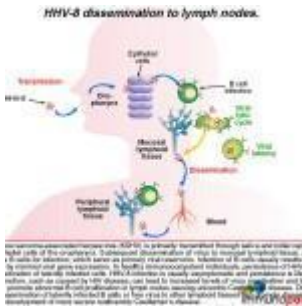


A case of lymphadenopathy and night sweats



- Patient Presentation
- History
- Differential Diagnosis
- Examination
- Investigations
- Discussion
- Treatment
- Final Outcome
- References
- Evaluation - Questions & answers
- MCQ

Patient Presentation

A 33 year old male presents with a one month history of a non-productive cough, fever, night sweats, malaise, abdominal pain and weight loss.

History

- Known HIV positive
- Diagnosed 8 months previously but not on ARV's.

Past medical history

- Nothing of significance

Past surgical history

- Nil

Family History

- Mother has hypertension, on medication
- Father is asthmatic, on medication

Allergies

- Nil known

Medication

- Nil

Social history

- 10 pack year history of smoking, stopped two years ago
- Occasional ethanol use
- No recreational drugs

Differential Diagnosis

- TB
- Lymphoma
- Pulmonary KS
- Sepsis
- Opportunistic infection
- Multicentric castlemans disease (MCD)

Examination

Examination on admission

Appearance

- Awake and alert, ill looking wasted man

Vitals

- Temperature: 38C
- BP:90/65
- HR:85
- RR:20 breaths per minute

General

- Moderate conjunctival pallor
- Ankle oedema
- Generalised lymphadenopathy (LAD), with one large node (3x3cm) in the right supraclavicular region

Respiratory system

- Tachypnoea with respiratory rate of 20 breaths per minute
- Crackles bilaterally

Abdomen

- Not distended
- Mild generalised tenderness on palpation
- Slight hepatomegaly and large, easily palpable splenomegaly
- No other masses
- Bowel sounds present

Cardiovascular

- Normotensive
- No murmurs or added heart sounds

CNS

- Normal level of consciousness, alert and co-operative
- Gait, power, tone, sensation and reflexes intact and functioning within normal limits.

Dermatological

- An erythematous, maculopapular, nonpruritic rash on the upper limbs and trunk. No confluence between lesions.

Investigations

Investigations	Results	Reference ranges
WCC	3.74	4-12x10 ⁹ /L
RCC	2.58	4.5-5.5x10 ¹² /L
HB	8	12.1-15.2g/L
MCV	86.2fl	79.1-98.9
MCH	30.2pg	27.0-32.0
MCHC	32.1g/dL	32.0-36.0
Red cell distribution width	12.7	11.6-14.0x10 ⁹ /L
Platelets	219	140-450x10 ⁹ /L
Normocytic normochromic anaemia		
CD4+	236 cells/mm ³	
CRP	150mg/L	0.0-5.0
LFT		
Total Protein	72g/L	60-85
Albumin	27g/L	35-52
GGT	53U/L	0-35
ALT	85U/L	14732
AST	70U/L	14732
LDH	1280U/L	248-480
Sputum	AFB negative x3	
Urine dipstix	++ protein	

Chest X ray:

- Lung fields clear

- Small bilateral pleural effusions

CT Abdomen:

- Confirms clinical findings.
- Enlarged spleen, slightly enlarged liver, intra-abdominal and retroperitoneal LAD

Lymph node excision biopsy:

- Histology shows angio-follicular hyperplasia, with hyperplastic follicles surrounded by a concentric mantle of plasma cells.
- Histology was compatible with multicentric castlemans disease (MCD), plasma cell variant.
- Follicle surrounded by a broad mantle zone consisting of a concentric layering of lymphocytes resulting in an onion-skin appearance. The follicles are frequently penetrated radially by a sclerotic blood vessel.

Immunohistochemistry:

- Multiple plasma cells positive for HHV8 LANA-1 protein (this test is used to show if virus is present)
- Plasma HHV8 viral load 10 000 copies/ ml

Discussion

Our case focuses on a 33 year old HIV positive man not on ARV treatment, who presents with a one month history of constitutional symptoms and a generalized lymphadenopathy. A lymph node biopsy is taken, which reveals hyperplastic follicles surrounded by a concentric mantle of plasma cells – consistent with a diagnosis of multicentric Castleman's disease. Our discussion will begin with an introduction to this rare disease and will follow with the the immunology behind its dissemination and progression.

Introduction

Castleman's disease is an uncommon lymphoproliferative disorder characterized by benign tumours that develop in the lymph nodes. Most often, they occur in the neck, chest and/or abdomen but may also be found in the axilla, pelvis, and pancreas. The disease is associated with human herpesvirus type-8 (HHV-8).

Castleman's disease is divided into four types, based on histology and location.

The first two are determined by the microscopic appearance of the lymph node:

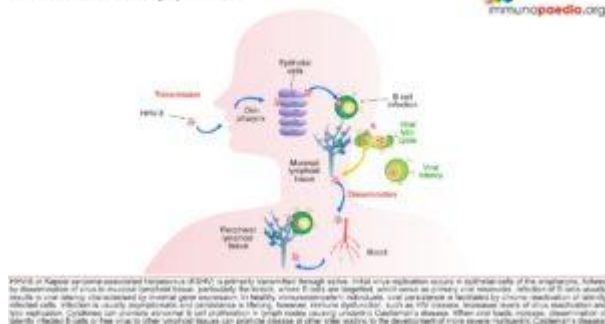
- hyaline-vascular type. More than 90 percent of the cases. Most individuals remain asymptomatic.
- plasma cell type. Associated with constitutional symptoms such as fever, weight loss, skin rash, early destruction of red blood cells with resulting haemolytic anaemia and increased immune factors resulting in hypergammaglobulinaemia.

The remaining two types are defined by the number of anatomic regions affected:

- Unicentric Castleman's disease affects lymph nodes in only one region
- Multicentric Castleman's disease affects multiple regions, including the liver and spleen with a resulting hepatosplenomegaly.

We describe a patient with a combination of these microscopic and anatomic variants.

Initial transmission and dissemination of disease to the lymph nodes



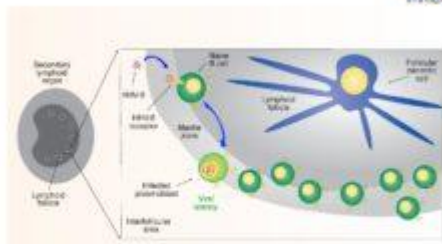
Human herpesvirus type-8 (HHV-8) or Kaposi sarcoma-associated herpes virus (KSHV) is primarily transmitted through saliva. The virus initially replicates in the epithelial cells lining the oropharynx and then disseminates

to local mucosal lymphoid tissue, in particular the tonsils. The virus targets B cells as its primary reservoir resulting in viral latency with minimal viral gene expression.

When the host is healthy with intact immune function, persistence of HHV-8 is facilitated by chronic reactivation of **latently** infected cells. Resulting infection is typically asymptomatic and viral persistence is life long. However, in people who are immunodeficient, such as in individuals who are HIV positive, their immune dysfunction can lead to increased levels of HHV-8 reactivation and **lytic** replication.

Release of cytokines can promote abnormal B cell proliferation in lymph nodes with a localized distribution, known as unicentric Castleman's disease. Increased virus replication, as a result of loss of immune control, can lead to the dissemination of latently infected B cells or free virus that infect multiple lymph node sites resulting in multicentric Castleman's disease.

In order to better understand how viral latency is established we need to look in greater detail at the infection of naïve B cells and how they bypass the germinal centers of secondary lymphoid organs.

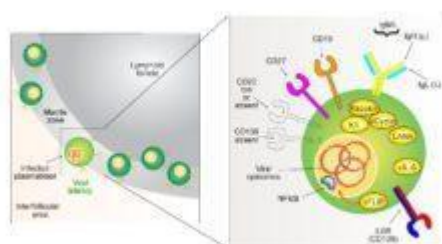


Infection of naive B cells in humanized mouse leads to viral latency by default. Infected B cells can transcribe and translate plasma proteins, HCV RNA, and/or HCV core protein, suggesting that the virus is replicating in these cells. However, the virus is not infectious in these cells as it requires surface $\alpha 1$ and $\alpha 2$ integrins, CD 80/86, and CD 80/82 which facilitate attachment of virus to target cells. Later infection is characterized by the replacement of viral sequences in the nucleus and appearance of a transient cluster of viral genome RNA in late stages of infected cells and in isolated virus particles. The latent virus particles brought to infection naive B cells by resting hematopoietic stem cells, which are the source of naive B cells, are not infectious. The latent virus particles are not infectious in the presence of resting B cells, suggesting that the virus is not infectious in the presence of resting B cells. The virus is not infectious in the presence of resting B cells, suggesting that the virus is not infectious in the presence of resting B cells.

HHV - 8 uses several membrane

receptors to gain entry into susceptible target cells including heparan sulfate, $\alpha 3 \beta 1$ integrin, [DC-SIGN](#), [xCT](#) and [ephA2](#). These receptors facilitate internalisation of the virus via endocytosis. Latent infection is characterised by maintenance of viral episomes in the nucleus and expression of a minimal number of viral genes which promotes long term survival of infected cells and escape from immune surveillance. Viral latent gene products are thought to transform naïve B cells by mediating intracellular signaling events normally associated with germinal centre reactions. However, the virus infected naïve B cells actually bypasses the germinal centre and localizes to the marginal zone of lymphoid follicles.

The infected plasmablasts located in the mantle zone are characteristically large in size and express cytoplasmic and membrane-bound immunoglobulins exclusively composed of IgM isotypes and lambda light chains. The characteristics of these plasmablasts and their resulting pathology are described in greater detail in the next two graphics.



Hybrid plating in 8 cells is associated with expression of its viral proteins. The viral protein p120 is thought to mediate transformation of infected B cells into plasmablasts via overexpression of genes under the control of the transcription factor, NF- κ B. Expression of late oncogenic genes as well as deregulation of B cell growth factor levels in the long-term survival of plasmic hybrids is critical. Analysis of cell surface alterations characterizes the phenotype of selected populations. A lack of CD19, a plasma cell marker, and loss of CD20 (B cell marker) is evident as well as expression of the B cell markers, CD19 (B cell marker), and CD27 (memory marker). Alternatively, some immunoglobulin B cells are exclusively IgG, are also markers of hybrid selection. In fact, of 8 cell development, B cell virus expression of lambda light chain genes occurs

HV-8 infected plasmablasts express particular membrane markers

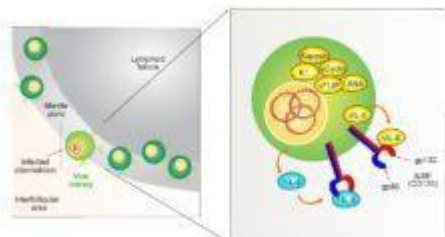
HHV-8 latency in B cells is associated with expression of six viral proteins (Kaposin, K1, vCyclin, LANA, vIL-6, vFLIP). The

viral protein vFLIP, is thought to mediate transformation of infected B cells into plasmablasts via expression of genes under the control of the host transcription factor NF- κ B. Expression of anti-apoptotic genes as well as production of B cell growth factors (under the control of NF- κ B) leads to the long term survival of latently infected B cells. A number of cell surface alterations characterize the phenotype of infected plasmablasts. A lack of CD138 (a plasma cell marker) and low or absent [CD20](#) (a B cell marker) is evident as well as expression of the IL-6 receptor, [CD19](#) (a B cell marker) and [CD27](#) (a memory marker). Membrane bound immunoglobulins that are exclusively IgM (heavy chain) and lambda (light chain) are also hallmarks of HHV-8 infection. In normal B cell development, NF- κ B drives expression of lamda light chains following unsuccessful kappa gene rearrangements. However, viral infection occurs subsequent to complete immunoglobulin receptor formation, thus we see the exclusive expression of lamda light chains in infected cells. Although this process is not well understood, it is thought to be caused by viral induction of NF- κ B transcriptional activity. Infected plasmablasts go on to lack class switching recombination because they bypass the germinal centre reactions.

HHV-8 infected plasmablasts produce cytokine growth factors



HHV-8 infected plasmablasts produce cytokine growth factors



The long term survival of latently infected B cells is regulated by both anti-apoptotic and pro-growth factors. IL-6 plays a central role as a growth factor for infected B cells. HHV-8 infection promotes B cell expression of the IL-6 receptor which is composed of two protein chains, gp80 and gp130. HHV-8 produces viral IL-6 (vIL-6), a homologue cytokine

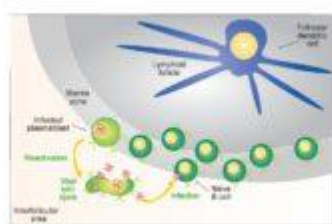
The long term survival of latently infected B cells is mediated by both anti-apoptotic and pro-growth factors. [IL-6](#) plays a central role as a growth factor for infected B cells. HHV-8 infection promotes B cell expression of the [IL-6 receptor](#) which is composed of two protein chains, gp80 and [gp130](#). HHV-8 produces viral IL-6 (vIL-6), a homologue cytokine

of human IL-6. vIL-6 signals through the gp130 chain, but does not need to bind to gp80 to activate cells. Although vIL-6 is expressed at high levels during lytic replication, latently infected B cells express low levels which stimulate the IL-6 receptor (IL6R or CD126) in an autocrine and paracrine manner to provide growth signals to the infected plasmablasts. Infected B cells also express human IL-6, due to NF- κ B activation, which binds the IL-6 receptor and promotes survival and polyclonal B cell proliferation and increased immunoglobulin production. In our case study, the increase in the levels of human IL-6 and vIL-6 in the patient gives rise to his presenting symptoms i.e. fever, malaise, wasting, lymphadenopathy and hepatosplenomegaly.

Immune dysfunction increases reactivation of latent HHV-8

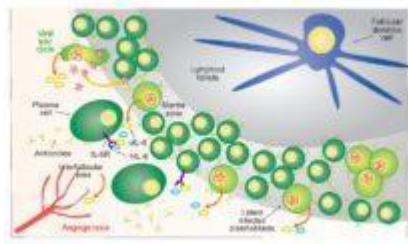
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Immune dysfunction increases reactivation of latent HHV-8



In healthy immunocompetent hosts, entry of infection is usually asymptomatic. Due to restriction of virus to already infected cells, reactivation to replenish virus reservoirs and promote transmission to new hosts occurs periodically. When the immune system becomes dysfunctional, such as in HIV infection, immune surveillance for T cells that limit reactivation of virus is compromised. This results in increased levels of replication and virus "bursting". Larger numbers of infectious virus in lymph node follicles can promote abnormal levels of polyclonal B cell proliferation via cytokine stimulation, particularly IL-6, resulting in lymph node enlargement (lymphadenopathy).

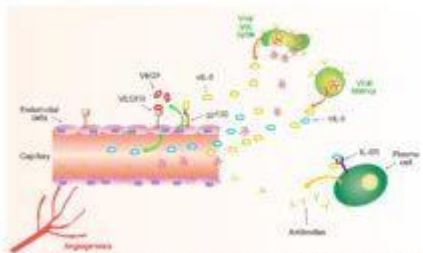
In healthy immunocompetent hosts, HHV-8 infection is usually asymptomatic, due to immune control of virus infected cells. Reactivation to replenish viral reservoirs and promote transmission to new hosts occurs periodically, but is limited. However, when the immune system becomes dysfunctional, such as in HIV infection, immune surveillance by T cells and subsequent ability to limit reactivation of virus is compromised. This results in increased levels of replication and infection of more B cells. Larger numbers of infected B cells in lymph node follicles can promote abnormal levels of polyclonal B cell proliferation via cytokine stimulation, particularly IL-6 as discussed above, with resulting lymphoid hyperplasia.



Polyclonal B cell proliferation associated with Castleman's disease is mediated by increased levels of IL-6. Immune dysfunction results in increased reactivation of latent virus reservoirs which in turn increases levels of viral latent infected cells as well as lytic replication. Latently infected plasmablasts that localise to the mantle zone produce vIL-6 as well as human IL-6. Although human IL-6 is a more potent activator of the IL-6 receptor, viral IL-6 only needs to engage the gp130 chain of the receptor to induce signaling. Gp130 is expressed on a wider range of cells than the full IL-6 receptor (gp130 and gp80), and in particular on endothelial cells.

IL-6 production stimulates B cell proliferation

Polyclonal B cell proliferation associated with Castleman's disease is mediated by increased levels of IL-6. Immune dysfunction results in increased reactivation of latent virus reservoirs which in turn increases levels of viral latent infected cells as well as lytic replication. Latently infected plasmablasts that localise to the mantle zone produce vIL-6 as well as human IL-6. Although human IL-6 is a more potent activator of the IL-6 receptor, viral IL-6 only needs to engage the gp130 chain of the receptor to induce signaling. Gp130 is expressed on a wider range of cells than the full IL-6 receptor (gp130 and gp80), and in particular on endothelial cells.



Endothelial cells are an essential source of human IL-6. Infected plasmablasts and B cells that are in the late phase of viral replication produce vIL-6, which activates endothelial cells to produce human IL-6. Although human IL-6 is a more potent activator of the IL-6 receptor, viral IL-6 only needs to engage the gp130 chain of the receptor to induce signaling. Gp130 is expressed on a wider range of cells than the full IL-6 receptor (gp130 and gp80), and in particular on endothelial cells.

Thus vIL-6 can activate endothelial cells via gp130 binding, which then produces vascular endothelial growth factor ([VEGF](#)), which stimulates angiogenesis and further production of human IL-6. These

elevated systemic levels of IL-6 are then associated with many of the symptoms of Castleman's disease.

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Treatment

ART was commenced

Chemotherapy: CHOP ([cyclophosphamide](#), [daunorubicin](#), [vincristine](#) and [prednisone](#)) and [rituximab](#) (anti CD20 monoclonal antibody)

Although not used to treat the patient in this case study new drugs that target IL-6 have been developed and are being tested in patients with MCD.

- [Tocilizumab](#) (Actemra®), is a monoclonal antibody that blocks the action of IL-6 by binding to its receptor on lymphocytes. Currently approved for treatment of rheumatoid arthritis in the United States, there has been some success in its off label use in patients with MCD.
- [Siltuximab](#), also a monoclonal antibody, targets IL-6 itself. This drug has been approved by the FDA and EMA for treatment of MCD.

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Final Outcome

The patient's clinical course showed a favourable response. At his 6 month review he is shown to be in remission.

CD4 count is now 400 cells/mm³

HHV8 viral load is less than detectable level

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Evaluation – Questions & answers

What is the diagnosis?

Multicentric Castleman's disease (MCD), a lymphoproliferative

disorder.

Which cell does the HHV-8 virus target?

B cells

What virus is associated with MCD?

Human herpesvirus-8 (HHV-8)

What happens to the virus once it has entered its target cell in an immunocompetent host?

The virus will typically remain latent. This latent infection is characterised by maintenance of viral episomes in the nucleus with only a minimal expression of viral genes occurring, thus promoting long term survival of infected cells and their escape from immune surveillance. Persistence is facilitated by chronic reactivation of these latently infected cells but the resulting infection is typically asymptomatic. Viral persistence is life long.

What happens to the virus once it enters an immunodeficient host?

When the immune system becomes dysfunctional, such as in HIV infection, immune surveillance by T cells and subsequent ability to limit reactivation of virus is compromised. This results in increased levels of replication and new infections. Larger numbers of infected B cells in lymph node follicles can promote abnormal levels of polyclonal B cell proliferation via cytokine stimulation, particularly IL-6, with resulting tumour development and proliferation of constitutional symptoms.

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