A REVIEW ON ETIOLOGY AND CHALLENGES ASSOCIATED WITH VARIOUS THERAPIES FOR THE TREATMENT OF PSORIASIS

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**Keywords:**
Etiology, Red-scaly skin, Biological drugs, T-cells, Cytokines

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**ABSTRACT:** Psoriasis is autoimmune, hyperproliferative skin disease, which is affecting 2-5% of the population. Etiology of psoriasis is multifactorial. The disease is identified as periodic recycle of events with red-scaly skin plaques. The epidemiology of Psoriasis is still unknown. From medication, this disease can only be prevented. Currently, there are many approaches to cure this disease, but still, no approach has completely cured the illness. New treatments are available for psoriasis, which are derived from biotechnology; they are known as biological drugs. The discovery of these new drugs derived from biotechnology prevents the activation of T-cells and targets cytokines. These drugs are less toxic and better functional, so patients, as well as a dermatologist, prefer the use of these biological drugs for the treatment of psoriasis over topical therapy, phototherapy, and systemic therapy. This review gives a detailed explanation of current therapies for the treatment of psoriasis and challenges associated along with it.

**INTRODUCTION:** Psoriasis is a proliferative disorder of the skin with repeating events of hyperkeratosis and inflammation with the worldwide manifestation around 2-5% 1-3. It is characterized by periodic recycling of red and sharp scaly skin plaques 4. Psoriasis is classified into chronic, plaque, guttate, pustular, and erythroderma. Among all the above types, plaque psoriasis is the major one 5-6. The etiology of this disease is multi-factorial that is the union of both environmental, as well as a genetic factor triggering the immune histological changes noticed in the skin 7. However, the cause of psoriasis is still unknown.

The amount of body affected by the psoriatic plaques is studied using percentage which is mild psoriasis (<2%), moderate psoriasis (2-10%) and severe (>10%) it may vary from patient to patients 8. In the recent days, patients suffering from psoriasis shall often express their feeling of consciousness, anger, helplessness, embarrassment, and frustration 9-10, which eventually is followed by low confidence, the absence of self-assurance, poor self-visualize and huge low feeling of prosperity 11.

Psoriasis is associated with diseases like diabetes, cardiovascular diseases, hypertension, and hypercholesterolemia 12-13. The connection between psoriasis with a cardiometabolic disorder like hypertension, obesity, and chronic kidney disease were reported 14 and has been confirmed via inspection in pediatric patients 15. World health organization (WHO) says that psoriasis is the most suffering autoimmune diseases in the US. According to world psoriasis day, around 2-3%
worldwide and 125 million people are suffering from psoriasis. According to study 16 in the US, 7.5 million (2.2%) of the American population are suffering from psoriasis. Prevalence of psoriasis in Africa resident American’s is 1-3% when compared with 2.5% of Caucasians.

The prevalence study states that psoriasis in adults ranging from 0.91 to 8.5% and same in case of the children, which is 0-2.1% 17. Prevalence data of psoriasis in India is obtained from studies carried out in the hospitals and studies conducted in medical colleges of north India such as Calcutta, Patna, Lucknow, New Delhi, and Amritsar. The total incidence of dermatological patients was ranging from 0.44 - 2.22% and the prevalence of psoriasis was 1.02%, due to the different climatic conditions, food habitat, lifestyle, and genetic difference, etc. In Amritsar, the incidence of psoriasis was found to be 2.2% compared to eastern India. Later, the study was conducted on a large number of patients, and the occurrence of psoriasis among dermatology patients was observed to be 2.8% in both male and females 18,19,20.

Among the current accessible medications like systemic therapy, phototherapy, and topical therapy, the treatment observed is not effective and safe in just preventing the though as it is not able to cure the complete illness 21. The treatment for psoriasis is dependent on patient age, general health, and severity of the pathology, comorbidities, and areas of the body affected 22. Novel colloidal drug delivery system (NDDS) aims at establishing the therapeutic effects of the existing drugs. It's size ranging from 1 nm 23. The NDDS has various advantageous over the conventional drug delivery system because of its increased drug bioavailability, minimized drug degradation, minimum loss of drug, prevents toxic effects and easy to handle with better patient compliance 24. New treatments are available for psoriasis, which are derived from biotechnology; they are known as biological drugs. Based on the action mechanism, these biological drugs are classified into two classes. Currently, available drugs will prevent the activation of T-cell and target cytokines 25. Psoriatic patients, as well as a dermatologist, prefer the use of the biological drugs for the treatment of psoriasis over topical, phototherapy, and systemic therapy 26.

Pathogenesis of Psoriasis: The mechanism behind psoriasis is still unknown. Pathologic process of psoriasis is partitioned into three stages.

I. Activation of T-lymphocyte: It describes the role of Antigen-presenting cell (APC’s) located in dermis & epidermis to identify and interact with an unidentified antigen.

An antigen binds to the major histocompatibility complex of APC’s  
Migration of antigen towards the lymph nodes carrying APC’s  
Antigen stimulates T-cells  
Activated T-cells migrates towards blood vessels and epidermis  
Release of cytokines  
With the influence of cytokines, psoriatic skin is formed

II. Exodus into the Skin: On initiation of T-lymphocytes, it takes two pathways - either multiplies to create memory effector cells or enter the circulatory framework to move to the aroused skin 27.

III. The Function of Cytokines: It takes significant work in the movement of psoriasis. Cytokines include tumor necrosis factor alpha, interleukin- 23, interleukin-17 that helps in the production of psoriasis lesions 28.

Psoriasis Types:
A. Plaque Psoriasis: This type of psoriasis is the most common type which can be seen in 90% of patients with the psoriatic disorder 29. It can be termed as Psoriasis vulgaris. In this kind of psoriasis, characteristics of the lesion are sharp, round, oval plaques and silvery white scales adhere to plaques loosely. Usually, the lesions can be seen near elbows, trunk, knees, and scalp 30.

B. Guttate Psoriasis: The word gutta is derived from Greek, which means droplet. The size of the lesion ranges from 1-2 mm 31.
affects children with upper respiratory tract infection or streptococcal infection. Lesions instantly grow on the trunk, arm, legs, and scalp. This type is only 2% of the psoriasis population.

C. Pustular Psoriasis: This type of psoriasis is a very rare case, but it drives lifelong, it is characterized by inflammation of the skin. This condition termed to be von zum bush psoriasis. It can be majorly seen near finger, hands, toes, feet. Only 5% of the population has this type of psoriasis.

D. Erythroderma Psoriasis: It is an uncommon type of psoriasis which involves whole body surface area. It gradually increases, due to the poor control in an individual. It is a life treating skin disease and the following conditions should be considered during diagnosis like drug rash, atopic dermatitis in children. Erythroderma is very harmful to the functions of the skin and leads to hypothermia, due to loss of iron, foliate and vitamin B12.

E. Nail Psoriasis: Fingernails are more involved than toenails in nail psoriasis. Currently, limited treatment options are available for nail psoriasis and poorly efficacious. Onycholysis is the characteristic feature of nail psoriasis. Underneath the nail plate, nail bed shall often show orange-yellow or oil spots. Discolouring of the nail plate with thickened keratinous materials gathered under the nail plate, which is called subungual hyperkeratosis.

F. Inverse Psoriasis: This type of psoriasis appears in the skin overlays such as territories of intergluteal and axillary areas. The regions of moist psoriasis are less scaly than the plaques form of psoriasis.

Challenges Associated with Oral, Biologics, Phototherapy, and Topical:
A. Challenges Associated with Oral Therapy: A patient suffering from mild to severe psoriasis, systemic therapy is necessary when they are not responding to the phototherapy. Methotrexate, Cyclosporine, Acitretin is used for the systemic treatment of psoriasis and have the advantage of oral administration well. Methotrexate found to be economical. Treatment was troublesome for people around 25% treated with phototherapy and 4% treated with systemic therapy. Systemic therapy has limited side effects. Adverse reactions that are not life threatening are the primary reasons for the use of systemic therapy.

Combination of both cyclosporine and methotrexate are very hazardous with drug interactions. Recommended instructions for the use of safe systemic agents are highlighted below.

I. Methotrexate: Methotrexate is an economical and very effective treatment for psoriasis, which has been utilized from the past decades. It is widely used for psoriasis, due to its anti-proliferative, anti-inflammatory & immunosuppressive actions. Methotrexate is a dihydrofolate reductase inhibitor resulting in reduced synthesis of purines and pyrimidines necessary for DNA synthesis. Downstream, this decreases hyperplasia of the epithelium and induces apoptosis of T-cells.

Methotrexate is given orally week by week cautiously, and the doses shall be increased till a minimum response is accomplished. The dose should not be greater than 30 mg/wk and shall be decreased to a minimum quantity needed to control psoriasis. A test dose ranges from 2.5-5mg.

Methotrexate is contraindicated in women who are conceived, pregnant, and suffering from impaired kidney function should not consume. Precaution is taken for the patients who are associated with liver infections; it causes hepatotoxicity as a common long term side effect. Continues long term use of methotrexate will lead to slight adverse effects like mucosal ulcerations, anorexia, fatigue stomatitis, and nausea. To prevent these side reactions, routine blood checks up is recommended as per the guidelines.

II. Cyclosporine: It is an immunosuppressive which acts by inhibition of calcineurin, as a result of inhibition it decreases the production of IL-2, which is helpful in the activation of T-cell. Methotrexate and Cyclosporine are widely used for the treatment of psoriasis from the past few decades.

The optimal dose of cyclosporine is based upon body weight. Initially, a dose of cyclosporine is 2.5mg/kg to 3 mg/kg which is divided into 2 doses daily & suggested to extend the dose which should
be stable for four weeks and slightly increasing the dose by 0.5 mg/kg/d till the disease is controlled.

In severe disease conditions, another dosing approach of cyclosporine is recommended, i.e. to treat the disease initially at a high dose like 5 mg/kg/d, and accordingly, the dose is decreased with the rate of disease control. Cyclosporine is not a good choice for long-term therapy for psoriasis. Use of CSA leads to contradictions like renal insufficiency and malignancy. Nephrotoxicity and Hypertension is a serious adverse reaction of cyclosporine. Precaution should be taken while using cyclosporine as it may interact with any other medications.

III. Acitretin: These are the vitamin A oral systemic agent derived from a retinoid, which has been used for the treatment of psoriasis. Acitretin acts by interfering with epidermal cell growth and differentiation. It is typically used to treat an erythrodermic and pustular type of psoriasis. The half-life of Acitretin is 30 h after that it may transform into the second generation of retinoid known as Etretinate and having a half-life of 168 days. The single dose of Acitretin is 10-50 mg/d, and in the combination lower dose is 25 mg/d is used to reduce the side effects. In case, it is used in combination of UV, the dose of light should be reduced by 30-50% in pregnant women. Adverse effects of Acitretin including cheilitis, oral and nasal mucosa, hair loss, dryness of eyes, burning or sticky skin epistaxis and xerosis. When Acitretin is used in combination with methotrexate, precautions should be taken or else it may lead to the hepatotoxicity and interfere with the contraceptive effect of micro-dosed progestin minipill.

B. Challenges Associated with Biologics: Biologics are the drugs, which are derived from the biotechnology. Many of the new biologics are undergoing clinical studies for the prophylaxis of psoriasis, which are having a similar action mechanism. Bimekizumab is in phase 3 trials, which is an IL-17 inhibitor, but unique to any other IL-17 antibody. Bimekizumab inhibits both IL-17A and IL-F. It has increase efficacy and rapid onset of action. Risankizumab has shown safety and efficacy in multiple phases 3 trial. In phase 2, it is compared with ustekinumab and reported that Risankizumab could be used for the treatment of moderate to severe plaque psoriasis.

Biologics mentioned so far will interact with one of the cytokines. Eculizumab is an antibody with a unique mechanism of action and acts as induce apoptosis of late-stage activated T-cell. By eliminating the T-cell, which is pathogenic for psoriasis, maintaining the immature host T-cell is a risk of malignancy. Tremelimunab activates the regulatory T-cells, but until studies are performed, it is unclear that this drug will become one among many therapies available for the disease treatment.

Management of Biologics in Patients: Management of the patient will depend upon the doctors prescribing the solutions. Doctors recommend basic blood check up, which include metabolic and complete blood counts, initially for every 3 months to check for any abnormalities. Once the patient's dose is the stable, blood work should be examined for every 6 months or depending on the physician's comfort. Screening for tuberculosis is performed yearly once. After the complete review, it is concerned about the prolonged infections, fatigue, unexpected weight loss, joint pain, and abdominal pain.

Skin examinations should be performed to detect skin cancer, and precaution should be taken to check all folds. Indications of edema should be sorted out in patients on TNF-inhibitors to evaluate for any signs of new or increased heart failure.

C. Challenges Associated with Phototherapy: If topical therapy is not effective in Psoriatic patients, the other option for the treatment of psoriasis is Phototherapy. Phototherapy includes the use of ultraviolet radiation (UVR) as a method of diagnosis for treating psoriasis. The wavelength range is 100 to 400 nm, and the therapeutically suitable range is from 290 nm and above. The use of UVR for the treatment of psoriasis tend to be advantageous to a patient with extreme disease conditions making it topically feasible. Phototherapy can be given as ultraviolet A1 (UVA1), (PUVA) Ultraviolet A plus psoralen, ultraviolet B (UVB) & a monochromatic UVB source of light at 308 nm. PUVA is not used consistently, as it can cause skin cancer on repeated exposure. PUVA is substituted with UVB, which is
primary phototherapy module used on psoriasis patients. Currently, the most commonly used phototherapy is narrowband UVB, *i.e.* which is delivered at 311 nm with a better effectivity than UVB sources in treating psoriasis.

Phototherapy works by adjusting the cytokine expression, apoptosis of lymphocytes, and advance cutaneous immune suppression 50. As per the National Psoriasis Foundation reports, only 1/3rd of the individuals suffering from the disease have undergone phototherapy 51. Standard In-office phototherapy is a tedious therapy consisting of 3-5 sessions week by week. In addition to that, patient as well as physicians, are stressed about the harmful side effects that occur on exposure to UV radiation like Photoaging, skin cancer, sunburn, *etc.* 52 According to the physician's point of view, phototherapy is costly due to the equipment, space maintenance charges and requires highly skilled phototherapy staff.

So, to overcome this restriction of in-office phototherapy, an alternative solution is individual phototherapy in houses and tanning beds. Phototherapy in-house and outpatient is the almost similar effect, only a small difference in the adverse reactions. Even some physicians suggest the home phototherapy because it is not time-consuming, safe usage, cost-effective and efficacious treatment. If the home or office phototherapy is not available. Indoor tanning shall be the viable option, suggested by the dermatologists. It is trouble-free to the patients and used extensively. These tanning beds might have significant fluctuation in the UV yield, which is the present challenge in getting a proper dose 53. Therapy might be self-administered by the patients. In any type of UV therapies, there is a possible risk of skin cancer. During the change of bulbs, precaution should be taken.

**D. Challenges Associated with Topical Therapy:** These are the medications having direct contact with the skin. These topical medications are the base treatment for the patients suffering from mild psoriasis to moderate psoriasis. Topical can be formulated as Ointment, Cream, Lotion, Gel, and various other forms. Benefits of these topical medications are reduced side effects, delivered in an effective manner, low cost, and non-invasive manner. Topical therapy is not so effective in terms of treatment when compared to the systemic therapy due to the slow absorption, continuous use of the medication, time-consuming to apply, an unpleasant sensation like greasy and bad odor 54-55. Topically applied drugs for psoriasis includes vitamin D analogs, Calcineurin inhibitors, Anthralin, Topical Corticosteroids. They can be given in combination such as Corticosteroid with vitamin D analog or Corticosteroid with Salicylic acid.

From the recent decade, colloidial carrier system, for example, solid lipid nanoparticles, nanostructured lipid bilayers, *etc.* are better vehicles of topical delivery. In this type of systems, the drug delivery is based upon the ability of the drug to penetrate via many skin barriers, the release of drug and their stability at nano-sized.

The major challenge in topical drug delivery is –

**a.** At first insufficient carriers for transporting of anti-psoriatic drugs and it depends on the physicochemical characteristics of the carrier 56, which leads to the variation in drug efficacy and drug absorption,

**b.** There is no proper animal model with the psoriatic condition, which lacks *in-vivo & in-vitro* studies 57.

**c.** Another challenge is due to the long-term procedure; psoriatic patients notice that the current treatment is not effective. Therefore, new therapy should be developed, which can be applied once a day.

**d.** Any new topical formulations must include proper cosmetic gracefulness like easy to use, no staining on clothes, bedding, *etc.* after application absorption rate should be rapid, less greasy.

**e.** In some cases of psoriasis, a combination of two therapies are used to achieve the quick response with minimal adverse effects; therefore new topical formulations have to be developed for better efficacy and safety during the usage.

**f.** The product should be in such a form that it can be used on all the body parts, including hair-bearing sites in case of plaque psoriasis 58-59.
Due to the long term therapy, patients have a fear of topical therapy as it contains corticosteroids, which may cause side effects.

They also prefer different vehicles to treat different locations affected by the disease (Scalp), which is very complex and decreases the adherence of the use of topical therapy 60.

**TABLE 1: CURRENT THERAPY FOR TREATMENT OF PSORIASIS**

<table>
<thead>
<tr>
<th>S. no.</th>
<th>Model Drug</th>
<th>Formulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5-fluorouracil</td>
<td>NLC-Hydrogel</td>
</tr>
<tr>
<td>2</td>
<td>Tacrolimus and curcumin</td>
<td>Liposphere gel</td>
</tr>
<tr>
<td>3</td>
<td>Acitretin</td>
<td>NLC Gel 63</td>
</tr>
<tr>
<td>4</td>
<td>Acitretin and aloe-emodin</td>
<td>Nano gel 64</td>
</tr>
<tr>
<td>5</td>
<td>Betamethasone dipropionate</td>
<td>NLC-Ointment</td>
</tr>
<tr>
<td>6</td>
<td>Methotrexate</td>
<td>NLC 66</td>
</tr>
<tr>
<td>7</td>
<td>Methotrexate and Trioxysalen</td>
<td>Niosomes b7</td>
</tr>
<tr>
<td>8</td>
<td>Methotrexate</td>
<td>Nano-gel 88</td>
</tr>
<tr>
<td>9</td>
<td>Tacrolimus</td>
<td>Hydrogel 69</td>
</tr>
<tr>
<td>10</td>
<td>Mometasone furoate</td>
<td>SLN-Gel 70</td>
</tr>
<tr>
<td>11</td>
<td>Betamethasone dipropionate and Salicylic acid</td>
<td>Nanocarrier</td>
</tr>
<tr>
<td>12</td>
<td>Cyclosporine</td>
<td>Hydrogel 71</td>
</tr>
<tr>
<td>13</td>
<td>Natural excipients (egg albumin and Xanthum gum)</td>
<td>Anti-psoriatic Gel</td>
</tr>
<tr>
<td>14</td>
<td>Silimarin</td>
<td>Topical Gel 74</td>
</tr>
<tr>
<td>15</td>
<td>Cyclosporine</td>
<td>Topical Gel 75</td>
</tr>
<tr>
<td>16</td>
<td>Calcipotriol</td>
<td>Emulgel 76</td>
</tr>
</tbody>
</table>

**Biological Agents for Treatment for Psoriasis**

- **Ustekinumab:** A human monoclonal antibody, which targets IL-23 & 12 (Interleukins). Interleukins are proteins, which occurs naturally and regulates the immune system by activating certain T-cell 77. Based on the body weight dose is calculated. In the case of adults, 45 mg is given at 0, 4, and 12 weeks after that, it will block the Interleukin -12 and Interleukin -23 responding to activated T-cells. It binds to the p-40 subunit 78. The common adverse effect is a serious allergic reaction, headache, tiredness, upper respiratory infection 79.

- **Adalimumab:** Adalimumab is an anti-TNF agent. It is a monoclonal antibody for the treatment of psoriasis and accepted by USFDA (United States Food and Drug Administration) and EMA (European Medicines Agency). It is a subcutaneous injection with immunoglobulin GI monoclonal antibody binding to the TNF-alpha and inactivates, promoting the down-regulation of the inflammatory reactions. The Dose range of Adalimumab is 80 mg for adults in case of subcutaneous injection that is followed by 40 mg given every other week 80-81. Medication can also use used for Rheumatoid arthritis, Psoriatic arthritis, and Crohn's disease 82. The adverse effects are nasopharyngitis, upper respiratory infection, and sinusitis. Adalimumab was correspondence with an increased risk of non-melanoma skin cancer as had been described in other clinical trials 48.

- **Etanercept:** Etanercept is TNF- alpha inhibitor utilized in the prophylaxis of psoriasis 83 and approved via USFDA for psoriatic arthritis & server plaque psoriasis. By inhibiting the interaction with a cell surface receptor, it will antagonize the action of TNF receptor. The standard dose of Etanercept for adults is 50 mg subcutaneously, two times a week for the initial three months of treatment. The pediatric standard dose is 0.8 mg/kg weekly 84. Bioavailability is 56-76% S.C. and the half-life is 70-132 h. Side effects are skin infection, sore throat, dizziness headache, hair loss fatigue, and rash 85-86.

- **Infliximab:** It is a monoclonal antibody, which is widely used in the treatment of autoimmune system disease like psoriasis and binding to TNF-alpha and cases programmed cell death of TNF, which activates T- lymphocytes & plays a vital role in inflammation 87. It neutralizes the effect of TNF-alpha by binding to transmembrane TNF-alpha, which is administered by intravenous route. It is also used in the treatment of diseases like Crohn's disease, Rheumatoid arthritis, and ulcerative colitis 88. The plasma half-life is 8-9.5 day, effective single dose is 5mg/kg for every alternative week, which is followed by regular dose after 8 weeks 89. The side effects are infusion reactions, progressive heart failure, severe infections, failure of liver rarely 90.

- **Alefacept:** In 2003, Alefacept was the first biologic to accept for the treatment of psoriasis, and it was withdrawn in 2011. Alefacept is an effective immunosuppressant drug and recombinant protein in the treatment of
psoriasis. The drug has a dual mechanism of action. Alefacept interferes on T-cell membrane of CD2 cell, which leads to inhibition of co-stimulatory lymphocyte function and activates CD4+ and CD8+ cells. Another mechanism is T-lymphocytes apoptosis, increases the binding activity between T cells and natural killer cells. Bioavailability is 63% when administered via intra-muscular. Side effects are itching, muscle aches, nausea, allergies risk of infections, malignancies.

**TABLE 2: NATURAL THERAPY FOR THE TREATMENT FOR PSORIASIS**

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aloe vera</td>
<td>It is stem-less, the drought-resisting plant belongs to the family Liliaceae, and a recent research study has shown that it has pharmacologically active agent used for the treatment of psoriasis. It has properties like wound healing, anti-pruritic &amp; anti-inflammatory. Hence, it has proven that Aloe vera as an effective remedy for the management of psoriasis. It moisturizes the skin by forming a protective layer which prevents from bacterial growth.</td>
</tr>
<tr>
<td>Capsicum annum</td>
<td>It belongs to the family Solanaceae; it also called as Cayenne. It contains capsaicin, which is showing the activity of reduced itching and pain in psoriasis. It shows its activity by depleting neurotransmitters in the sensory nerves. American Academy of Dermatology studied by external application to the skin, and it was an effective herb for pruritic psoriasis.</td>
</tr>
<tr>
<td>Allium cepa</td>
<td>It belongs to the family Liliaceae, it has the capacity of extracting union gels which enhances the appearance of scars, and this concentrated gel enhances the smoothness, feel and the worldwide manifestation of the site study at 4, 6 and 10 weeks evaluated by a blinded examiner.</td>
</tr>
<tr>
<td>Silybum marianum</td>
<td>It belongs to the family Daisy family; Its common name is milk thistle. The liver neutralizes certain toxins associated with psoriasis. This herb helps in inhibiting the human T-cell activation; it has anti-inflammatory properties as well as decreases the unbalanced proliferation of skin cells. Side effects like gastrointestinal disturbances and mild allergic reactions have been seen. These herbs are available in the form of a tablet or liquid extract.</td>
</tr>
<tr>
<td>Wrightia tinctoria</td>
<td>It belongs to family Apocynaceae. These leaves have properties like anti-inflammatory, astrangent, anti-bacterial activity. These leaves are containing beta amyrin and glucoside, which acts towards skin healing properties of the plant. It was used to treat different types of skin disorder.</td>
</tr>
</tbody>
</table>

**TABLE 3: FDA APPROVED DRUGS FOR PSORIASIS**

<table>
<thead>
<tr>
<th>Year of approval</th>
<th>Drug</th>
<th>Specific Psoriasis</th>
<th>Side effects</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>Ilumya (Tildrakizumab-asmn)</td>
<td>Plaque Psoriasis</td>
<td>Infection at upper respiratory tract, Reactions near the Injection site</td>
<td>Sun Pharmaceuticals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Diarrhea</td>
<td></td>
</tr>
<tr>
<td>Dose</td>
<td>Ilumya administered – S. C injection and 100 mg is suggested for weeks of 0, 4, &amp; every 12 weeks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>Siliq (Brodalumab)</td>
<td>Plaque Psoriasis</td>
<td>Oropharyngeal pain, Fatigue, Influenza, Nausea, A headache, Upper respiratory infections, Diarrhoea, Injection site reactions</td>
<td>Valeant Pharmaceuticals</td>
</tr>
<tr>
<td>Tremfya (Guselkumab)</td>
<td>Moderate-to-severe plaque psoriasis</td>
<td></td>
<td></td>
<td>Janssen Biotech</td>
</tr>
<tr>
<td>Dose</td>
<td>Siliq administered as Subcutaneous injection; the Recommended dose is 210mg administered by S.C at weeks of 0, 1, &amp; 2 followed by 210 mg every week. If a response has not been seen, it is said to discontinue the treatment. Tremfya is administered – S. C, Injection. Weeks of 0, 4 &amp; every 8 weeks the dose is 100mg</td>
<td></td>
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<tr>
<td>2016</td>
<td>Taltz (Ixekizumab)</td>
<td>Plaque psoriasis</td>
<td>Injection site reactions, Upper respiratory tract infections, Nausea, Tinea infections</td>
<td>Eli Lilly</td>
</tr>
<tr>
<td>Dose</td>
<td>Plaque psoriasis: Dose -160 mg, split in two injections dose of 80mg - Week 0, after that 80 mg at Weeks for 2, 4, 6, 8, 10 &amp; 12, then 80 mg every 4 weeks Active psoriatic arthritis: Dose - 160 mg via S.C &amp; split in two 80 mg for Week of 0, after that 80 mg every 4 weeks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Enstilart (calcipotriene and betamethasone dipropionate)</td>
<td>Plaque Psoriasis</td>
<td>Hypocalcemia Application site irritation Skin hypopigmentation Nasopharyngitis, Diarrhoea, Infection at upper respiratory tract</td>
<td>LEO Pharmaceuticals</td>
</tr>
<tr>
<td>Cosentyx (Secukinumab)</td>
<td>Plaque psoriasis</td>
<td></td>
<td>Novartis</td>
<td></td>
</tr>
<tr>
<td>Dose</td>
<td>It is administered as foam for topical application. Applied on areas affected Daily one time for 4 weeks and gently rubbed. Not more than 60g, every 4 days should be used. Dose – 300mg via S.C. For Weeks of 0, 1, 2, 3, &amp; 4 after that 300 mg all 4 weeks. Each 300 mg dose - two S.C injection of 150 mg</td>
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</tbody>
</table>
CONCLUSION: Psoriasis is a multifactorial disease. The treatment for a complete cure with safety has not been found. There is a rapid improvement in recent years for prophylaxis of psoriasis but still no complete cure for this pathology. Researchers developed a new biological drug derived from biotechnology for effective long term treatment of psoriasis. Biological drugs are a substituent for conventional treatment of moderate to severe psoriasis. These biologics are expensive. They aim at immunological pathways of psoriasis and helps in developing a new biological treatment for treating the pathways of different type of psoriasis. These biologics shows the signs of more effectiveness towards psoriasis with reduced side effects than older and conventional drug delivery system. However, long-term therapy to enhance efficacy is under clinical trials and tests.

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