



# Virology for 2<sup>nd</sup> Year MD Students

**(06) DNA viruses:**

*Papillomaviridae* (HPV)

*Polyomaviridae* (BK, JC, Merkel cell  
Polyomavirus)

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# Papillomaviridae

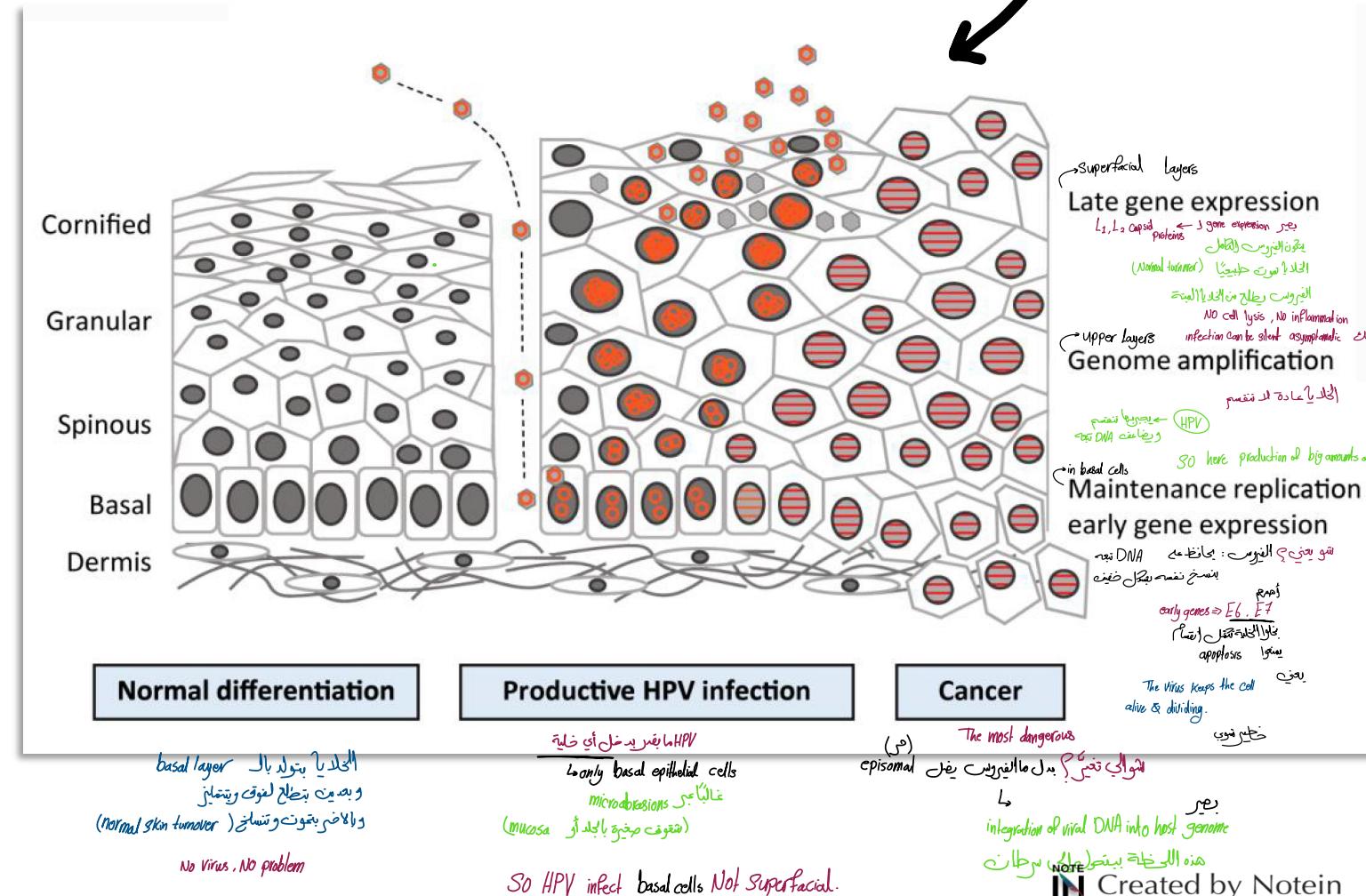
ممكن يكون شرح زيادة بتذكر الدكتور  
حتى عندها بس بدون  
المفهوم ن

## Human papillomavirus (HPV)

dsDNA, non-enveloped viruses  
that replicate in the nucleus. The  
virus has many types ( $>200$ ).

**Transmission:** direct contact,  
sexual.

**Tropism:** epithelial cells of the  
skin and mucous membranes.





# HPV Important features

1. HPV is the most common cause of sexually transmitted infections worldwide.
2. Most HPV infections resolve spontaneously within 2-3 years.
3. Many infections are totally asymptomatic, so the patient can have HPV without knowing.  
does not mean harmless. ←  
لا تُعرف ولا ألم ولا آلام أُخرين  
المريض ينقل المرض
4. Some HPV types are benign, some have low-risk of causing cancer and some are high-risk types that can cause the following cancers: cervical, penile, anal, oropharyngeal, and vulvar cancers.
5. High-risk HPV types have transforming proteins that are related to cancer development.  
→ هي الأساس الجيني للسرطان

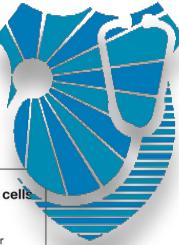
↳ E6 → p53 off (No apoptosis)  
E7 → Rb off (cell cycle ON)

result malignant transformation.

بعض طرفيه  
الذئب المفتوحة  
في الملاط البارد  
+ asymptomatic  
انتشار حادث  
وبالذئب المفتوحة ممكناً أن يموت  
=

The immune system can get rid of it without treatment.  
low-risk types

كل HPV  
يعطي إلى  
سرطان



# HPV Clinical Features

\* Warts, Not Cancer = HPV-6, HPV-11

\* High-risk Oncogenic types = HPV-18, HPV-16

Common warts

→ Low-risk

Condyloma acuminata (genital warts)

caused mainly by HPV-6 and HPV-11

Laryngeal papilloma. (benign) often linked 6, 11  
Popillomas in the larynx

Cervical cancer caused mainly by  
HPV-16 and HPV-18

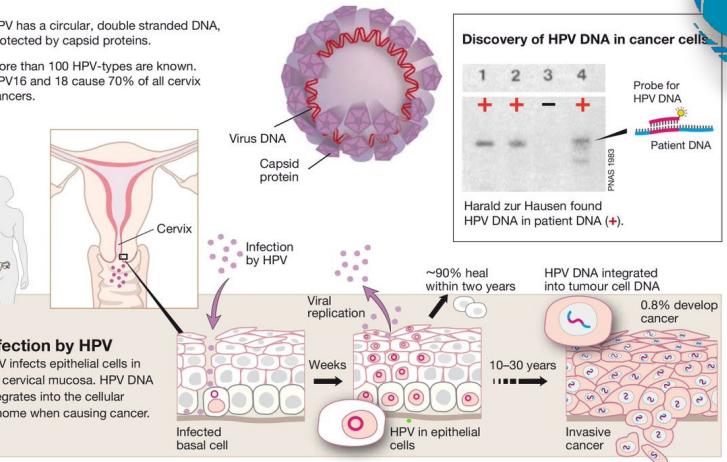
Other cancers: penile, anal,  
oropharyngeal, and vulvar cancers.

Caused by high-risk HPV types (e.g.,  
HPV-16 and HPV-18)

HPV - human papilloma virus

HPV has a circular, double stranded DNA, protected by capsid proteins.

More than 100 HPV-types are known. HPV16 and 18 cause 70% of all cervical cancers.



Condyloma acuminata can be found on vagina, vulva, cervix, around the anus and on penile shaft



# HPV Clinical Features





# HPV diagnosis and management

## Diagnosis:

- A. Clinical <sup>visual</sup>
- B. Pap smear (Papanicolaou smear is a cytology method of cervical screening to look for precancerous lesions in the cervix). *Screening ≠ Viral detection*
- C. PCR. Detects HPV DNA  
Identifies the type (risk stratification)

**Treatment:** Most do not require treatment. Other methods: surgical excision, laser therapy, chemical agents (e.g., podophyllotoxin and podophyllin, imiquimod).

warf *die & goes up* *نمر الماء يذهب* *يختفي الماء*

*safer than podophyllin*

**The treatment removes the lesion Not the virus itself**



# HPV epidemiology and prevention

part of the virus

## Prevention: Subunit vaccines:

1. **Cervarix** (bivalent vaccine for HPV-16 and <sup>only</sup> <sub>means 2</sub> HPV-18).

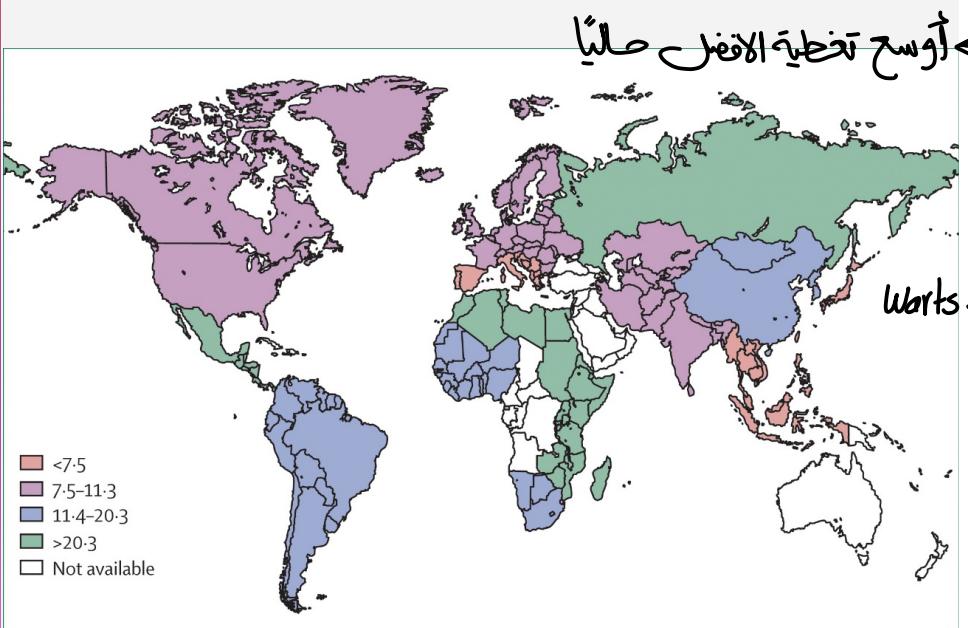
يعني تحمي ضد شعتين HPV-16, HPV-18

2. **Gardasil** (quadrivalent vaccine for HPV-6, <sup>Cancer & warts</sup> <sub>means 4 types</sub> HPV-11, HPV-16, and HPV-18).

3. **Nonavalent vaccine** (for the following types: <sup>شعتين</sup> <sub>means 9 types</sub> 6, 11, 16, 18, 31, 33, 45, 52, 58). Cancers

**Epidemiology:** The global HPV prevalence is about 10%.

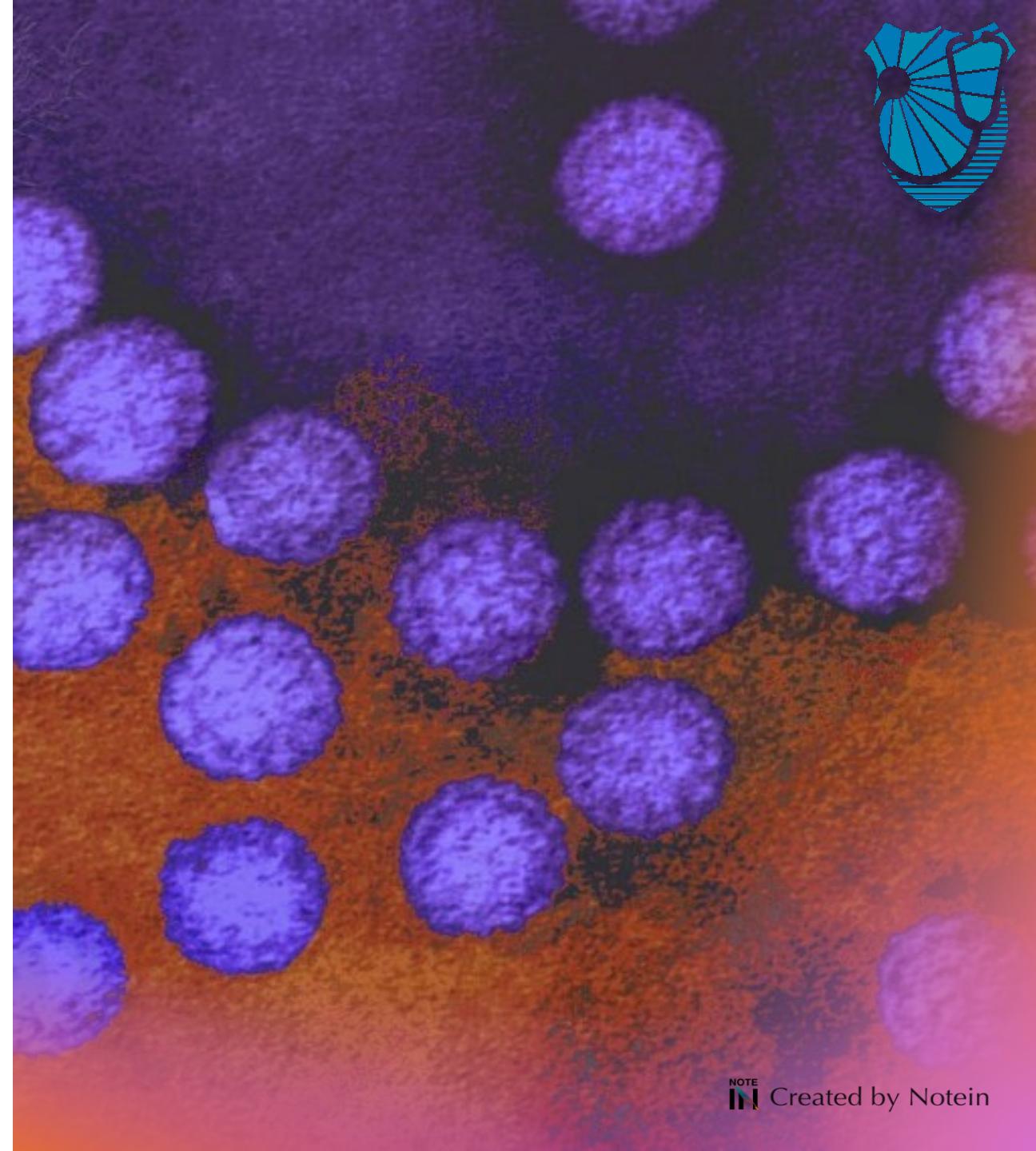
يعني حوالي 10% HPV هم





# Polyomaviridae

- Double-stranded DNA, non-enveloped viruses that replicate in the nucleus  
*نفس الترتيب والتسلسل لـ HPV بسلسلتين مختلفتين*  
*relatively resistant*
- JC virus, BK virus and Merkel cell polyomavirus
- Most of these infection remain latent in the body without symptoms.  
*asymptomatic*  
*\*AIDS, transplant*  
*شائع في بعض الحالات في نفاس ملائكة*  
*The virus present but silent*
- Transmission: not established





# Polyomaviridae

## Clinical features:

Bladder  
(cystitis)

التهاب المثانة المزمن

A. BK

or renal transplant

Why?

AIDS

PML

مرض عصبى خىنر  
Demyelination

B. JC virus: progressive multifocal leukoencephalopathy  
(PML) in AIDS patients.

(PML) in AIDS patients.

سبب إعادة تشريح  
Latent Virus  
with immunosuppression.

C. Merkel cell polyomavirus: Merkel cell carcinoma (rare skin

cancer). So, Merkel cell polyomavirus is an oncovirus

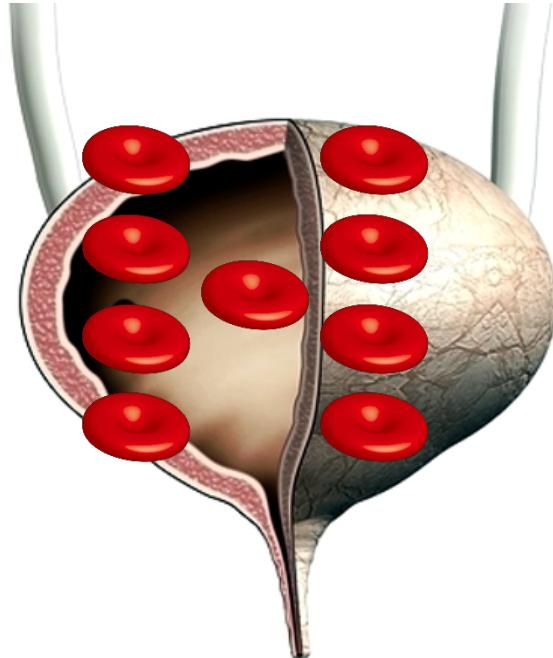
Pictures next  
Slide :-

HPV (oncogenic) → Cervical Cancer

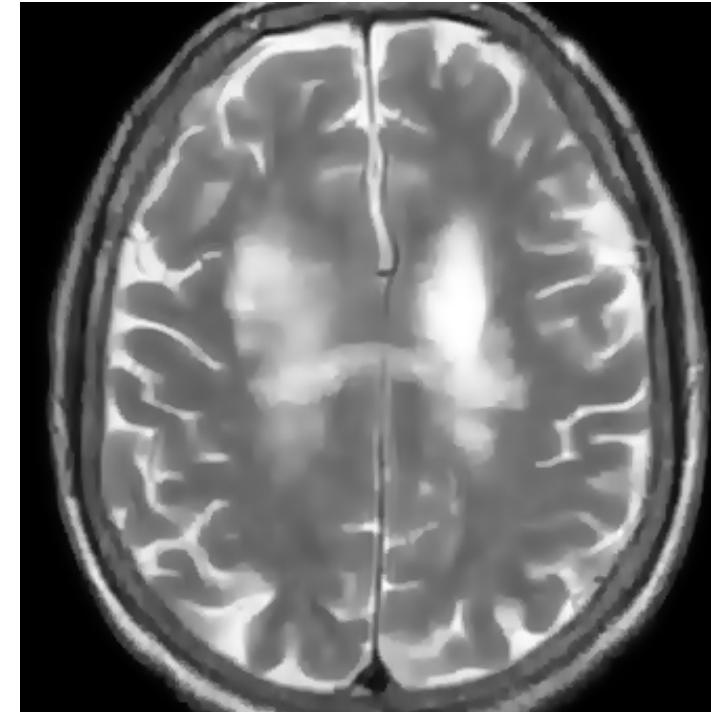
MCPyV (oncogenic) → Merkel cell Carcinoma  
Created by Notein  
Rare Skin Cancer



# *Polyomaviridae*



BK virus: Hemorrhagic cystitis



JC virus: Progressive multifocal leukoencephalopathy (PML)



MCPyV: Merkel cell carcinoma



# *Polyomaviridae*

## Diagnosis:

A. PCR  $\rightsquigarrow$  DNA كشف

B. Radiology  $\rightarrow$  PML (MRI brain)  $\xrightarrow{JC}$  خصوصاً في

C. Histopathologic examination (Merkel) في الأورام

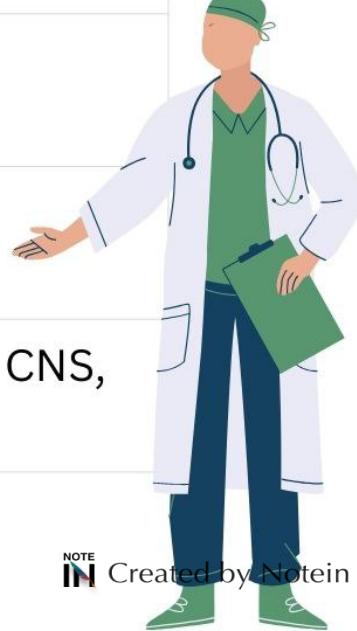
Treatment: No specific treatment.

Prevention: Vaccines have not been approved for prevention so far.

Epidemiology: Widely spread. A majority of humans have the infection by BK and JC viruses.

$\hookrightarrow$  as latent.

Feature	<b>Papillomaviridae (HPV)</b>	<b>Polyomaviridae</b>
Genome	dsDNA	dsDNA
Envelope	✗ Non-enveloped	✗ Non-enveloped
Replication	In nucleus	In nucleus
Latency	✗ Not prominent	✓ Common
Transmission	Direct contact, sexual	Not established
Tropism	Epithelial cells (skin & mucosa)	Variable (urinary tract, CNS, skin)



HPV Type	Risk	Disease
6, 11	Low-risk	Genital warts, Laryngeal papilloma
16, 18	High-risk	Cervical cancer
16	High-risk	Penile, anal, oropharyngeal cancers

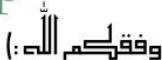
Aspect	Details
Clinical	Visual diagnosis (warts)
Pap smear	Cervical <b>screening</b>
PCR	Detects HPV DNA (typing)
Treatment	Usually none
If needed	Excision, laser, podophyllin/podophyllotoxin, imiquimod
Important	Treats lesions <b>X</b> not virus

Condition	Caused by
Common warts	Low-risk HPV
Condyloma acuminata	HPV-6, 11
Laryngeal papilloma	HPV-6, 11 (benign)
Cervical cancer	HPV-16, 18
Other cancers	High-risk HPV (esp. 16)

# POLYOMAVIRIDAE

Virus	Disease	Patient Group
<b>BK virus</b>	Hemorrhagic cystitis	Transplant patients
<b>JC virus</b>	PML (demyelination)	AIDS / immunosuppressed
<b>Merkel cell polyomavirus</b>	Merkel cell carcinoma	Skin cancer (oncovirus)

if anything hard to read  
or understand you can  
post on Facebook and I'll  
help



🧠 Ultra-Fast Memory Map  
HPV  
6,11 → warts  
16,18 → cancer  
Pap smear → females only  
Vaccine → prevention  
Polyoma  
BK → bladder  
JC → brain (PML)  
Merkel → skin cancer  
Latent + immunosuppression

Feature	Details
Latency	✓ Very common
Symptoms	Usually asymptomatic
Reactivation	With immunosuppression
Diagnosis	PCR, radiology, histopathology
Treatment	✗ No specific antiviral
Vaccine	✗ None approved
Epidemiology	Widely spread (BK & JC in most humans)



**Thank You...  
Wishing you all the best!**

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