# Common opportunistic infections in HIV infected infants and children Part 2 non-respiratory infections

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## Introduction

Increased susceptibility to infections is the major cause of disease, end organ damage and death in human immunodeficiency virus (HIV)-infected children. This article will focus on prevention, diagnosis and management of the most common and less common severe infections that are specifically associated with HIV-related immune compromise, as well as some aspects relating to immune reconstitution inflammatory syndrome (IRIS).

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## INTRODUCTION

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## GENERAL PREVENTION

### *Good basic care*

Providing good basic care with nutritional support, aggressive management of intercurrent infections and regular follow-up have been shown to improve outcome even in the absence of highly active antiretroviral therapy (HAART).[1] In addition, the timely initiation of HAART does prevent severe opportunistic infections associated with stage 4 disease, and may be seen as part of good basic care. The importance of educating caretakers in the basic principles of infection control cannot be over-emphasized; providing basic information/guidance on the prevention of food and waterborne diseases (particularly in lower resourced settings) may be of particular benefit.

### *Vaccination*

The current recommendation is that HIV-infected children should receive all routine vaccinations according to the Expanded Program of Immunization (EPI). These include the live vaccinations BCG, Polio and measles, despite a small risk of developing vaccine-related disease. In addition, HIV-infected children also benefit from conjugated pneumococcal, varicella (if CD4% =15%) and flu vaccines; although the protection provided is less than in immune competent children, these vaccinations are indicated in settings where it is available.[2] Due to reduced immune responses, clinicians should ensure that all vaccine doses are given as indicated. Currently there are no recommendations regarding revaccination following HAART and subsequent immune reconstitution.

### *Co-trimoxasole prophylaxis*

Prophylaxis with co-trimoxasole (CTX) has been shown to reduce mortality in HIV-infected Zambian children by 43% and reduced hospitalizations by 23%, irrespective of disease stage or CD4 count. It is clear that the major reduction in morbidity and mortality achieved by this simple intervention is not limited to the prevention of pneumocystis pneumonia (PCP) alone. (3) Indications for the use of prophylactic CTX were given in "Common opportunistic infections in HIV infected infants and children: Part 1 - respiratory infections", published in the prior edition of this journal. When in doubt patients should receive the benefit of this cheap and effective intervention.

## INFECTIOUS DISEASES

### Cytomegalovirus

Infection with CMV occurs early, and is often asymptomatic in children from low socioeconomic settings. Proof that a child is infected does not indicate CMV-related disease. Evidence of infection can be demonstrated by culturing CMV from upper airway secretions and/or urine or by serological testing. Quantitative measurement of the PP65 antigen indicates CMV viremia, but confirmation of CMV-related end organ disease remains problematic, as it can only be proven by histology this is not always feasible. CMV can affect virtually

any organ system; for the purpose of this discussion we will focus mainly on CMV retinitis.

The treatment of CMV consists of intravenous (IV) gancyclovir and/or oral valgancyclovir, but these drugs are expensive and valgancyclovir is not available in the public sector. The bioavailability of oral gancyclovir is poor and in both the case of gancyclovir and valgancyclovir there is no peadiatric formulation and the dose for children is not established. All forms of systemic CMV should be evaluated for treatment with IV gancyclovir. Gancyclovir may cause significant bone marrow suppression and patients should be carefully and regularly assessed while receiving high doses. Reactivation and deterioration due to CMV shortly after initiation of HAART may be part of the immune reconstitution inflammatory syndrome (IRIS), which is discussed under a separate heading. Complete eradication of CMV may be very difficult, especially in severely immune compromised children, in which case chronic suppressive therapy may be required, this is not readily available in the public sector.

***Retinitis***

CMV retinitis should be suspected in a severely immune compromised child that report changes in visual acuity and/or "floaters". In small infants it may be indicated by an acquired inability to fix and follow and/or absent light reflexes. An ophthalmologist can confirm suspicions through clinical assessment. Once the diagnosis is confirmed treatment with intravenous gancyclovir should be commenced and expert opinion sought. Repeat intra-ocular injections with gancyclovir have been used with great success in adults, but are technically difficult in children, usually general anaesthesia is require and there is a risk of contaminating the vitreous of the eye with bacteria or fungi. Intra-ocular implants are successfully used in adults in industrialised countries, however these implants are not widely available in South Africa and to date there are no reports on its use in children.

***Hepatitis***

CMV infection should be suspected in infants with a low CD4 count and unexplained liver disease. CMV causes a hepatitis, cholangitis, and acalculus cholecystitis. Jaundice may be evident and ALT, AST, GGT and ALP are often increased. If CMV hepatitis is suspected the infant should be referred for specialist opinion.

***Colitis and oesophagitis***

CMV may involve any part of the intestine. The colon is most frequently involved, followed by the oesophagus and small bowel. CMV colitis often presents with unexplained chronic diarrhoea, abdominal pain and fever. The stools often contain blood (frank or occult blood) and the abdominal film may show a persistently dilated colon. The diagnosis is confirmed by colonoscopy and biopsy. Colon perforation and strictures are rare complications.

***Herpes simplex***

Primary infection with herpes simplex virus (HSV 1) commonly results in extensive, but self limiting (3-5 days), gingivostomatitis in immune competent children. HIV-infected children experience similar extensive gingivostomatitis, but it may take a very long time to heal (ulcers persisting >4 weeks is an AIDS defining condition) and painful recurrences are not uncommon. Treatment with acyclovir may shorten the course of illness and in children with frequent recurrences it is advisable to provide them with oral acyclovir to initiate treatment as soon symptoms appear.

Disseminated infection with HSV 1 can cause encephalitis and/or acute hepatic failure. One should suspect dissemination in any acutely ill child with herpetic lesions in the mouth and features of meningoencephalitis or acute hepatic dysfunction. The cerebrospinal fluid (CSF) in herpes encephalitis shows a lymphocytic pleocytosis with slightly raised protein. A positive polymerase chain reaction (PCR) test for HSV 1 in the CSF is the gold standard test. Therapy is most effective when started early and consists of IV acyclovir 20mg/kg/dose 8hourly for 21 days.

HSV 1-associated keratitis, conjuctivitis and retinitis may also occur and should be aggressively managed to prevent permanent eye damage.

**Varicella zoster**

***Prevention***

Chickenpox and zoster are different disease manifestations caused by the same virus. It is important to recognise that chickenpox can be prevented in susceptible children if the present within 96 hours of contact with an infectious case, either someone with chickenpox or zoster, and caretakers should be informed about this. Additionally all patients presenting to a clinic with chickenpox or zoster should be seen rapidly and isolated from other patients in order to prevent nosocomial transmission, as especially chicken pox is highly transmissible. Children with chickenpox or zoster that require hospitalization should be isolated until all the vesicles have crusted, this may take longer in immune compromised children. Table 1 lists the interventions strategies available; it is important to note that prevention may fail and that the onset of symptoms may be delayed for up to 28 days after the exposure in cases where preventative measures where instituted.

**Table 1:** Post exposure prophylaxis for chickenpox

| STRATEGY | TIMING | IMPORTANT CONSIDERATIONS |
|---|---|---|
| Active Vaccinations | Within 72 hours | Only if CD4 >15%<br>Not generally recommended in HIV infected children |
| Varicella Immune Globulin | Within 96 hours | Do not use with active vaccine |
| Acyclovir | >96 hours passed or no passive vaccination available | 80mg/kg/day (4 divided doses for 7 days<br>Do not use with active vaccine |

*Report of the committee on Infectious Diseases American Academy of Pediatrics Red Book 2006 27th Edition. Elk Grove Village:p81-83

***Chickenpox***

The usual clinical picture of chickenpox may be more severe and more frequently complicated by secondary bacterial infection in HIV-infected children. Dissemination to the central nervous system, lungs and liver may occur. Treatment with high dose oral acyclovir may reduce the period of infectivity and may shorten the course of illness. IV acyclovir is recommended for severely ill children and for children with suspected

dissemination; VZV is more resistant to acyclovir than HSV 1 and therefore the recommended standard treatment dose is 20mg/kg/dose 8 hourly.

***Zoster***

Zoster represents a "flare-up" of the chickenpox virus that has remained "dormant" within the anterior horn cell of the sensory nerve. It is usually limited to specific dermatomes and occurs fairly commonly in HIV infected adults and children who had chickenpox previously. It is considered complicated if more than one dermatome is involved and/or if the blisters become chronic; it is important to remember that these blisters are also infectious. The condition is best treated with high dose oral acyclovir and pain relief with adequate doses of paracetamol. It is important that carbamazepine should not be started routinely, since most patients will improve without this drug. If carbamazipine is deemed necessary to help control chronic pain then the usual dose escalation regimen should be followed to prevent adverse drug reactions and potential drug interactions, particularly with antiretroviral drugs, should be taken into consideration.

**Molluscum contagiosum**

Molluscum contagiosum is caused by a virus from the Pox viridea family. It commonly manifests as self limiting dome shaped papules with a characteristic central umbilication and a plug of cheesy material inside; it usually takes 12-18 months to disappear. In children with HIV/AIDS skin involvement can be extensive with multiple papules, giant nodular tumours, and/or epidermal cysts. These lesions are cosmetically very disfiguring and children may be teased relentlessly by their peers. Keratoconjunctivitis can develop secondary to lesions on the eyelids and it may also obscure the child's vision; an ophalmologist should be consulted regarding curettage. Although not an indication for HAART on its own, one should consider HAART if the lesions are extensive and the child experiences much social difficulty. When HAART is initiated the lesions may "deteriorate" initially due to IRIS, but HAART should not be discontinued.

**Human papiloma virus**

Warts are common and may be very troublesome, particularly if they occur in the genital area. Genital warts can occur in the absence of sexual abuse, but the possibility should be considered.

Treatment options include:

- Chemical - podophyllin 25%, 80%trichloroacetic acid or imiqiod cream
- Mechanical - liquid nitrogen, cautery or laser

Lesions often recur and in severe cases HAART may be the only option. Occasionally warts may cause upper airway obstruction; this condition is very difficult to treat and should be referred for expert management.

**Progressive multifocal leukoencephalopathy**

Progressive multifocal leukoencephalopathy (PML) is a fatal, subacute, demyelinating disease of the central nervous system caused by a reactivation of the polyomavirus JC, which induces a lytic infection of oligodendrocytes. Fortunately it rarely affects children. The onset of PML is insidious, but the disease leads to death in 3-6months if HAART is not initiated. In the early phases there is impairment of speech and vision and mental deterioration, but in the advanced stages paralysis of limbs, cortical blindness, and sensory abnormalities are common. CSF is often normal, but the virus may be detected by PCR. Magnetic resonance imaging (MRI) is the diagnostic modality of choice and shows white matter lesions without swelling, mass effect or contrast enhancement. In HIV-infected children, HAART is the only effective therapeutic option, although PML may also be IRIS-related.

**Cryptococcus neoformans**

Cryptococcus neoformans is an ubiquitous yeast. The organism enters the body via the respiratory tract and disseminates from there via the blood stream, which explains why any organ system may be affected. Disease is rarely seen in children < 5 years of age and usually occurs only at very low CD4 counts. Common clinical manifestations include meningitis, pneumonia and a rash that may look similar to molluscum contagiosum. Diagnosis relies on culture and/or detection of the cryptococcal antigen. Cryptococcal disease may have a complicated relapsing course with significant morbidity and mortality despite treatment with HAART. A lumbar puncture should always be performed to exclude meningitis and expert advice should be sought.

***Meningitis***

At onset, symptoms are usually non-specific and secondary to raised intracranial pressure, (these include fever, nausea, vomiting, headache, visual disturbances and a change in mental status). Classic clinical signs include meningism, cranial neuropathies and papilloedema, while focal deficits may also occur. CSF changes include a mononuclear pleocytosis, elevated protein and low glucose. Staining with India ink may reveal typical encapsulated yeasts, but caution should be exercised if the test is negative as India ink staining is positive in only 60% of cases. Therefore, it is advised that cryptococcal antigen testing should be performed on all suspect cases with negative India ink staining. Computed tomography (CT) or MRI may reveal communicating hydrocephalus, pseudocysts or mass lesions (cryptococcomas). Children may also have chest radiograph abnormalities.

Therapy should be instituted promptly, followed by secondary prevention (see table 2). Predictors of poor prognosis in children with cryptococcal meningitis are persistently raised intracranial pressure and a persistent alteration in mental status. Raised intracranial pressure should be managed aggressively, as it causes severe headache and may lead to irreversible optic ischaemia. This is achieved by weekly lumbar punctures to determine the opening pressure and provide therapeutic CSF drainage. Consideration can also be given to the use of asetazolamide and furosemide if communicating hydrocephalus is present. HAART should be initiated in all children once the first 2-3 weeks of treatment has been completed. There is some evidence in adults to suggest that maintenance fluconazole can be stopped once a sufficient immune restoration has occurred (CD4 count sustained >200), but there is no data in children.

**Candida**

Candida infections affect mainly the mucus membranes of the mouth or the nappy area in immune competent infants. In HIV-infected children Candida infections are not restricted to infancy, may cause extensive and persistent (or recurrent) infections and may spread to the oesophagus and larynx as well.

***Oral Candida***

Oral Candida is the most frequent oral

**Table 2:** The drug management of Cryptococcus neoformans meningitis

| DURATION | DRUG | DOSE |
|---|---|---|
| **TREATMENT PHASE** | | |
| 0-14days | Amphotericine B | 0.7-1.5mg/kg/day ivi * |
| 15th day - end of week 10 | Fluconazole | 6-12mg/kg/day PO (Maximum 400mg) |
| **MAINTENANCE PHASE** | | |
| Week11 onwards | Fluconazole | 3-6mg/kg/day PO (Maximum 200mg) |

* A slow infusion given over 12-24 hours will reduce the risk of adverse effects and renal toxicity. Paracetamol given at the start of the infusion will reduce the risk of fever and rigors

manifestation in infected children and often has a recurrent and persistent nature. The clinical picture is varied (table 3) but pseudomembranous candida remains the most common. Lesions should be treated promptly to provide symptomatic relief and to prevent further spread. Initial treatment is with nystatin 100 000IU/ml 2.5 ml, 4 times per day, making sure that the whole surface of the mouth is well covered. If this fails a miconazole containing gel can be used. If this also fails use systemic fluconazole 3-6mg/kg/day for 1 week.

***Laryngeal Candida***

Suspect this condition in children with chronic stridor and visible candida lesions in the mouth; although visualising lesions in the mouth is not a requirement for the diagnosis. Confirmation is by flexible scope of the upper airway. Treat with systemic fluconazole 6-12mg/kg/dose /day for 7-14 days.

***Candida oesophagitis***

A presumptive diagnosis of Candida oesophagitis can be made in the presence of oral thrush and symptoms of esophagitis in severely immune compromised patients. Confirmation is by endoscopic evaluation and biopsy, but this is rarely required. Complications, in particular strictures, can occur. Treatment is with oral fluconazole 6-12mg/kg/day for 14-21 days.

***Disseminated Candida***

Blood stream infection is associated with hospitalization and intravenous access particularly with central lines. Treatment may consist of fluconazole 6-12mg/kg/day IVI for 14-21days, but remember that chronic use of fluconazole causes resistance and some Candida species are naturally resistant to fluconazole. Consideration should be given to using Amphotericine B in severely ill children and in children where the condition is deteriorating in spite of fluconazole use.

**Tuberculous meningitis**

The neurological and CSF findings in HIV-infected children with tuberculous meningitis (TBM) are similar to HIV-uninfected children. The classical CT signs of TBM, such as obstructive hydrocephalus and basal meningeal enhancement tend to be less prominent (compared to uninfected children) and may cause some diagnostic confusion. The presence of hydrocephalus warrants an air encephalogram to determine whether it is communicating on non-communicating. Communicating hydrocephalus requires treatment with acetazolamide 50-100mg/kg/day in 3 divided doses and furosemide 1mg/kg/day in 3-4 divided doses for 4 weeks. Obstructive, non-communicating hydrocephalus requires a ventriculo-peritoneal (VP) shunt. The drug regimen and dosages recommended are; isoniazid 20mg/kg/day, rifampicin 20mg/kg/day, pyrazinamide 40mg/kg/day and ethionamide 20mg/kg/day for a duration of 9 months.

To reduce the risk of immune mediated complications the use of corticosteroids (prednisone 2-4mg/kg/day for 4 weeks and then tapered) is advised and to minimize the risk of IRIS, the initiation of HAART should preferably be delayed for 2-4weeks after antituberculosis treatment started.

**Toxoplasmosis**

Fortunately toxoplasmosis seems to be rare in HIV-infected children and this may in part be due to the widespread use of co-trimoxasole that also provides primary prophylaxis against toxoplasmosis. Diagnosis may be complicated, as IgM responses may be absent or delayed and a positive IgG response only indicates previous infection, which is common, and not necessarily disease. Confirmation maybe achieved by a positive PCR test from a sterile site, but this is rarely available. CNS disease can present with seizures, focal signs or depressed level of consciousness. Diagnosis of CNS toxoplasmosis is often based on the classical CT picture of multiple ring enhancing lesions that responds to treatment with high doses of co-trimoxasole. Sulphadiazine (the treatment of choice when used in combination with pyrimethamine) is not available in South Africa. In patients who cannot tolerate high dose co-trimoxasole, a combination of pyrimethamine and clindamycin may be used, but pyrimethamine causes significant bone marrow suppression and leucovorin or folic acid should be considered before treatment is commenced. Ophthalmologic disease manifests as a characteristic retinitis and treatment is essential to prevent visual loss.

**Gastroenteritis**

Diarrhoea is common occurrence in HIV infected infants and children. Causes may include infections with common agents such as rota virus or shigella, opportunistic infections and malabsorption related to HIV. The course is often complicated by malnutrition and co-morbidities such as pneumonia. The general management of infectious diarrhoea remains the same as for HIV infected children, however, clinicians should recognise that opportunistic

**Table 3:** The clinical spectrum of oral candidiasis

| Type | Description |
|---|---|
| **Pseudo membranous** | White plaques loosely adherent to mucosa. When wiped of reveals erythematous plaque with or with out bleeding. |
| **Erythematous** | Flat diffuse or discrete plaques. Usually on palete or tongue |
| **Hyperplastic** | Diffuse white adherent lesions. Usually on the buccal mucosa |
| **Angular cheilitis** | Fissures or lineal ulcers in the corners of the mouth with inflammatory erythema |

infections ie CMV or cryptosporidium parvum may be involved.
Table 4 lists common causes of diarrhoea in HIV-infected children and treatment modalities. All children should receive the usual supportive care.

***Cryptosporidium parvum***
This is a common cause if diarrhoea in children and is usually self limiting. It should also be noted that routine chlorination of water does not kill cryptosporidium parvum. The clinical diarrhoea presentation can be divided into; 1) acute/fulminant >21stools/day 2) sub-acute <28 days 3) chronic >28 days. The diagnosis is made on stool microscopy, but only if it is specifically requested. In adults and children with HIV and low CD4 count this infection has dire consequences with prolonged hospitalization, severe effects on nutritional status and may ultimately lead to death. Treatment is supportive; maintaining hydration and providing nutritional support. There is currently no specific treatment available in South Africa, nitazoxanide the only drug with proven efficacy against this organism is not locally registered and the dose and duration of treatment has not been established in HIV-infected children. Azithromycin and clarithromycin has efficacy in some patients and a trail of therapy should be considered.

In addition to diarrhoea this parasite can cause a chronic infection of bile ducts leading to permanent narrowing. The diagnosis can be made by performing ERCP however this investigation is often not possible in small infants and may result in morbidity in the form of pancreatitis. The newer magnetic resonance techniques may be less an invasive diagnostic modality. Experts should be consulted regarding the management of this condition.

**Kaposi sarcoma**
Kaposi sarcoma is thought to be result from infection with Human Herpes Virus 8. Lesions include the classical blue/purple papules on the skin or oral mucosa, mass lesions in the upper airways and invasion of the lymph nodes. Systemic involvement includes gastrointestinal disease, presenting with recurrent bleeds, and pulmonary disease with recurrent episodes of pulmonary bleeding, persistent pleural effusion or severe upper airway obstruction. This is a definite indication to start HAART, but a paediatric oncologist should be consulted to consider added chemotherapy and the prognosis with systemic illness remains guarded, despite optimal treatment.

**Immune reconstitution inflammatory syndrome (IRIS)**
IRIS results from an exaggerated inflammatory response to a pathogen during immune restoration leading to a paradoxical deterioration in the clinical condition of the patient. Although this condition has received new prominence in the HIV/AIDS era, it has been well

**Table 4:** Infectious causes of gastroenteritis and the specific management

| Organism | Diagnosis | Specific Treatment | Comments |
|---|---|---|---|
| Rotavirus | Stool viral culture | | Common and very contagious |
| CMV | Clinical suspicion and endoscopy | Gancyclovir 5mg/kg 12hourly 14-21days | Colitis |
| Adenovirus | Stool viral culture | | Colitis Stool viral culture |
| Shigella | Stool culture | Nalidixic acid 12.5mg/kg 6hourly 5days OR if systemically ill 3rd generation cephalosporin | Bloody mucoid stools fever and abdominal pain<br>CNS adverse events common in children <1year |
| Salmonella | Stool culture | According to sensitivity<br>Usually 3rd generation cephalosporin | Bloody mucoid stools fever and abdominal pain |
| E Coli | Stool culture | According to sensitivity | |
| Campylobacter jejuni | Stool microscopy | Erythromycin 30-50 mg/kg/day in divided doses 7days | |
| Yersinia enterocolitica | Stool culture | According to sensitivity | |
| C. difficile | Clinical suspicion<br>Toxin in stool | Metronidazole 7mg/kg/dose 6 hourly PO | History of antibiotic use and hospitalization<br>Bloody mucoid stools fever and abdominal pain<br>Can treat empirically |
| Giardia lambdia | Stool Microscopy<br>Duodenal aspiration microscopy<br>Stool immunoflorecence | Metronidazole 15mg/kg/day in divided doses for 5 days<br>Albendazole if >2years 400mg/day for 5 days | Common<br>Difficult to make a specific diagnosis<br>Empirical treatment is acceptable<br>Albendazole for resistant cases |
| Cryptosporidium parvum | Modified ZN on stool | Azithromycin 12mg/kg/day<br>Paromamycin- not currently available in SA<br>Nitrious oxanide -- not currently available in SA | |
| Microsporidium | Stool Microscopy | Albendazole if >2years 400mg/day for 5 days | Less common than in adults<br>Diarrhea is often associated with malabsorption and is worsened by food ingestion |

described in patients recovering from other immune suppressive conditions, i.e. chemotherapy and kwashiorkor. In HIV/AIDS it usually occurs between 14 days and 3 months after HAART initiation but late onset of IRIS has been documented. It is important to differentiate IRIS from treatment failure. Children with advanced HIV disease and/or unrecognized/untreated opportunistic infection are most at risk of developing IRIS. It is important to note that it is not only opportunistic infections that may occur; an increase in common infections, i.e. pneumonia is also well documented. Clinical presentation of the opportunistic infection may be atypical. Apart from the presenting illness, laboratory findings demonstrate good HIV control with a rapid decline in viral load and increase in CD4 count. In adults, cavitatory TB is the most common IRIS associated phenomenon. This is less common in children, but in our experience IRIS associated BCG disease is not uncommon in infants recently started on HAART. All cases of adverse events due to BCG should be reported to your local monitoring officer for the Expanded Program of Immunization (EPI), your local vaccination clinic should be able to assist you in this process.

Table 5 lists some of the conditions associated with IRIS. No evidence-based guidelines exist for the management of IRIS in children. Careful screening for sub-clinical opportunistic infections and the treatment thereof before initiating HAART is recommended. Clinicians should maintain a high index of suspicion. Specific treatment of the organism involved is essential, the use of anti-inflammatory agents have not been studied, but may be essential. The need to discontinue HAART due to IRIS is rare, and is usually associated with severe hepatitis B or C exacerbations.

**Table 5:** Conditions associated with immune reconstitution inflammatory syndrome (IRIS)

| Pathogen | IRIS presentation |
|---|---|
| Mycobacterium tuberculosis | Mediastinal lymphadenitis |
| | Pulmonary infiltrates, |
| | Pleural effusion, |
| | Ascitis, |
| | Hepatosplenomegaly, |
| | Focal cerebritis, |
| | Tuberculomas. |
| Mycobacterium avium complex | Painful lymphadenopathy, |
| | Fever, |
| | Hepatosplenomegaly, |
| | Pulmonary infiltrates, |
| | Inflammatory masses (endobronchial & abdominal cavity) |
| | Pyomiositis, |
| | Cutaneous abcesses. |
| mBCG | Ulceration of scar |
| | Right axilla adenitis |
| Cryptococcus neoformans | Mediastinal lymphadenitis, |
| | Aseptic meningitis with raised ICP, |
| | Hypercalcaemia |
| | Pulmonary infiltrates |
| Cytomegalovirus | Retinitis, |
| | Immune reconstitution uveitis, |
| | Exacerbation of pneumonia |
| Varicella zoster virus | Dermatomal Zoster |
| Herpes simplex virus | Atypical cutaneous lesions, |
| | Encephalopathy |
| Hepatitis B,C | Hepatitis flare |
| JC virus | Progressive multifocal leukoencephalopathy |
| Mollascum contagiosum | Increase in size of warts |
| Pneumocystis jerovecci | Pneumonitis relapse in previously treated patients. |
| Human papiloma virus | Increase in size |
| | Exacerbation of airways obstruction |
| Kaposi Sarcoma | Increase in lesions |

## Conclusion

HIV-infected children with significant immune compromise may suffer from a variety of conditions and it is important to remember that common things occur commonly. We tried to highlight some of the most common and/or severe conditions that are particular to this group, but realize that it by no means a fully exhaustive discussion. However, we hope that an increased awareness of these conditions and their correct management will improve the level of care provided to HIV-infected children. This was the penultimate article in this series and the final article will discuss common (non-infectious) HIV-associated conditions in children.

**See CPD Questionnaire, page 39**

**(P) This article has been peer reviewed**

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