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Widyaningsih Oentari
Department of Dermatology and Venereology, Faculty of Medicine Universitas Sumatera Utara, Medan, North Sumatra, Indonesia

Angie Regina Sutrisno
Department of Dermatology and Venereology, Faculty of Medicine Universitas Sumatera Utara, Medan, North Sumatra, Indonesia

Nelva Karmila Jusuf
Department of Dermatology and Venereology, Faculty of Medicine Universitas Sumatera Utara, Medan, North Sumatra, Indonesia

See next page for additional authors

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Authors

- Widyaningsih Oentari
  Department of Dermatology and Venereology, Faculty of Medicine Universitas Sumatera Utara, Medan, North Sumatra, Indonesia
- Angie Regina Sutrisno
  Department of Dermatology and Venereology, Faculty of Medicine Universitas Sumatera Utara, Medan, North Sumatra, Indonesia
- Nelva Karmila Jusuf
  Department of Dermatology and Venereology, Faculty of Medicine Universitas Sumatera Utara, Medan, North Sumatra, Indonesia
- Khairina Nasution
  Department of Dermatology and Venereology, Faculty of Medicine Universitas Sumatera Utara, Medan, North Sumatra, Indonesia

Case Report

Intense pulsed light (IPL) as adjuvant therapy for acne vulgaris: A case series

Widyaningsih Oentari, Angie Regina Sutrisno, Nelva Karmila Jusuf, Khairina Nasution

Department of Dermatology and Venereology, Faculty of Medicine Universitas Sumatera Utara, Medan, North Sumatra, Indonesia

Email: widyaningsih.oentari@gmail.com

Abstract

Background: Acne vulgaris is a chronic inflammatory disease of the pilosebaceous follicle with polymorphic clinical manifestation typically found on facial, neck and/or back area. The pathogenesis is complex and multifactorial. Management of acne vulgaris is determined based on its severity. Adjuvant therapies, such as intense pulsed light (IPL), have been described in accelerating the healing process during treatment.
Case Illustration: We report two cases regarding the usage of IPL as adjuvant therapy in acne vulgaris. Both patients were diagnosed with moderate acne vulgaris. The first patient was given topical adapalene 0.1% gel every night and sunscreen in the morning, and the other patient was given clindamycin gel applied twice a day, benzoyl peroxide 2.5% cream applied once a day at night, and sunscreen in the morning. Both patients were treated using IPL as their adjuvant therapy every three weeks, with a total of 2 IPL sessions in 2 months. Evaluation using clinical and ultraviolet-induced red fluorescence (UVRF) examination showed gradual improvement.
Discussion: IPL as an adjuvant therapy of acne vulgaris has been thought to interfere with the function of the sebaceous glands by its direct phototoxic effects and thermal damage. It also has bactericidal effects on *C. acnes* through the formation of free radicals. The combination of topical treatment and IPL yielded clinical improvements in both patients.
Conclusion: IPL may be beneficial as adjuvant therapy in acne vulgaris in this case series.

Keywords: *acne vulgaris, adjuvant therapy, intense pulsed light, UVRF*

Background

Acne vulgaris is a chronic inflammatory disease of the pilosebaceous follicle with polymorphic clinical manifestation of comedones, papules, pustules, and nodules with varying degrees of severity.[1] It is usually found on the facial, neck and/or back area.[2] In most cases, acne is found in adolescence, with more than 20% of patients suffering from moderate-to-severe acne, and as much as 50% of the population continues to suffer from this condition until their adulthood.[3,4] An observational study conducted in Medan showed that this condition was mostly seen in 21-year old patients.[5]

Acne vulgaris is still considered a worldwide disease. Research conducted by Global Burden of Disease showed that AV is the 8th most prevalent disease globally in 2010.[3]

In Indonesia, acne vulgaris can be found in at least 80-100% of population, and most of the cases were found in 12 – 25-year old age group.[1,6] Studies showed that acne could negatively affect quality of life, self-confidence, mood, and anxiety leading to depression and suicidal thought.[4] Moreover, research shows that stress level is associated with the severity of acne vulgaris.[7]

The pathogenesis of acne vulgaris is complex and multifactorial. Generally, four factors play critical roles in its pathogenesis: hyperproliferation of epidermis, increased sebum production, inflammation, and increased proliferation of *Propionibacterium acnes,* which was recently referred to as *Cutibacterium acnes.*[1,6] Management of acne vulgaris is determined based

on the severity of acne vulgaris. Some adjuvant therapies, such as intense pulsed light (IPL), may be administered to accelerate healing or improve skin conditions during treatment.[6,8] Therefore, we present case series regarding the usage of IPL as adjuvant therapy in acne vulgaris.

Case Illustration

Case 1

A 23-year-old female came to Dermatology and Venereology Clinic, Universitas Sumatera Utara General Hospital, with pimples and blackheads on her face in the last five years. It worsened after the usage of cosmetics and during her menstrual period. Previous treatments did not yield any improvement. The patient's sister had a similar complaint of acne. Dermatological examination showed comedones (81), papules (31), nodules (4), and multiple pustules (6) on the facial region (Figure 1).

Evaluation using Visiopor PP34® (Courage + Khazaka electronic GmbH, Germany) was conducted on the patient's forehead, nose, right cheek, left cheek, and chin to assess the percentage of porphyrins. Visiopor PP34 ® uses UVA (375 nm) to visualize porphyrins as orange to red spots (UVRF spots) that indicate *C. acnes* presence. The presented data will be based on numbers and percentages of area covered by the orange-red spots. The average number of ultraviolet-induced red fluorescence (UVRF) spots was 13.2. Meanwhile, the percentage of area covered by UVRF spots was 0.93% (Figure 2).

Figure 1. First Patient Examination Showed Multiple Comedones, Papules, Nodules, and Pustules

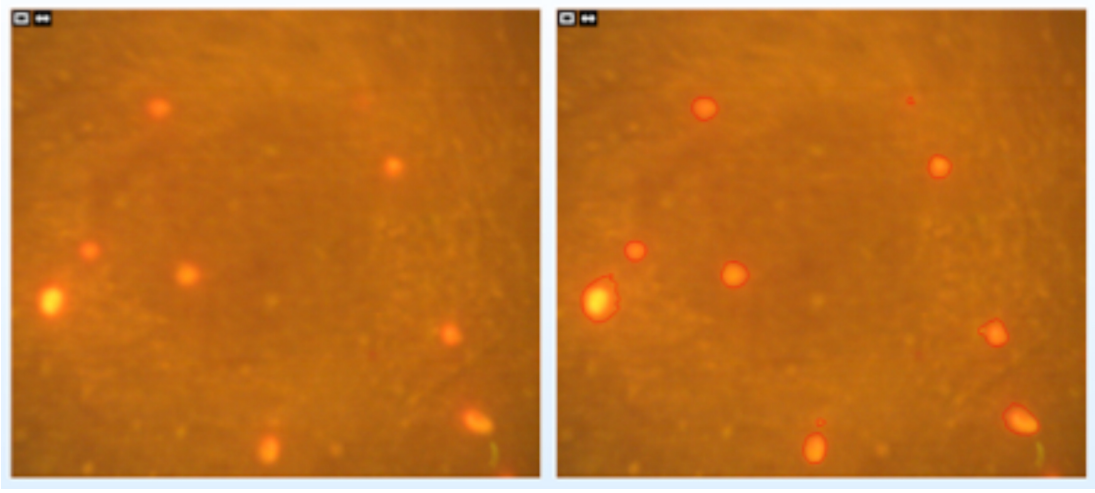

Figure 2. Examination Using Visiopor PP34® on the Nose Area

Based on the patient's history and physical examination, the patient was diagnosed with moderate acne vulgaris. The patient was given topical adapalene 0.1% gel every night and sunscreen in the morning. As an adjuvant therapy, the patient was treated using IPL with fluence 10 J/cm^2 and wavelength of 400-1200 nm every 3 weeks. The patient underwent two sessions of IPL. The patient was counseled regarding her diet, cosmetic usage, and skincare usage. She was asked to come every week for follow-ups visits.

The patient continued using adapalene 0.1% for 3 weeks and were asked to stop 3 days prior to the next IPL session. On the next visits, her acne condition was evaluated by dermatological examination and Visiopor PP34 ®. After the second session of IPL, the patient was evaluated once a week. The patient did not show or complain of any side effects. Gradual improvements were observed at the weekly evaluation. Dermatological examination on one week following the second IPL session showed multiple comedones (56), papules (19), nodules (3) and pustules (1) on her face (Figure 3). Examination using Visiopor PP34® showed a mean total spot UVRF of 3.2, and the percentage of area covered by UVRF spot is 0,17% (Figure 4).

Case 2

A 24-year-old female patient came to Dermatology and Venereology Clinic, Universitas Sumatera Utara General Hospital with pimples, red bumps, and blackheads on her face in the last 10 years. The patient has complained of frequent blackheads and pimples on the cheeks, forehead and chin areas since she was 14 years old.

Figure 3. First Patient Examination One Week After Second IPL Session

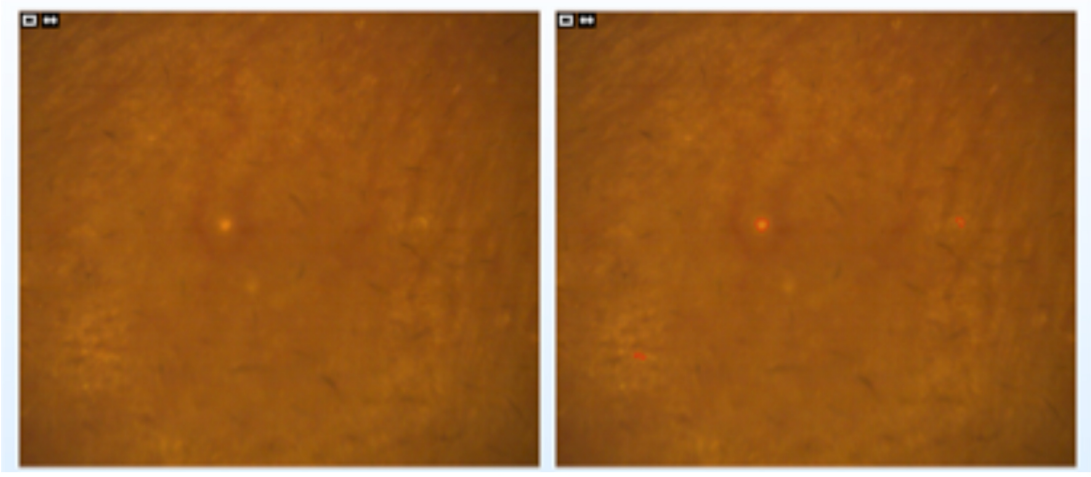

Figure 4. Examination Using Visiopor PP34® on the Nose Area One Week After Second IPL Session

The patient had a previous history of using over-the-counter skincare and facial treatments, but no improvement was noted. These conditions usually became worse during her menstrual period or after using makeup. The patient had a menstrual cycle of 38-39 days and has not encountered her monthly menstrual period at the time of consultation. Dermatological examination revealed multiple comedones (62), papules (50), and pustules (10) on the facial region (Figure 5).

The examination was continued with Visiopor PP34® on the forehead, right cheek, left cheek, and chin to assess the percentage of porphyrins (Figure 6). The average number and percentage of UVRF spots covered by the area were 35.4 and 2.52%, respectively. Patients also underwent laboratory examinations and the values of LH, FSH, progesterone, and estradiol were respectively 2.43 mIU/ml, 1.4 mIU/ml, 18.15 ng/ml, and 193 pg/ml (all within normal limits).

The patient was diagnosed with moderate acne vulgaris. The patient was given clindamycin gel applied twice a day, benzoyl peroxide 2.5% cream applied once a day at night and sunscreen in the morning. This patient was scheduled for IPL with fluence 10 J / cm^2 and wavelength 400-1200 nm every 3 weeks. This patient was going through two IPL sessions. Right after IPL session, the patient complained erythema on her face but it gradually disappeared over time. We recommend the patient to reduce dairy product and chocolate consumption. The patient was also briefed about diet, cosmetic usage, skin care. Patients were asked to control every week.

One week after the second session of IPL, the patient said that most of the red papules and pustules were improved (Figure 7). Inspections with Visiopor PP34 ® showed the average number of spots and percentage of area covered by UVRF spots respectively at 33.4 and 1.91% (Figure 8). After comparing the examination result each week, significant improvements were seen.

Figure 5. Second Patient Examination with Multiple Comedones, Papules, and Pustules on the Facial Area

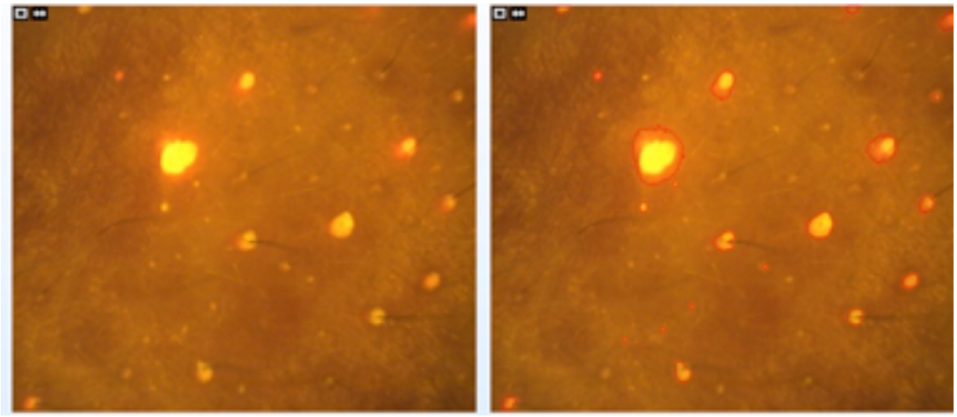

Figure 6. Examination Using Visiopor PP34® on the Left Cheek

Figure 7. Second Patient Examination One Week After Second IPL Session

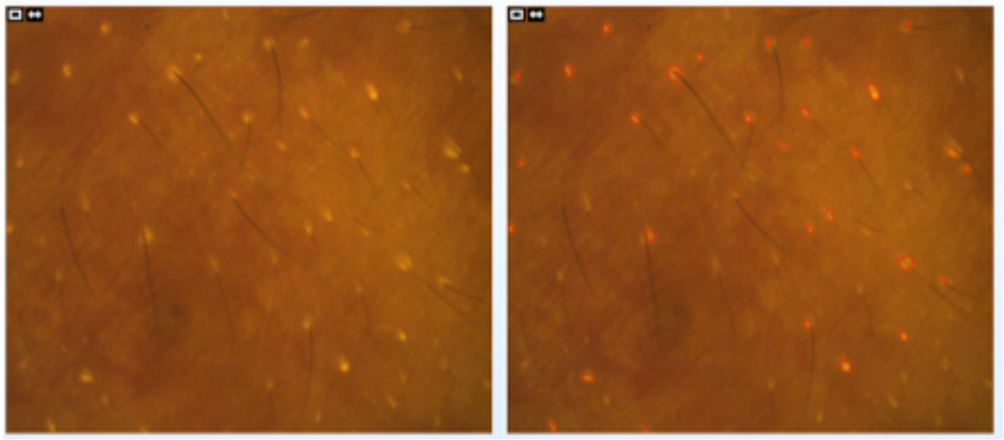

Figure 8. Visiopor PP34® Evaluation on Left Cheek Area One Week after Second IPL Session

Discussion

Acne vulgaris is a chronic inflammatory disease of the pilosebaceous unit and is one of the most common dermatological problems worldwide.[3,9] Four elements play an important role in the pathogenesis of acne vulgaris: hyperproliferation of epidermal follicles, sebum production, *Cutibacterium acnes*, and inflammation and immune response. *C. acnes* is known to produce metabolic products, such as protoporphyrin, coproporphyrin I, and coproporphyrin III, which contribute to the occurrence of perifollicular inflammatory reactions. Its presence may be detected by the appearance of reddish-orange fluorescence in the follicle on ultraviolet A (UVA) with 320-340 nm wavelength. Several studies have shown that the fluorescence intensity is related to the density of *C. acnes,* and its decrease is related to the clinical improvement of acne vulgaris.[9]

The recurrence and relapse of acne vulgaris are very common and negatively affect the patient's psychological condition and quality of life. Clinical manifestations of acne vulgaris are usually found in areas of the body with high pilosebaceous gland densities such as the face, chest, and back. Lesions may initially appear as non-inflammatory lesions, namely comedones, and throughout the course of the disease, inflammatory lesions that include papules and pustules, as well as deep nodules or nodules. The diagnosis is based on the clinical features and can be classified according to the severity, type of lesion, and age of onset.[3]

One of the differential diagnoses in these patients was acneiform eruption. Acneiform eruption is an eruption of skin lesions that resemble the lesion of acne vulgaris, which may be caused by drugs, chemicals, ultraviolet radiation, and others. The hallmark of acneiform eruption is acute or subacute

papulopustules due to follicular inflammation. Acneiform eruption may not only appear at the predilection sites of acne vulgaris, but it can also occur in all parts of the body with sebaceous follicles.[10,11]

Gram-negative folliculitis can occur in patients with acne vulgaris who were previously treated with oral antibiotics for a long period of time, especially tetracycline. The patients often experience improvement after oral tetracycline administration, but worsening of acne vulgaris may follow afterwards. The common clinical features of Gram-negative folliculitis are papulopustules lesions around the nose and deep nodules. In papule or pustular lesions, cultures may reveal *Enterobacter*, *Klebsiella* or *Escherichia,* and *Proteus*.[1,10] Based on the patient's history and physical examinations, the diagnosis of acneiform eruption and Gram-negative folliculitis could be excluded. Based on The 2015 Indonesian Acne Grading Expert Meeting referring to the Lehmann criteria, both patients were diagnosed with moderate acne vulgaris.

First-line therapies for moderate acne are topical retinoic acid, benzoyl peroxide, and antibiotics and/or doxycycline oral antibiotics. The alternative therapies for acne vulgaris include topical azelaic acid, salicylic acid, and intralesional corticosteroids, and/or other oral antibiotics. Oral isotretinoin and physical therapy (comedones extraction, chemical peeling and phototherapy/ photodynamics) may be administered as third-line therapy.[6,12]

Intense pulsed light (IPL) is one of the light-based therapeutic methods which is the choice of adjuvant management in acne.[3,13] This therapy is known to be effective in managing moderate-to-severe acne.[10] Patidar et al. used IPL as a monotherapy for acne vulgaris, and it showed promising results.[14] Light-based therapies has been postulated to reduce the amount of *C. acnes*, reduce the size and suppress the function of pilosebaceous units. It is thought that light with wavelengths between 400 to 700 nm is absorbed by porphyrins, which are naturally produced by sebaceous follicles containing *C. acnes*. IPL with 400 to 1200 nm wavelengths is thought to interfere with the function of the sebaceous glands with direct phototoxic effects and thermal damage, and provide bactericidal effects on *C. acnes* through the formation of free radicals.[3,15] Side effects of IPL are usually mild and can be tolerated by patients.[13] Until now, further research regarding the use of light-based therapy on acne is still needed.[16]

IPL devices use flashlamps and filters to produce high-intensity light in a specific spectrum of waves, fluence, and pulsation duration. Red and blue light absorption can activate porphyrins, thereby suppressing the growth of *C. acnes*. In addition, chromophores on the skin can absorb the broad spectrum of light produced by IPL, causing damage to blood vessels of sebaceous glands, thereby reducing its size and suppressing its function. This light therapy can also provide anti-inflammatory effects by reducing tumor necrosis factor alpha (TNF-α) and encouraging signal transforming growth factor-beta 1 (TGF-β)/ Smad3. A systematic study concluded the various results of acne treatment with IPL from various studies relating to the type of inflammatory or non-inflammatory acne.[15]

Several studies evaluated the use of IPL as adjuvant therapy of acne vulgaris. In a study with 19 patients with mild-to-moderate acne vulgaris were treated with IPL twice a week for 4 weeks. Following the regimen, more than 50% of subjects showed improvement.[17] In another study consisting of 30 patients with mild-to-moderate acne vulgaris, the patients' left and right sides were randomly applied 0.1% adapalene gel or 5% benzoyl peroxide gel daily, with three separate IPL sessions each month. The severity of acne vulgaris was measured pre-treatment, during treatment, and post-treatment using several different parameters, such as acne severity index (ASI), total acne lesions counting (TLC), and acne global severity scale (AGSS). The study showed significant differences between AGSS, TLC, and ASI before and after treatment with adapalene 0.1% gel plus IPL, and also with benzoyl peroxide 5% gel with IPL. However, there were no significant differences in AGSS, TLC, and ASI between both groups after treatment.[18]

In both patients, we used UVRF to evaluate the patient's skin condition. Auto-fluorescence is thought to be caused by coproporphyrin III (CPPIII) and protoporphyrin IX (PPIX) produced by *C. acnes*. Studies found that UVRF can be produced by resident bacteria, namely *C. acnes* and *S. epidermidis*,[10] which rationalize the UVRF as an assessment to monitor the density of this resident bacteria and help evaluate the management of acne vulgaris.[19,20] After the second IPL treatment, both patients were still diagnosed with moderate acne vulgaris. However, we found a decrease in the number of lesions and a decrease in the mean value of the number of spots and the percentage of area covered by UVRF spots in both patients. Both patients showed clinical improvements after undergoing IPL as adjuvant therapy.

Conclusion

We report two patients with moderate acne vulgaris. Both patients were treated with topical medication every day and IPL as their adjuvant therapy every 3 weeks. Clinical evaluation and UVRF assessment using Visiopor PP34® were conducted to assess the severity of acne vulgaris. A decrease in the number of lesions and spots and the percentage of area covered by UVRF spots were observed in both patients. These showed that IPL has beneficial effects as adjuvant therapy in acne vulgaris.

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