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

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ABSTRACT: Psoriasis is autoimmune, hyperproliferative skin disease, which is affecting 2-5% of the population. Etiology of psoriasis is multi-factorial. 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.

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The amount of body affected by the psoriatic plaques is studied using percentage which is mild psoriasis (<2%), moderate psoriasis (2-10%) and sever (>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]. Guttate psoriasis

affects children with upper respiratory tract infection or streptococcal infection [32]. 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 zumbush psoriasis. It can be majorly seen near finger, hands, toes, feet [33]. 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 [34]. 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 [35]. 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 threating are the primary reasons for the use of systemic therapy [36].

Combination of both cyclosporine and methotrexate are very hazardous with drug interactions. Recommended instructions for the use of safe systemic agents are highlighted below [37].

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 [38]. 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 [39].

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 [40]. 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 [41]. 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[42].

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 [43]. It is typically used to treat an erythrodermic and pustular type of psoriasis. The half-life of Acitretin is 49 h after that it may transform into the second generation of retinoid knows as Etretinate and having a half-life of 168 days [44]. 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% [37]. It is contraindicated 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 [45].

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 [46]. 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 [47].

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. Tremelimumab 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 u, 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 [48].

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[49]. 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 1/3rdof 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, colloidal 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].

g. Due to the long term therapy, patients have a fear of topical therapy as it contains corticosteroids, which may cause side effects.

h. 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

S. no.	Model Drug	Formulation
1	5-fluorouracil	NLC-Hydrogel [61]
2	Tacrolimus and curcumin	Liposphere gel [62]
3	Acitretin	NLC Gel [63]
4	Acitretin and aloe-emodin	Nano gel [64]
5	Betamethasone dipropionate	NLC-Ointment [65]
6	Methotrexate	NLC [66]
7	Methotrexate and Trioxysalen	Niosomes [67]
8	Methotrexate	Nano-gel [68]
9	Tacrolimus	Hydrogel [69]
10	Mometasone furoate	SLN-Gel [70]
11	Betamethasone dipropionate and Salicylic acid	Nanocarrier Hydrogel [71]
12	Cyclosporine	Microemulsions [72]
13	Natural excipients (egg albumin and Xanthum gum)	Anti-psoriatic Gel [73]
14	Silymarin	Topical Gel [74]
15	Cyclosporine	Topical Gel [75]
16	Calcipotriol	Emulgel [76]

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 [91]. The drug has a dual mechanism of action [92]. 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 [91]. Bioavailability is 63% when administered *via* intra-muscular. Side effects are itching, muscle aches, nausea, allergies risk of infections, malignancies [93].

TABLE 2: NATURAL THERAPY FOR THE TREATMENT FOR PSORIASIS

Aloe vera	It is stem-less, the drought-resisting plant belongs to the family Liliaceae, and a recent research study has shown that it is having pharmacologically active agent used for the treatment of psoriasis. It has properties like wound healing, anti-pruritic & anti-inflammatory. Hence, it has proven that *Aloe vera* as an effective remedy for the management of psoriasis [94-95]. It moisturizes the skin by forming a protective layer which prevents from bacterial growth
Capsicum annum	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 [96]
Allium cepa	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 [97]
Silybum marianum	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 is having 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 [98]
Wrightia tinctoria	It belongs to family Apocynaceae. These leaves have properties like anti-inflammatory, astringent, anti-bacterial activity [99]. 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 [100]

TABLE 3: FDA APPROVED DRUGS FOR PSORIASIS [101]

Year of approval	Drug	Specific Psoriasis	Side effects	Company
2018	Ilumya (Tildrakizumab-asmn)	Plaque Psoriasis	Infection at upper respiratory Reactions near the Injection site Diarrhea	Sun Pharmaceuticals
Dose	Ilumya administered – S. C injection and 100 mg is suggested for weeks of 0, 4, & every 12 weeks			
2017	Siliq (Brodalumab) Tremfya (Guselkumab)	Plaque Psoriasis Moderate-to-severe plaque psoriasis	Oropharyngeal pain, Fatigue, Influenza, Nausea, A headache Upper respiratory infections, Diarrhoea, Injection site reactions	Valeant Pharmaceuticals Janssen Biotech
Dose	Siliq administered as Subcutaneous injection; the Recommended dose is 210mg administered by S.C at weeks of 0, 1, & 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 & every 8 weeks the dose is 100mg			
2016	Taltz (Ixekizumab)	Plaque psoriasis Active psoriatic arthritis	Injection site reactions, Upper respiratory tract infections, Nausea, Tinea infections	Eli Lilly
Dose	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 & 12, then 80 mg every 4 weeks Active psoriatic arthritis**:** Dose - 160 mg via S.C & split in two 80 mg for Week of 0, after that 80 mg every 4 weeks			
2015	Enstilar (calcipotriene and betamethasone dipropionate)	Plaque Psoriasis	Hypocalcemia Application site irritation Skin hypopigmentation	LEO Pharmaceuticals
	Cosentyx (Secukinumab)	Plaque psoriasis	Nasopharyngitis, Diarrhoea, Infection at upper respiratory tract	Novartis
Dose	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, & 4 after that 300 mg all 4 weeks. Each 300 mg dose - two S.C injection of 150 mg			

2014	Otezla (Apremilast)	Moderate to severe Plaque psoriasis	A headache, including a tension headache, Infection upper respiratory tract, Nausea	Celgene
Dose	Otezla is given as tablet as oral administration. The tablet should not be a crush, split, or chewed. 1st Day -10mg in AM. 2nd Day - 10mg in AM&PM. 3rd Day - 10mg in AM & 20mg in PM. 4th Day - 20mg in AM & PM. 5th Day - 20mg in AM & 30mg in PM, Followed by 30 mg in AM &PM on 6th Day			
2009	Stelara (ustekinumab)	Plaque psoriasis	Infection at upper respiratory tract Headache, Fatigue, Diarrhoea	Janssen Biotech
Dose	Stelara- S.C injection. The weight of Patients ≤100kg (220 lbs): Initially 45mg & later 4 weeks, after that 45mg every 12 weeks The weight of Patients>100kg (220lbs): Initially 90mg & later 4 weeks, after that 90mg every 12 weeks.			
2003	Amevive (alefacept)	Psoriasis	Injection Site Pain Injection Site Inflammation Itching, Sore throat, Dizziness	Biogen IDEC
Dose	7.5mg *via* I.V (or) 15mg *via* I.M			

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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REFERENCES:

1. Mabuchi T, Chang TW, Quinter S and Hwang ST: Chemokine receptors in the pathogenesis and therapy of psoriasis. Journal of Dermatological Science 2012; 65(1): 4-11
2. Tsuruta D: NF-κB links keratinocytes and lymphocytes in the pathogenesis of psoriasis. Recent Patents on Inflammation & Allergy Drug Discovery 2009; 3(1): 40-8.
3. Krueger JG and Bowcock A: Psoriasis pathophysiology: current concepts of pathogenesis. Annals of the Rheumatic Diseases 2005; 64(2): 30-6.
4. Nograles KE and Krueger JG: Anti-cytokine therapies for psoriasis. Experimental Cell Research 2011; 317(9): 1293-300.
5. Galimova ES, Akhmetova VL and Khusnutdinova EK: Molecular genetic basis of susceptibility to psoriasis. Russian Journal of Genetics. 2008; 44(5): 513.
6. Campalani E and Barker JN: The clinical genetics of psoriasis. Current Genomics. 2005; 6(1): 51-60.
7. Foley P and Strober BE: Current and future oral systemic therapies for psoriasis. Dermatologic Clinics 2015; 33(1): 91-109.
8. Lebwohl M, Menter A, Koo J and Feldman SR: Combination therapy to treat moderate to severe psoriasis. Journal of the American Academy of Dermatology 2004; 50(3): 416-30.
9. Armstrong AW, Schupp C, Wu J and Bebo B: Quality of life and work productivity impairment among psoriasis patients: findings from the National Psoriasis Foundation survey data 2003–2011. PloS one 2012; 7(12): e52935.
10. Weiss SC, Kimball AB, Liewehr DJ, Blauvelt A and Turner ML: Quantifying the harmful effect of psoriasis on health-related quality of life. Journal of the American Academy of Dermatology 2002; 47(4): 512-8.
11. Kimball AB, Gieler U, Linder D, Sampogna F and Warren RB: Psoriasis: is the impairment to a patient's life cumulative? Journal of the European Academy of Dermatology and Venereology 2010; 24(9): 989-04.
12. Azfar RS, Seminara NM, Shin DB, Troxel AB and Margolis DJ: Increased risk of diabetes mellitus and the likelihood of receiving diabetes mellitus treatment in patients with psoriasis. Archives of Dermatology 2012; 148(9): 995-00.
13. Wu Y, Mills D and Bala M: Psoriasis: cardiovascular risk factors and other disease comorbidities. Journal of Drugs in Dermatology 2008; 7(4): 373-7.
14. Gisondi P and Girolomoni G: Cardiometabolic comorbidities and the approach to patients with psoriasis. Actas Dermo-Sifiliograficas 2009; 100: 14-21.
15. Paller AS, Mercy K, Kwasny MJ, Choon SE and Cordoro KM: Association of pediatric psoriasis severity with excess and central adiposity: an international cross-sectional study. JAMA Dermatology 2013; 149(2): 166-76.
16. Parisi R, Symmons DP, Griffiths CE and Ashcroft DM: Global epidemiology of psoriasis: a systematic review of incidence and prevalence. Journal of Investigative Dermatology 2013; 133(2): 377-85.
17. Parisi R, Symmons DP, Griffiths CE and Ashcroft DM: Global epidemiology of psoriasis: a systematic review of

incidence and prevalence. Journal of Investigative Dermatology 2013; 133: 377-85.
18. Okhandiar RP and Banerjee BN: Psoriasis in The Tropics: An Epidemiological Survey. Journal of the Indian Medical Association 1963; 41: 550.
19. Bedi TR: Clinical profile of psoriasis in North India. Indian Journal of Dermatology, Venereology, and Leprology 1995; 61(4): 202.
20. Kaur I, Handa S and Kumar B: Natural history of psoriasis: a study from the Indian subcontinent. The Journal of Dermatology 1997; 24(4): 230-4.
21. Gillard SE and Finlay AY: Current management of psoriasis in the United Kingdom: patterns of prescribing and resource use in primary care. International Journal of Clinical Practice 2005; 59(11): 1260-7.
22. Mrowietz U, Kragballe K, Reich K, Spuls P and Griffiths CE: Definition of treatment goals for moderate to severe psoriasis: a European consensus. Archives of Dermatological Research 2011; 303(1): 1-0.
23. Rawat Singh M, Pradhan K and Singh D: Lipid matrix systems with emphasis on lipid microspheres: potent carriers for transcutaneous delivery of bioactives. Current Drug Delivery 2012; 9(3): 243-54.
24. Torchilin VP: Structure and design of polymeric surfactant-based drug delivery systems. Journal of Controlled Release 2001; 73(2-3): 137-72.
25. Kaplan FO, Daniel H and Barker J: Mechanisms of Disease: Psoriasis. NestleIn: New England Journal of Medicine 2009; 361(5): 496-09.
26. Christophers E, Segaert S, Milligan G, Molta CT and Boggs R: Clinical improvement and satisfaction with biologic therapy in patients with severe plaque psoriasis: results of a European cross-sectional observational study. Journal of Dermatological Treatment 2013; 24(3): 193-8.
27. El-Darouti M and Hay RB: Psoriasis: highlights on pathogenesis, adjuvant therapy, and treatment of resistant and problematic cases (part I). J Egypt Women Dermatol Soc 2010; 7: 64–67
28. Pietrzak AT, Zalewska A, Chodorowska G,Krasowska D and Michalak-Stoma A: Cytokines and anticytokines in psoriasis. Clinica Chimica Acta 2008; 394(1-2): 7-21.
29. Levine D and Gottlieb A: Evaluation and management of psoriasis: an internist's guide. Medical Clinics 2009; 93(6): 1291-03.
30. Raychaudhuri SP and Gross J: A comparative study of pediatric-onset psoriasis with adult onset psoriasis. Pediatric Dermatology 2000; 17(3): 174-8.
31. O'Doherty CJ and Macintyre C: Palmoplantar pustulosis and smoking. Br Med J (Clin Res Ed). 1985; 291(6499): 861-4.
32. Krishnamurthy K, Walker A, Gropper CA and Hoffman C: To treat or not to treat? Management of guttate psoriasis and pityriasis rosea in patients with evidence of group A Streptococcal infection. Journal of drugs in dermatology: 2010; 9(3): 241-50.
33. Baker H and Ryan TJ: Generalized Pustular Psoriasis: A Clinical and Epidemiological. Study of 104 Cases. British Journal of Dermatology 1968; 80(12): 771-93.
34. Farber EM and Nall L: Erythrodermic (exfoliative) psoriasis. Cutis 1993; 51(2): 79-82.
35. Wozel G: Psoriasis treatment in difficult locations: scalp, nails, and intertriginous areas. Clinics in Dermatology 2008; 26(5): 448-59.
36. Yeung H, Wan J, Van Voorhees AS, Duffin KC and Krueger GG: Patient-reported reasons for the discontinuation of commonly used treatments for moderate to severe psoriasis. Journal of the American Academy of Dermatology 2013; 68(1): 64-72.
37. Menter A: Guidelines of care for the management of psoriasis and psoriatic arthritis: section 4. J Am Acad Dermatol 2009; 61: 451-85
38. Czarnecka-Operacz M and Sadowska-Przytocka A: The possibilities and principles of methotrexate treatment of psoriasis–the updated knowledge. Advances in Dermatology and Allergology/Postępy DermatologiiI Alergologii 2014; 31(6): 392.
39. Elango T, Dayalan H, Gnanaraj P, Malligarjunan H and Subramanian S: Impact of methotrexate on oxidative stress and apoptosis markers in psoriatic patients. Clinical and Experimental Medicine 2014; 14(4): 431-7.
40. Lebwohl M and Ali S: Treatment of psoriasis. Part 2. Systemic therapies. Journal of the American Academy of Dermatology 2001; 45(5): 649-64.
41. Food and Drug Administration (FDA). Cyclosporin FDA package insert. Available from: URL:http://www.accessdata.fda.govSearch.Overview&DrugName=CYCLOSPORINE. Accessed January 9, 2009.
42. Lebwohl M, Ellis C, Gottlieb A, Koo J and Krueger G: Cyclosporine consensus conference: with emphasis on the treatment of psoriasis. Journal of the American Academy of Dermatology 1998; 39(3): 464-75.
43. Pilkington T and Brogden RN: Acitretin: a review of its pharmacology and therapeutic use. Drugs. 1992; 43(4): 597-27
44. Brindley CJ: Overview of recent clinical pharmacokinetic studies with acitretin (Ro 10-1670, etretin). Dermatology. 1989; 178(2): 79-87.
45. Berbis PH, Bun H, Geiger JM, Rognin C and Durand A: Acitretin (RO10-1670) and oral contraceptives: interaction study. Archi of Dermatological Res 1988; 280(6): 388-9.
46. Papp KA, Merola JF, Gottlieb AB, Griffiths CE and Cross N: Dual neutralization of both IL-17A and IL-17F with bimekizumab in patients with psoriasis: results from BE ABLE 1, a 12-week randomized, double-blinded placebo-controlled phase 2b trial. Journal of the American Academy of Dermatology. 2018 Mar 30.
47. Papp KA, Blauvelt A, Bukhalo M, Gooderham M and Krueger JG: Risankizumab versus ustekinumab for moderate-to-severe plaque psoriasis. New England Journal of Medicine 2017; 376(16): 1551-60.
48. Schadler ED, Ortel B and Mehlis SL: Biologics for the primary care physician: Review and treatment of psoriasis. Disease-a-Month 2018; 14: 1-40.
49. Richard EG and Hönigsmann H: Phototherapy, psoriasis, and the age of biologics. Photodermatology, photoimmunology & Photomedicine 2014; 30(1): 3-7.
50. Wong T, Hsu L and Liao W: Phototherapy in psoriasis: a review of mechanisms of action. Journal of Cutaneous Medicine and Surgery 2013; 17(1): 6-12.
51. Nijsten T, Rolstad T, Feldman SR and Stern RS: Members of the national psoriasis foundation: more extensive disease and better informed about treatment options. Archives of Dermatology 2005; 141(1): 19-26.
52. Matsumura Y and Ananthaswamy HN: Toxic effects of ultraviolet radiation on the skin. Toxicology and Applied Pharmacology 2004; 195(3): 298-08.
53. Radack KP, Farhangian ME, Anderson KL and Feldman SR: A review of the use of tanning beds as a dermatological treatment. Dermatology and Therapy 2015; 5(1): 37-51.
54. Devaux S, Castela A, Archier E, Gallini A and Joly P: Adherence to topical treatment in psoriasis: a systematic

literature review. Journal of the European Academy of Dermatology and Venereology 2012; 26: 61-7.
55. Carroll CL, Feldman SR, Camacho FT and Balkrishnan R: Better medication adherence results in greater improvement in severity of psoriasis. British Journal of Dermatology 2004; 151(4): 895-7.
56. Rahman M, Akhter S, Ahmad J, Ahmad MZ and Beg S: Nanomedicine-based drug targeting for psoriasis: potentials and emerging trends in nanoscale pharmacotherapy. Expert Opinion on Drug Delivery 2015; 12(4): 635-52.
57. Boyman O, Hefti HP, Conrad C, Nickoloff BJ and Suter M: Spontaneous development of psoriasis in a new animal model shows an essential role for resident T cells and tumor necrosis factor-α. Journal of Experimental Medicine 2004; 199(5): 731-6.
58. Mitra A and Wu Y: Topical delivery for the treatment of psoriasis. Expert Opinion on Drug Delivery 2010; 7(8): 977-92.
59. Warren RB, Brown BC and Griffiths CE: Topical treatments for scalp psoriasis. Drugs 2008; 68(16): 2293-02.
60. Tan X, Feldman SR, Chang J and Balkrishnan R: Topical drug delivery systems in dermatology: a review of patient adherence issues. Expert Opinion on Drug Delivery 2012; 9(10): 1263-71.
61. Rajinikanth PS and Chellian J: Development and evaluation of nanostructured lipid carrier-based hydrogel for topical delivery of 5-fluorouracil. International Journal of Nanomedicine 2016; 11: 5067.
62. Jain A, Doppalapudi S, Domb AJ and Khan W: Tacrolimus and curcumin co-loaded liposphere gel: Synergistic combination towards the management of psoriasis. Jou of Controlled Release 2016; 243: 132-45.
63. Agrawal Y, Petkar KC and Sawant KK: Development, evaluation and clinical studies of Acitretin loaded nanostructured lipid carriers for topical treatment of psoriasis. International Journal of Pharmaceutics 2010; 401(1-2): 93-02.
64. Divya G, Panonnummal R, Gupta S, Jayakumar R and Sabitha M: Acitretin and aloe-emodin loaded chitin nanogel for the treatment of psoriasis. European Journal of Pharmaceutics and Biopharmaceutics 2016; 107: 97-109.
65. Kong X, Zhao Y, Quan P and Fang L: Development of a topical ointment of betamethasone dipropionate loaded nanostructure lipid carrier. Asian Journal of Pharmaceutical Sciences 2016; 11(2): 248-54.
66. Pinto MF, Moura CC, Nunes C, Segundo MA and Lima S: A new topical formulation for psoriasis: development of methotrexate-loaded nanostructured lipid carriers. International Journal of Pharmaceutics 2014; 477(1-2): 519-26.
67. Parnami N, Garg T, Rath G and Goyal AK: Development and characterization of nanocarriers for the topical treatment of psoriasis by using combination therapy. Artificial Cells, Nanomedicine, and Biotechnology. 2014; 42(6): 406-12.
68. Avasatthi V, Pawar H, Dora CP, Bansod P and Gill MS: A novel nanogel formulation of methotrexate for topical treatment of psoriasis: optimization, *in-vitro* and *in-vivo* evaluation. Pharmaceutical Development and Technology 2016; 21(5): 554-62.
69. Gabriel D, Mugnier T, Courthion H, Kranidioti K and Karagianni N: Improved topical delivery of tacrolimus: a novel composite hydrogel formulation for the treatment of psoriasis. Journal of Controlled Release 2016; 242: 16-24.
70. Madan JR, Khude PA and Dua K: Development and evaluation of solid lipid nanoparticles of mometasone furoate for topical delivery. International Journal of the Pharmaceutical Investigation 2014; 4(2): 60.
71. Baboota S, Alam MS, Sharma S, Sahni JK and Kumar A: Nanocarrier-based hydrogel of betamethasone dipropionate and salicylic acid for treatment of psoriasis. International journal of the pharmaceutical investigation 2011; 1(3): 139.
72. Benigni M, Pescina S, Grimaudo MA, Padula C and Santi P: Development of microemulsions of suitable viscosity for cyclosporine skin delivery. International Journal of Pharmaceutics 2018; 545(1-2): 197-05.
73. Laxmi RJ, Karthikeyan R, Babu PS and Babu RN: Formulation and evaluation of antipsoriatic gel using natural excipients. Journal of Acute Disease 2013; 2(2): 115-21.
74. Khan PA, Thube R and Rab RA: Formulation development and evaluation of silymarin gel for psoriasis treatment. J Innov Pharm Biol Sci 2014; 1(1): 21-6.
75. Chen M, Kumar S, Anselmo AC, Gupta V and Slee DH: Topical delivery of Cyclosporine A into the skin using SPACE-peptide. Journal of Controlled Release 2015; 199: 190-7.
76. Gaikwad DT and Jadhav NR: Formulation design and evaluation of an emulgel containing Terminalia arjuna bark extract for transdermal delivery. Pharmacognosy Magazine 2018; 14(55): 249.
77. Papp KA, Langley RG and Lebwohl M: Efficacy and safety of ustekinumab, a human, interleukin-12/23 monoclonal antibody, in patients with psoriasis: 52-week results from a randomized, double-blind, placebo-controlled trial. Lancet 2008; 371: 1675-84
78. Koutruba N, Emer J and Lebwohl M: Review of ustekinumab, an interleukin-12 and interleukin-23 inhibitor used for the treatment of plaque psoriasis. Therapeutics and Clinical Risk Management 2010; 6: 123-41.
79. Roberts JL, Ortonne JP, Tan JK, Jaracz E and Frankel E: Alefacept Clinical Study Group. The safety profile and sustained remission associated with response to multiple courses of intramuscular alefacept for treatment of chronic plaque psoriasis. Journal of the American Academy of Dermatology 2010; 62(6): 968-78.
80. Mease PJ, Gladman DD, Ritchlin CT, Ruderman EM and Steinfeld SD: Adalimumab for the treatment of patients with moderately to severely active psoriatic arthritis: results of a double-blind, randomized, placebo-controlled trial. Arthritis & Rheumatism: Official Journal of the American College of Rheumatology 2005; 52(10): 3279-89.
81. Menter A, Tyring SK, Gordon K, Kimball AB and Leonardi CL: Adalimumab therapy for moderate to severe psoriasis: a randomized, controlled phase III trial. Journal of the American Academy of Dermatology 2008; 58(1): 106-15.
82. Takeuchi T, Yamanaka H, Ishiguro N, Miyasaka N and Mukai M: Adalimumab, a human anti-TNF monoclonal antibody, outcome study for the prevention of joint damage in Japanese patients with early rheumatoid arthritis: the HOPEFUL 1 study. Annals of the Rheumatic Diseases 2014; 73(3): 536-43.
83. Iyer S, Yamauchi P and Lowe NJ: Etanercept for severe psoriasis and psoriatic arthritis: observations on combination therapy. British Journal of Dermatology 2002; 146(1): 118-21.

84. Hsu L, Snodgrass B and Armstrong A: Antidrug Antibodies in Psoriasis: A Systematic Review. British Journal of Dermatology 2014; 170: 261-73.
85. Papp KA, Tyring S, Lahfa M, Prinz J and Griffiths CE: Etanercept Psoriasis Study Group. A global phase III randomized controlled trial of etanercept in psoriasis: safety, efficacy, and effect of dose reduction. British Journal of Dermatology 2005; 152(6): 1304-12.
86. Saini R, Tutrone WD and Weinberg JM: Advances in therapy for psoriasis: an overview of infliximab, etanercept, efalizumab, alefacept, adalimumab, tazarotene, and pimecrolimus. Current Pharmaceutical Design 2005; 11(2): 273-80.
87. Reich K, Nestle FO, Papp K, Ortonne JP and Evans R: EXPRESS Study Investigators. Infliximab induction and maintenance therapy for moderate-to-severe psoriasis: a phase III, multicentre, double-blind trial. The Lancet 2005; 366(9494): 1367-74.
88. Gottlieb AB, Masuda S, Ramamurthi R, Abdulghani A and Romano P: Pharmacodynamic and pharmacokinetic response to anti-tumor necrosis factor-α monoclonal antibody (infliximab) treatment of moderate to severe psoriasis vulgaris. Journal of the American Academy of Dermatology 2003; 48(1): 68-75.
89. Saini R, Tutrone WD and Weinberg JM: Advances in therapy for psoriasis: an overview of infliximab, etanercept, efalizumab, alefacept, adalimumab, tazarotene, and pimecrolimus. Current Pharmaceutical Design 2005; 11(2): 273-80.
90. Winterfield LS and Menter A: Infliximab. Dermatologic Therapy 2004; 17(5): 409-26.
91. Krueger GG, Papp KA, Stough DB, Loven KH and Gulliver WP: A randomized, double-blind, placebo-controlled phase III study evaluating efficacy and tolerability of 2 courses of alefacept in patients with chronic plaque psoriasis. Journal of the American Academy of Dermatology 2002; 47(6): 821-33.
92. Krueger GG and Callis KP: Development and use of alefacept to treat psoriasis. Journal of the American Academy of Dermatology 2003; 49(2): 87-97.
93. Korman NJ and Moul DK: Alefacept for the treatment of psoriasis: a review of the current literature and practical suggestions for everyday clinical use. Seminars in Cutaneous Medicine and Surgery 2005; 24(1): 10-18.
94. Syed TA, Ahmad SA, Holt AH, Ahmad SA, Ahmad SH and Afzal M: Management of psoriasis with Aloe vera extract in a hydrophilic cream: a placebo-controlled, double-blind study. Tropical Medicine & International Health 1996; 1(4): 505-9.
95. Davis RH, Parker WL, Samson RT and Murdoch DP: Isolation of a stimulatory system in an aloe extract. Journal of the American Podiatric Medical Association 1991; 81(9): 473-8.
96. Shaikh GH: Alternative Medicine for Psoriasis–Natural Herbal Ayurvedic Treatment-a Review. Journal of Current Research in Ayurvedic and Pharmaceutical Sciences 2012; 3(06): 1-10
97. Shams-Ghahfarokhi M, Shokoohamiri MR, Amirrajab N, Moghadasi B and Ghajari A: *In-vitro* antifungal activities of *Allium cepa*, *Allium sativum* and ketoconazole against some pathogenic yeasts and dermatophytes. Fitoterapia 2006; 77(4): 321-3.
98. Rao SG, Udupa AL, Udupa SL, Rao PG and Rao G: Calendula and Hypericum: two homeopathic drugs promoting wound healing in rats. Fitoterapia 1991; 62: 508-10.
99. Singh KK and Tripathy S: Natural Treatment Alternative for Psoriasis: A Review on Herbal Resources. Journal of Applied Pharmaceutical Science 2014; 4: 114-21.
100. Himalaya health care. Sweet Indrajao. [Internet]. [Cited 2016 Jul 4]. Available from http://www.himalayahealthcare.com/herbfinder/wrightia-tinctoria.html
101. https://www.centerwatch.com/drug-information/fda-approved-drugs/therapeutic-area/3/dermatology

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