hours of a high-risk exposure. They should complete the HBV vaccination course and have testing for HBsAg at three months post exposure and provided this is negative, have routine delivery and management of the newborn.<sup>18</sup>

# Hepatitis C Virus (HCV)

## Epidemiology in the Antenatal Population and Mode of Transmission

An estimated 211 000 people were living with chronic HCV in Australia at the end of 2009.<sup>28</sup> The prevalence of HCV antibodies in the Australian antenatal population is estimated at 1.4% of pregnant women.<sup>29</sup> Approximately 70% of people with HCV antibodies have ongoing viral infection as indicated by a detectable HCV RNA test. Risk factors for HCV are in Table 2 below.<sup>30</sup>

**Table 2: Risk factors for HCV**

- People who have ever injected drugs
- People who are, or have been, incarcerated
- Recipients of organs, tissues, blood or blood products before February 1990 in Australia, or at any time overseas
- People with tattoos or skin piercings – indications to test will include poor infection control procedures, e.g. tattooing and skin piercings which were carried out in some overseas countries or in a custodial setting
- People born in countries with high hepatitis C prevalence (Asia, Africa, Middle East, Eastern and Southern Europe)
- Sexual partners of people with hepatitis C

## Effect of HCV on Pregnancy

Women with HCV are generally at no greater risk of obstetric or perinatal complications than HCV uninfected women. Advanced liver disease is uncommon in pregnancy, however if present, the issues arising from this, such as coagulation disturbances, may complicate the pregnancy and delivery.

## Effect of Pregnancy on HCV

Prospective studies following women with HCV during pregnancy and in the postpartum period have reported a trend to normalisation of liver function tests with an increase in the

**Table 3: Hepatitis C (HCV) Intervention Summary**

Recommendation for antenatal screening	Selective screening based on risk factors or maternal request
Risk of vertical transmission	5% if HCV RNA detected (if not also infected with HIV)
Recommended interventions (without strong evidence)	Avoidance of procedures that risk breaching baby's skin or mucous membranes Expressing and discarding breast milk if nipples bleeding

HCV viral load during the third trimester of pregnancy.<sup>31</sup> The viral load returns to pre-pregnancy levels in the postpartum period with the proportion of viremic women remaining unchanged.<sup>31</sup> Women with HCV may be at risk of a hepatic flare in the months following delivery<sup>32</sup> and should be monitored by an infectious diseases specialist or a hepatologist.

## Mother-to-Child Transmission (MTCT)

The estimated rate of MTCT of HCV in viremic women is approximately 5%,<sup>33,34</sup> although this may be higher if the woman is also infected with HIV.<sup>35</sup> The exact mechanism of HCV transmission to the newborn is unknown.<sup>36</sup>

## Antenatal HCV Screening

The National Hepatitis C Testing Policy 2007 recommends selective antenatal screening for HCV based on identified risk factors as listed in Table 2.<sup>30</sup> Other reasons for testing include maternal request after discussing risk factors and/or signs of liver disease or extra-hepatic manifestations of HCV.<sup>30</sup> All testing must be confidential, voluntary, and with informed consent.

The rationale for selective screening includes the low prevalence of hepatitis C amongst pregnant women and the lack of evidence to suggest that universal screening would identify more cases than selective screening. Indeterminate and false positive results may be expected to occur in a low-prevalence population, causing unnecessary anxiety. Importantly, the risk of MTCT is low, and interventions to minimise the risk of transmission are very limited.

Treatments for HCV are contraindicated in pregnant women. Although women diagnosed antenatally may be given health advice, it is unlikely that being diagnosed whilst pregnant will result in any positive health benefit for mother or baby during the pregnancy.



While RANZCOG, in its position statement on routine antenatal assessment, recommends screening of all pregnant women for HCV infection, it does acknowledge this as a contentious area of practice.<sup>19</sup>

The recommended screening test for HCV is an HCV antibody using an enzyme immunoassay (EIA). All women who test positive for the HCV antibody should have confirmation with a second independent assay before they are reported as positive.<sup>30</sup>

Women who are hepatitis C antibody positive require liver function tests and qualitative HCV RNA testing. Those who are HCV RNA negative are at extremely low risk of transmitting HCV to their newborn,<sup>34</sup> however as HCV antibodies are not protective, they are at risk of re-infection if re-exposed. Quantification of HCV viral load is not recommended in the routine management of pregnancy, and is currently used to assess transmission risks in research settings only.

### **Interventions During Pregnancy, Delivery and Postpartum**

In contrast to HBV and HIV, there is little evidence that interventions during pregnancy or at the time of delivery reduce the risk of MTCT of HCV. For a woman with a diagnosis of HCV during pregnancy, referral to an infectious diseases specialist or hepatologist, as well as to hepatitis support groups for information and advice, should be made during the pregnancy. This will facilitate provision of accurate information, counselling and linkages for follow up and treatment if desired postpartum.

The role of elective caesarean section in the management of women infected with HCV remains uncertain, and further research is required before a recommendation can be made on the mode of delivery used to prevent transmission.<sup>37</sup> Standard precautions and delay of intramuscular injections until after the baby has been bathed to remove all maternal blood are advised.

There is no evidence that breastfeeding is associated with an increased risk of HCV transmission to the newborn despite the detection of HCV RNA in breast milk.<sup>38,39</sup> Consideration should be given to expressing and discarding milk if nipples are cracked and bleeding, until healed.<sup>18</sup>

The infant should have an HCV antibody test at 12-18 months of age. If HCV antibody positive, the infant requires qualitative HCV RNA testing to determine if he/she is still infectious, and referral to a paediatric hepatologist. Earlier detection with qualitative HCV RNA testing at 2-3 months is possible, however this is unlikely to alter the care of the newborn.<sup>40</sup>

# Human Immunodeficiency Virus (HIV)

## Epidemiology in the Antenatal Population and Mode of Transmission

An estimated 20 171 people were living with HIV in Australia at the end of 2009.<sup>28</sup> The prevalence of HIV in pregnant women in Australia is estimated to be 0.04%.<sup>41</sup> The most common mode of HIV transmission in Australia is via sexual contact. Other reported modes of transmission include vertical transmission, injecting drug use, unsafe tattooing and piercing and receipt of blood products prior to 1985. People from HIV high-prevalence countries and their sexual partners are at increased risk of HIV.

## Effect of HIV on Pregnancy

Women with HIV generally have uneventful pregnancies. For women with HIV receiving antiretrovirals, the data regarding use of combination antiretroviral therapy (cART) and adverse pregnancy outcomes are conflicting. Some studies have found an association between cART and pre-term delivery,<sup>42,43</sup> whilst others have not.<sup>44,45</sup> HIV infection is not associated with fetal malformations. Efavirenz, an antiretroviral treatment for HIV, has been associated with neural tube defects and should not be used in the first trimester of pregnancy.<sup>46</sup>

## Effect of Pregnancy on HIV

Pregnant women with HIV have lower CD4 counts than when they were not pregnant, due to physiological changes such as haemodilution, however the CD4 percentage remains stable.<sup>46</sup> Similarly, plasma HIV viral load levels are not changed by pregnancy. Pregnant women with HIV are not at increased risk of mortality or progression to AIDS. Pregnant women should be monitored for side effects of cART, particularly hepatic dysfunction, hepatic steatosis, lactic acidosis and nevirapine hypersensitivity, all of which may be more common in pregnancy.<sup>46</sup>

## Mother-to-Child Transmission (MTCT)

HIV may be transmitted to the newborn during pregnancy, delivery, or via breast-

**Table 4: HIV Intervention Summary**

Recommendation for antenatal screening	Routine/universal screening
Risk of vertical transmission without intervention	13 to 40%
Recommended interventions proven to reduce vertical transmission	Antiretrovirals to mother antenatally and during delivery Antiretrovirals to baby Caesarean section* Avoidance of breastfeeding
Benefit with intervention	95-97% reduction in risk (<2% risk of vertical transmission)
*The additional benefit of caesarean section in women on cART with an undetectable maternal viral load is unknown	

feeding. Rates of transmission from mother-to-child without interventions have been reported from 13-40%.<sup>47</sup>

In developed countries, where interventions such as cART, elective caesarean section and avoidance of breastfeeding are available, the rate of MTCT is reported as less than 2%.<sup>48,49</sup> The maternal plasma HIV viral load is the most important test for determining risk of MTCT.<sup>49,50</sup> Even though viral load is important, there is no level associated with a zero risk of transmission. In Australia from 2000 to 2009, transmission rates from mother-to-child were 1.97% for mothers aware of their HIV status prior to or at delivery, compared with 50% for those diagnosed after delivery.<sup>28</sup>

## Antenatal HIV Screening

Universal antenatal screening for HIV is recommended in the National HIV Testing Policy<sup>30</sup> and by RANZCOG.<sup>19</sup>

The screening test for HIV infection is an enzyme immunoassay (EIA) for HIV antibodies. The majority of tests in Australia are fourth generation assays that detect HIV antigen as well as HIV antibodies. Although false positive tests on the EIA are rare, all positive specimens are confirmed with a Western Blot. Repeat testing may be required if a woman has an indeterminate test result or HIV exposure in the preceding three months.<sup>51</sup>

The potential benefits of a woman knowing her HIV status include the opportunity to receive medical care for her own health and the prevention of transmission to current or future partners and/or to her children through vertical transmission.

## Interventions During Pregnancy, Delivery and Postpartum

Strategies used to reduce MTCT of HIV in Australia include antiviral therapy to the mother and newborn, caesarean delivery, and avoidance of breastfeeding.



Antiretroviral therapy to reduce MTCT is recommended in all HIV-infected pregnant women, including those with an undetectable viral load.<sup>46</sup> Antiretroviral drugs can reduce MTCT through a variety of mechanisms. During pregnancy, antiretrovirals decrease maternal viral load in the blood and genital secretions. Antiretrovirals administered to the mother immediately before and during delivery cross the placenta and provide pre-exposure prophylaxis to the newborn. Administration of antiretrovirals to the newborn after birth provides post-exposure prophylaxis against virus exposure during the birth.<sup>46</sup>

Elective caesarean section has been associated with a 50% reduction in risk of vertical transmission in the era prior to cART.<sup>52,53</sup> The added benefit of elective caesarean section in women on cART with an undetectable viral load is unknown.<sup>54</sup>

Transmission of HIV via breast milk has been reported.<sup>55</sup> Hence, current guidelines recommend avoidance of breastfeeding in resource-rich countries where there is access to safe, affordable and culturally appropriate alternatives.<sup>46</sup>

The newborn should be tested with an HIV PCR test in the first week of life, week 6, and at 12 weeks. If all PCRs remain negative, a clinical review at 12 months is recommended and an HIV antibody test at 18 months to document seroreversion.

## Summary of Antenatal Testing Recommendations

All antenatal testing for HBV, HCV and HIV should be offered with appropriate pre-test and post-test discussion.

### Pre-Test Discussion

- Information on how HIV, HBV, +/- HCV is transmitted
- Risk assessment and discussion of the reason for testing
- Information about confidentiality and privacy
- Information about how the woman will receive her results
- Implications of a negative or positive result including window period if relevant
- Assessment of support mechanisms if the woman is anxious about the result
- Assessment that the woman is prepared to be tested and gives her informed consent

### Post-Test Discussion

- For negative results, discuss prevention and repeat testing if required
- Positive test results must be given in person
- Assess immediate needs and implications
- Reassess support requirements and refer to support services as needed
- Provide information about sexual, blood and body fluid safety
- Discuss whom the woman should tell and how
- Advise the woman about her rights and requirements regarding disclosure
- Conduct legislative requirements for notification and contact tracing
- Reinforce confidentiality of the result
- Provide referrals for expert care

### Hepatitis B (HBV) Intervention Summary

Recommendation for antenatal screening	Routine/universal screening
Risk of vertical transmission with no intervention	10% if HBeAg negative 90% if HBeAg positive
Recommended interventions proven to reduce vertical transmission	HBV Immunoglobulin and HBV vaccine to infant
Benefit of intervention	95% reduction in risk

### Hepatitis C (HCV) Intervention Summary

Recommendation for antenatal screening	Selective screening based on risk factors or maternal request
Risk of vertical transmission	5% if HCV RNA detected (if not also infected with HIV)
Recommended interventions (without strong evidence)	Avoidance of procedures that risk breaching baby's skin or mucous membranes  Expressing and discarding breast milk if nipples bleeding

### HIV Intervention Summary

Recommendation for antenatal screening	Routine/universal screening
Risk of vertical transmission without intervention	13 to 40%
Recommended interventions proven to reduce vertical transmission	Antiretrovirals to mother antenatally and during delivery Antiretrovirals to baby Caesarean section* Avoidance of breastfeeding
Benefit with intervention	95-97% reduction in risk (<2% risk of vertical transmission)

\*The additional benefit of caesarean section in women on cART with an undetectable maternal viral load is unknown

### Avoidance of Invasive Procedures:

It is generally recommended that procedures which may lead to a breach in the skin or mucous membranes of the baby, such as fetal scalp electrodes, fetal scalp blood sampling, vigorous aspiration of the newborn be avoided if the mother is known to have, or is at high risk of having, a blood-borne virus. Avoidance of these procedures as a strategy to prevent MTCT has not been adequately assessed in prospective trials, but there are limited data suggesting a protective benefit.<sup>56,57</sup>

## ASHM resources

Other ASHM resources are available from the ASHM website: [www.ashm.org.au/publications](http://www.ashm.org.au/publications)

### Profession Based Booklets

- An Overview of Hepatitis C: Clinical Management in Opiate Pharmacotherapy Settings
- Correctional Officers and Hepatitis C
- Dental Health and Hepatitis C
- Dentists and HIV
- General Practitioners and Hepatitis C
- Nurses and Hepatitis C
- Police and Blood-Borne Viruses
- Prehospital Care Workers and Blood-Borne Viruses

### Factsheets

- Decision Making in Hepatitis B
- Hepatitis C in brief – a factsheet
- Hepatitis C Management and Treatment for Clients of Pharmacotherapy Services
- HIV Patient Fact Sheet

### Monographs

- ASHM Directory of HIV, hepatitis and related services
- B Positive: all you wanted to know about hepatitis B – a guide for primary care
- Coinfection: HIV & Viral Hepatitis – a guide for clinical management
- Hepatitis C: clinical management in opiate pharmacotherapy settings
- HIV and viral hepatitis C: policy, discrimination, legal and ethical issue
- HIV Management in Australasia: a guide for clinical care
- HIV, Viral Hepatitis and STIs: a guide for primary care

### Distance-learning Kit

- Clinical Science of HIV Medicine CD

### Manuals

- Australasian Contact Tracing Manual

### Online resource

- Guide to Australian HIV Laws and Policies for Healthcare Professionals. Available online only at [www.ashm.org.au/HIVLegal](http://www.ashm.org.au/HIVLegal)

## Acknowledgements

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- Susan Hey, Hepatitis Australia
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ISBN: 978 1 920773 97 5

9 781920 773977

Published June 2011  
ABN: 48 264 545 457

## Antenatal Testing and BBVs – Online Learning Module

An accompanying online education module covering the most important aspects of this printed resource and incorporating interactive self-assessment activities has been developed. The aim of the online module is to discuss BBV screening in antenatal testing. To find out further information or to access this online education module visit the Australasian Society for HIV (ASHM) website at [www.ashm.org.au/e-learning](http://www.ashm.org.au/e-learning).



## Contacts

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## Detailed References

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FUNDED BY:



Australian Government  
Department of Health and Ageing

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# Antenatal Testing and BBVs

SUPPLEMENTARY

## References

- 1 Cowie B, Karapanagiotidis T, Enriquez A, Kelly H. Markers of hepatitis B virus infection and immunity in Victoria, Australia, 1995 to 2005. *Aust N Z J Public Health* 34(1): 72-78
- 2 Moore DJ, Bucens MR, Holman CD, Ott AK, Wells JI. Prenatal screening for markers of hepatitis B in Aboriginal mothers resident in non-metropolitan Western Australia. *Med J Aust* 1987; 147: 557-8.
- 3 O'Sullivan BG, Gidding HF, Law M, Kaldor JM, Gilbert GL, Dore GJ. Estimates of chronic hepatitis B virus infection in Australia, 2000. *Aust NZ J Public Health* 2004; 28: 212-6.
- 4 World Health Organisation Department of Communicable Diseases Surveillance and Response. 2002 Hepatitis B. [www.who.int/emc](http://www.who.int/emc)
- 5 Safir A, Levy A, Sikuler E, Sheiner E. Maternal hepatitis B or hepatitis C Virus carrier status as an independent risk factor for adverse perinatal outcomes. *Liver International* 2010; 765-770.
- 6 Lao TT, Chan BCP, Leung WC, Ho LF, Tse KY. Maternal hepatitis B infection and gestational diabetes mellitus. *J Hepatology* issue 47 2007; 46-50.
- 7 Tse KY, Ho LF, Lao T. The impact of maternal HBsAg carrier status on pregnancy outcomes: A case-control study. *J Hepatology* issue 43 2005; 771-775.
- 8 Jonas M, Hepatitis B and pregnancy: An underestimated issue. *Liver international*. 2009; 29(s1): 133-139
- 9 Cobey FC, Salem RR. A review of liver masses in pregnancy and a proposed algorithm for their diagnosis and management. *Am J Surg* 2004; 187: 181-91
- 10 de la Rosa MA, Nicol'as-P'erez D, Mu'niz-Montes JR, et al. Evolution and management of a hepatocellular carcinoma during pregnancy. *J Obstet Gynaecol Res* 2006; 32: 437-9.
- 11 ter Borg MJ, Leemans WF, de Man RA, Janssen HLA. Exacerbation of chronic hepatitis B infection after delivery. *J Vir Hepat* 2008; 15: 37-41.
- 12 Lin HH, Wu WY, Kao JH, et al. Hepatitis B post-partum e antigen clearance in hepatitis B carrier mothers: correlation with viral characteristics. *J Gastroenterol Hepatol* 2006; 21: 605-9.
- 13 Lee C, Gong Y, Brok J, Boxall EH, Gluud C. Hepatitis B immunisation for newborn infants of hepatitis B surface antigen-positive mothers. *Cochrane Database of Systematic Reviews* 2006. Issue 2. Art. No.:CD004790. DOI:10.1002/14651858.CD004790.pub2.
- 14 Takegoshi K, Zhang W. Hepatitis B virus infections in families in which the mothers are negative but the fathers are positive for HBsAg. *Hepatol Res* 2006; 36: 75-7
- 15 Tajiri H, Tanaka Y, Kagimoto S, Murakami J, Tokuhara D, Mizokami M. Molecular evidence of father-to-child transmission of hepatitis B virus. *J Med Virol*. 2007; 79: 922-6
- 16 Komatsu H, Inui A, Sogo T, Hiejima E, Kudo N, Fujisawa T. Source of transmission in children with chronic hepatitis B infection after the implementation of a strategy for prevention in those at high risk. *Hepatology Research* 2009; 39: 569-76
- 17 Ko YC, Li SC, Yen YY, Yeh SM, Hsieh CC. Horizontal transmission of hepatitis B virus from siblings and intramuscular injection among preschool children in a familial cohort. *Am J Epidemiol* 1991;133: 1015-23
- 18 Palasanthiran P, Starr M, Jones C, editors. Management of perinatal infections. Sydney: Australasian Society for Infectious Diseases (ASID); 2002 (Rev 2007). Available from: URL: <http://www.asid.net.au/downloads/Management-of-Perinatal-Infections-ASID-2002-rev-2007.pdf> Accessed March 2010
- 19 The Royal Australian and New Zealand College statement C-Obs 3. Antenatal Screening tests. 2008. Available from <http://ranzcog.edu.au/publications/statements/C-obs3.pdf>

- 20 Cowan SA, Bagdonaite J, Qureshi K. Universal hepatitis B screening of pregnant women in Denmark ascertains substantial additional infections: results from the first five months. *Eurosurveillance* 2006; 11: pii=2969.
- 21 National Health and Medical Research Council. The Australian immunisation handbook. 9th edition. Canberra: Commonwealth Department of Health and Ageing, 2008.
- 22 Wiseman E, Fraser MA, Holden S et al. Perinatal transmission of hepatitis B virus: an Australian experience. *Med J Aust* 2009; 190(9): 48992
- 23 Xu W, Cui Y, Wang L, Yang H, Liang Z, Li X, Zhang S, et al. Lamivudine in late pregnancy to prevent perinatal transmission of hepatitis B virus infection: a multicentre, randomised, double-blind, placebo-controlled study. *Journal of Viral Hepatitis* 2009; 16:94-103
- 24 Lee SD, Lo KJ, Tsai YT, Wu JC, Wu TC, Yang ZL, Ng HT. Role of caesarean section in prevention of mother-infant transmission of hepatitis B virus. *Lancet*. 1988 Oct 8; 2(8615): 833-4
- 25 Wang J, Zhu Q, Zhang X. Effect of delivery mode on maternal-infant transmission of hepatitis B virus by immunoprophylaxis. *Chinese Medical Journal* 2002 Oct; 115(10):1510-2.
- 26 Wang JS, Zhu QR, Wang XH. Breastfeeding does not pose any additional risk of immunoprophylaxis failure on infants of HBV carrier mothers. *Int J Clin Pract* 2003; 57:100-2
- 27 Hill JB, Sheffield JS, Kim MJ et al. Risk of hepatitis B transmission in breast-fed infants of chronic hepatitis B carriers. *Obstet Gynecol* 2002; 99: 1049-52
- 28 National Centre for HIV Epidemiology and Clinical Research. HIV/AIDS, viral hepatitis and sexually transmissible infections in Australia Annual Surveillance Report 2010. National Centre in HIV Epidemiology and Clinical Research, The University of New South Wales, Sydney, NSW 2010.
- 29 Sfameni SF, Francis B, Wein P. Seroprevalence and assessment of risk factors for hepatitis C virus infection in pregnancy. *Aust N Z J Obstet Gynaecol*. 2000 Aug; 40(3): 263-7.
- 30 Australian Government Department of Health and Ageing. National Hepatitis C Testing Policy. Hepatitis C Subcommittee of the Ministerial Advisory Committee on AIDS, Sexual Health and Hepatitis; the Blood Borne Virus and Sexually Transmissible Infections Subcommittee of the Australian Population Health Development Committee. 2007.
- 31 Gervais A, Bacq Y, Bernuau J, et al. Decrease in serum ALT and increase in serum HCV RNA during pregnancy in women with chronic hepatitis C. *J Hepatol* 2000; 32: 293-99.
- 32 Chen JD, Chung JL, Kao JH, Chen DS. Post-partum acute exacerbation of chronic hepatitis in a hepatitis C-carrier mother. *J Gastroenterol Hepatol*. 2001 Jun;16(6):705-8.
- 33 Dore J, Kaldor JM and McCaughan GW, 'Systemic review of role of polymerase chain reaction in defining infectiousness among people infected with hepatitis C virus', *British Medical Journal* 315, 1997, pp. 333-337.
- 34 Yeung LT, King SM, Roberts EA. 2001. Mother-to-infant transmission of hepatitis C virus. *Hepatology* 34: 223-229.
- 35 Polis CB, Shah SN, Johnson KE, Gupta A. Impact of Maternal HIV Coinfection on the Vertical Transmission of Hepatitis C Virus: A Meta-analysis *Clinical Infectious Diseases* 2007; 44: 1123-1131
- 36 Indolfi G, Resti M. Perinatal transmission of hepatitis C infection. *J Med Virol* 2009 81: 836-43
- 37 Gibb DM, Goodall RL, Dunn DT, et al. Mother to child transmission of hepatitis C virus: evidence for preventable peripartum transmission. *Lancet* 2000; 356: 904-7.
- 38 Lin HH, Kao JH, Hsu HY, Ni YH, Chang MH, Huang SC, Hwang LH, Chen PJ, Chen DS. Absence of infection in breast-fed infants born to hepatitis C virus-infected mothers. *J Pediatr*. 1995 Apr;126(4): 589-91.
- 39 Polywka S, Schröter M, Feucht HH, Zöllner B, Laufs R. Low risk of vertical transmission of hepatitis C virus by breast milk. *Clin Infect Dis*. 1999 Nov;29(5):1327-9.
- 40 Hardikar W, Elliott EJ, Jones CA. The silent infection: should we be testing for perinatal hepatitis C and, if so, how? *Med J Aust*. 2006 Jan 16;184(2):54-5.
- 41 Chew CB, Downie JC, Cunningham AL. Unlinked anonymous screening of antenatal patients for antibody to human immunodeficiency virus type 1 (HIV-1). *Med J Aust*. 1994 Jun 6;160 (11):693-6.
- 42 Lorenzi P, Spicher VM, Laubereau B, et al. Antiretroviral therapies in pregnancy: maternal, fetal and neonatal effects. Swiss HIV Cohort Study, the Swiss Collaborative HIV and Pregnancy Study, and the Swiss Neonatal HIV Study. *AIDS*, 1998. 12(18):F241-7. <http://www.ncbi.nlm.nih.gov/pubmed/9875571>
- 43 Thorne C, Patel D and Newell ML. Increased risk of adverse pregnancy outcomes in HIV-infected women treated with highly active antiretroviral therapy in Europe. *AIDS*, 2004. 18(17): 2337-9. <http://www.ncbi.nlm.nih.gov/pubmed/15577551>
- 44 Tuomala RE, Shapiro DE, Mofenson LM, et al. Antiretroviral therapy during pregnancy and the risk of an adverse outcome. *N Engl J Med*. 2002. 346(24):1863-70. <http://www.ncbi.nlm.nih.gov/pubmed/12063370>

- 45 Tuomala RE, Watts DH, Li D, et al. Improved obstetric outcomes and few maternal toxicities are associated with antiretroviral therapy, including highly active antiretroviral therapy during pregnancy. *J Acquir Immune Defic Syndr*. 2005. 38(4):449-73. <http://www.ncbi.nlm.nih.gov/pubmed/15764963>
- 46 Perinatal HIV Guidelines Working Group. Public Health Service Task Force Recommendations for Use of Antiretroviral Drugs in Pregnant HIV-Infected Women for Maternal Health and Interventions to Reduce Perinatal HIV Transmission in the United States. April 29, 2009; pp 1-90. Available at <http://aidsinfo.nih.gov/ContentFiles/PerinatalGL.pdf>. Accessed March, 2010
- 47 Vujovic, O. Initiation of antiretroviral therapy in the naive patient. 2009: 77-91.
- 48 Mandelbrot L, Landreau-Mascaro A, Rekeciewicz C, et al. Lamivudine-zidovudine combination for prevention of maternal-infant transmission of HIV-1. *JAMA*, 2001. 285(16): 2083-93
- 49 Cooper ER, Charurat M, Mofenson LM, et al. Combination antiretroviral strategies for the treatment of pregnant HIV-1 infected women and prevention of perinatal HIV-1 transmission. *J Acquir Immune Defic Syndr Hum Retrovirol*. 2002. 29(5):484-94. <http://www.ncbi.nlm.nih.gov/pubmed/11981365>
- 50 Garcia PM, Kalish LA, Pitt j, Minkoff H, Quinn TC, Burchett S et al. Maternal levels of plasma human immunodeficiency virus type 1 RNA and the risk of perinatal transmission. *N Engl J Med*. 1999; 341: 394-402.
- 51 Giles M, Workman, C. Clinical manifestations and the natural history of HIV, HIV Management in Australasia: 125-131
- 52 The European Mode of Delivery Collaboration. Elective caesarean-section versus vaginal delivery on prevention of vertical HIV-1 transmission: a randomised clinical trial. *Lancet*, 1999. 353(9158): 1035-9.
- 53 Kind C, Rudin C, Siegrist CA, et al. Prevention of vertical HIV transmission: additive protective effect of elective caesarean section and zidovudine prophylaxis. *AIDS*, 1998. 12(2): 205-10.
- 54 European Collaborative Study. Mother-to-child transmission of HIV infection in the era of highly active antiretroviral therapy. *Clin Infect Dis*. 2005 Feb 1;40(3): 458-65.
- 55 Nduati R, John G, Mbori-Ngacha D, Richardson B, Overbaugh J, Mwatha A et al. Effect of breastfeeding and formula feeding on transmission of HIV-1: a randomized clinical trial. *JAMA* 2000 Mar 1;283(9):1167-74. 2000; 283: 1167- 74.
- 56 Steininger C, Kundi M, Jatzko G, Kiss H, Lischka A, Holzmann H. 2003. Increased risk of mother-to-infant transmission of hepatitis C virus by intrapartum infantile exposure to maternal blood. *J Infect Dis*, 187:345–351
- 57 Mast EE, Hwang LY, Seto DS, Nolte FS, Nainan OV, Wurtzel H, Alter MJ. 2005. Risk factors for perinatal transmission of hepatitis C virus (HCV) and the natural history of HCV infection acquired in infancy. *J Infect Dis*, 192:1880–1889

#### **Additional References**

- Connor EM, Sperling RS, Gelber R, KiselevP, Scott G, O’Sullivan MJ, et al. Reduction of maternal-infant transmission of human immunodeficiency virus type 1 with Zidovudine treatment. *N Engl J Med* 1994;331:1173-80
- Giles M, Hellard M, Sasadeusz J. Hepatitis C and pregnancy: an update. *Australian & New Zealand Journal of Obstetrics & Gynaecology* 2003;43(4):290-3.
- Hepatitis Australia. Position Statement: Improving hepatitis C antenatal screening practice. 2007
- Lambert JS, Watts JS, Stiehm ER, Bethel J, Meyer WA 3rd, Whitehouse J et al. Risk factors for preterm birth, low birth weight, and intrauterine growth retardation in infants born to HIV-infected pregnant women receiving zidovudine. *Pediatric AIDS Clinical Trials Group 185 Team. AIDS* 2000;14:1389-99.
- Spencer JD, Latt N, Beeby PJ et al. Transmission of hepatitis C virus to infants of human immunodeficiency virus-negative intravenous drug-using mothers: rate of infection and assessment of risk factors for transmission. *J.Viral. Hepat.* 1997; 4: 395–409.
- The International Perinatal HIV Group The mode of delivery and the risk of vertical transmission of human immunodeficiency virus type 1 - a meta-analysis of 15 prospective cohort studies. *N Engl J Med* 1999;340:977-87.