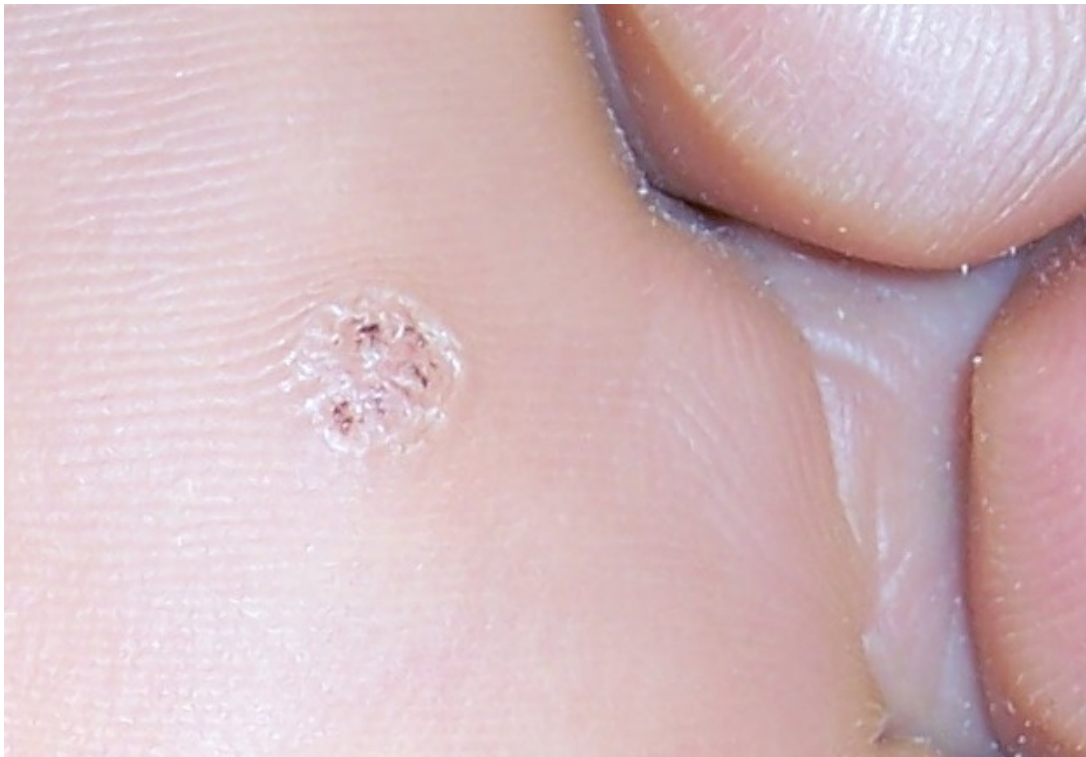


## Plantar Wart (Foot Wart) — Causes and Treatment

[See online here](#)

**Plantar warts are hyper-keratinized skin lesions that are found on the planter surfaces of the feet and hands. They are caused by the human papillomavirus and are usually painless. Despite being painless, they can cause embarrassment to the patient and can interfere with normal daily functions such as walking when they are found in the planter surface of the foot. Treatment can either be ignorance of warts, topical non-specific therapy or destruction of the epidermal cell layer by chemical or physical agents.**



### Definition of Plantar Warts

Plantar warts are caused by **human papillomavirus** and are also known as **verruca pedis**. Warts caused by the human papillomavirus can be found in any part of the human body, but this discussion will mainly be concerned with warts that are found on the **plantar surfaces of the feet and hands**. The lesions are **well-circumscribed** and have **hyperkeratosis**.

# Epidemiology of Plantar Warts

Warts, irrespective of their site, are **very common among adults and children** and their prevalence is estimated to be about **7 to 12 per 100**. Children are more likely to have plantar warts and the **prevalence in children is approximately 20%**.

**Immunocompromised patients** are more likely to have extensive warts that can transform into **malignant lesions**.

For obscure reasons, plantar warts are **more common in whites** compared to other races. The condition is **common in both genders** without any gender preference.

## Pathophysiology of Plantar Warts

It is hypothesized that the human papillomavirus cannot enter the body unless the skin is traumatized or damaged; therefore, a **skin injury** is thought to precede the formation of plantar warts. Once the virus gains access to the body, it is known to invade and reside in the third layer of the skin also known as the stratum spinosum.

In the **stratum spinosum**, **keratinocytes** are formed and **keratinocyte differentiation** takes place. It is hypothesized that the **human papillomavirus DNA synthesis** is dependent on DNA sequences related to keratinocytes production and differentiation which explains the preferential localization of the virus in the stratum spinosum skin layer.

**Viral DNA synthesis** starts within the upper layers of the stratum spinosum and granulosum skin layers which is followed by the assembly of the virions. Another important pathogenic feature of the human papillomavirus is its ability to **embed itself within the surrounding papillaries** which makes it undetectable to the different natural defense mechanisms found in the different skin layers.

The viral DNA was found to be related to **enhanced basal cell replication** and **hyperplasia** of the granular cell layer of the skin. **Keratinocytes** show signs of **dysplasia** and **damage** which is thought to be related to the proliferation of the viral DNA.

## Clinical Presentation of Plantar Warts

The exact clinical presentation of plantar warts might be different due to the **different types** of human papillomaviruses.

**Common symptoms are :**

- Dried thickened skin on the plantar surface of the foot
- Pain in the lesion while standing, walking or on applying pressure.
- The black dot-like appearance on the dried skin due to small capillary hemorrhages.

Currently, **more than 100 sub-types** of human papillomavirus have been identified.

The most commonly identified viral sub-types are human papillomavirus types 2, 4, 7, 26-29 and 57. These viruses cause **small papules** that are **rough** and **irregular in shape**. They are **hyperkeratotic**. These warts can be found in the **feet, hands, fingers, and lips** in addition to the **genital areas**.

| Human papillomavirus | Warts   |
|----------------------|---|
| <b>Type 1</b>        | <ul style="list-style-type: none"> <li>• Painful plantar warts</li> <li>• Single or multiple; more commonly found in children</li> </ul>  |
| <b>Type 2</b>        | <ul style="list-style-type: none"> <li>• Raised flesh-colored plaques with multiple small warts</li> <li>• Treatment-resistant</li> </ul> |
| <b>Type 3</b>        | Grey or brown warts that occur on the face and the beard  |
| <b>Type 4</b>        | Small punctate warts that have a central depression which is painless   |

**Human papillomavirus type 4** warts might be similar to those caused by the human papillomavirus type 1, but the main difference is that they are painless and their **keratin layer** is hardened compared to the soft keratin layer of the human papillomavirus type 1 warts.

People who work in the **meat industry** are more likely to form a special kind of plantar warts that are **large in size** and have a **cauliflower appearance**. These warts are known as **butcher's warts** and are caused by **human papillomavirus type 7**.

Finally, **young women, children** and the **immunocompromised** might develop **flat warts** which are caused by **viral subtypes 3, 10, and 27-29**. These flat warts are known to resolve without any specific treatment.

## Diagnostic Workup for Plantar Warts

Plantar warts are diagnosed clinically and no laboratory investigations are needed to confirm the diagnosis. Patients might undergo confirmatory testing for research purposes. In that case, three main tools are available for the confirmation of the presence of the human papillomavirus.

New warts should be biopsied because older ones are more likely to yield a negative result. **Immunohistochemical detection** of the different human papillomavirus antigens and proteins can help in confirming the diagnosis.

Another possible method to confirm the presence of the virus is the utilization of a **Southern blot hybridization technique** which helps in the identification of the viral DNA. The most feasible option to confirm the status of human papillomavirus in the wart's sample is to perform a **polymerase chain reaction** to detect the viral DNA.

An interesting feature of the common warts is that once the dome is scrapped, **minute small thrombosed capillaries** can be seen. They appear as small black dots within the wart.

It is important to emphasize that all of these tests are only used for research indications, but they are not clinically indicated unless in doubt. Because human papillomavirus warts might be **pre-malignant** in few cases, a biopsy can help differentiate a malignant from a benign lesion.

## Treatment of Plantar Warts

The easiest and most feasible option to treat warts is simply to **ignore** them. In healthy individuals, most warts are known to eventually resolve without any specific treatment. Unfortunately, this process can take years and might be unacceptable to some patients.

As we have explained, viral DNA synthesis and viral replication are highly dependent on keratinocytes' differentiation; therefore, one method to treat plantar warts is to simply **destruct the epidermal cell layers by chemical or physical means**. For instance,

salicylic acid can be used to alter the normal architecture of the epidermis and this is known to alter the viral replication process. Eventually, the viral antigens become exposed to our **immune system** which helps in clearing out the virus from our body.

**Cryotherapy** is also used to alter the outer layers of the epidermis in the wart. Liquid nitrogen is usually used to destroy the epidermis and initiate an immune response to the exposed antigens.

Other treatment options include **silver nitrate** which, when injected into the wart, can induce a response in up to 60% of the cases within 6 weeks. **Imiquimod** is a recently approved immune modifier drug that was found to be effective in the treatment of both genital and common warts. **Tretinoin** was found to be effective against flat warts in children.

**Immunocompromised patients** and those with **extensive wart disease** can receive **intravenous cidofovir**. This treatment, however, should be restricted to extensive and severe disease only because of the risk of **nephrotoxicity**.

## References

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