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Skin during pregnancy

During pregnancy, many systemic changes may occur, them being haematological, cardiac, renal, respiratory, gastrointestinal, endocrine or metabolic. Some other modifications may target the cutaneous layers. It seems logical that during pregnancy, hormonal or other less well-explained pathways may influence one or more of the skin cell types. Pigmentary changes, such as melasma, but also vascular or structural modifications may affect the skin of pregnant women. Among the latter, striae distensae are probably the most common. Hair disorders featuring hair loss are frequently of concern during this period. Endocrine changes will often affect the skin glands, especially sebaceous ones, provoking acne. By contrast, some specific diseases originating in the skin may also occur during the course of the gestation. Most of them present pruritic symptoms and for this reason affect the quality of life of pregnant women. Cutaneous infections such as varicella zoster virus, genital warts, infestation by *Candida*, Lyme disease or scabies may be observed during the period of gestation.

Skin is modified during pregnancy and/or postpartum. These changes are usually only physiological, expressing changes in hormones or other factors secreted through the placenta, ovaries or enlarged pituitary gland. However, various dermatoses may specifically develop during this period and may influence the foetal outcome or, more rarely, the mother's health. Therefore, being able to diagnose and manage them is of high importance. Further, the increasing demand about cosmetic procedures, even during pregnancy, makes necessary to adapt our knowledge about their safety during this period.

In this review, cutaneous modifications will be classified as physiological changes, specific dermatoses of pregnancy, cutaneous infections that may modify the prognosis of pregnancy, miscellaneous skin diseases that may be affected by pregnancy and finally the safety of cosmetic dermatologic procedures during pregnancy will be overviewed, in order to offer to the dermatologists updated information permitting them to bring accurate assistance to their pregnant patients.

Key words

Pregnancy, skin, changes, dermatoses, infections, procedures.

During pregnancy, profound changes occur, them being immunologic, metabolic, endocrine, and vascular, which make the pregnant woman susceptible to changes of the skin and appendages, both physiologic and pathologic. Knowing these changes is fundamental to bring the patient the adequate treatment. In this paper, we can find a description of the physiological changes induced by pregnancy, their impact at skin level as well regarding the physiological skin changes observed, as the specific dermatoses of gestation. Pregnancy may also affect the course of chronic diseases existing before this period. Finally, a short review concerning the safety of dermatologic cosmetic procedures in pregnant women is finalizing this article.

1. Physiological changes in pregnancy

Physiological changes occur in pregnancy to nurture the developing foetus and prepare the mother for labour and delivery [1]. These changes are mainly of haematological, cardiac, renal, endocrine and metabolic nature.

Haematological changes

Plasma volume increases progressively throughout normal pregnancy, greater than the increase in red blood cell mass, provoking a fall in haemoglobin concentration, haematocrit, red blood cell count and platelet count [2]. Pregnancy also causes a two- to three-fold increase in the requirement for iron, a 10- to 20-fold increase in folate requirements and a two-fold increase in the requirement for vitamin B₁₂ [1]. Changes in the coagulation system during pregnancy produce a physiological hypercoagulable state, in favour of clotting, predisposing the pregnant and postpartum woman to venous thrombosis [3].

Cardiac changes

Cardiac changes during pregnancy facilitate the adaptation of the cardiovascular system to the increased metabolic needs of the mother, thus enabling adequate delivery of oxygenated blood to peripheral tissues and the foetus. Changes occur mainly in the peripheral vascular compliance and resistance (affecting afterload), myocardial function

and contractility, heart rate, and sometimes heart rhythm and the neurohormonal system [4]. Women without heart disease adapt well and adverse cardiac events are rare. On the contrary, in presence of important maternal structural heart disease, increased cardiovascular demands of pregnancy can result in cardiac decompensation, arrhythmias, and, rarely, maternal death [4].

Renal changes

The primary adaptive change in renal vasculature in pregnancy is a marked fall in systemic vascular resistance (SVR) occurring by week six of gestation [5]. This creates a state of arterial under-filling with increased renal blood flow. Relaxin, a peptide hormone produced by the corpus luteum, decidua and placenta, plays an important role in the regulation of haemodynamic and water metabolism during pregnancy [4]. Relaxin stimulates the formation of endothelin, which in turn mediates vasodilation of renal arteries via nitric oxide (NO) synthesis [6] and of course plays a role in skin pigmentation. Despite activation of the renin–angiotensin–aldosterone (RAA) system in early pregnancy, a simultaneous relative resistance to angiotensin II develops, counterbalancing the vasoconstrictive effect and allowing profound vasodilatation [7]. As a consequence of renal vasodilatation, renal plasma flow and glomerular filtration rate (GFR) both increase, compared to non-pregnant levels, by 40–65 and 50–85%, respectively [8]. The increased renal blood flow leads to an increase in renal size of 1–1.5 cm, reaching the maximal size by mid-pregnancy [4], associated with an increase in renal vasculature, interstitial volume and urinary dead space. There is also dilation of the ureters, renal pelvis and calyces, urinary stasis in the dilated collecting system predisposing pregnant women with asymptomatic bacteriuria to pyelonephritis [9].

Respiratory changes

There is a significant increase in oxygen demand during normal pregnancy, leading to an increase in minute ventilation, causing arterial pO_2 to increase and arterial pCO_2 to fall [4]. Diaphragmatic elevation in late pregnancy results in decreased functional residual capacity and pregnancy may also be accompanied by a subjective feeling of breathlessness without hypoxia [4].

Changes in the alimentary tract

Nausea and vomiting are very common complaints in pregnancy, affecting 50–90% of pregnancies [10]. The exact underlying mechanism is not clear but pregnancy-associated hormones such as human chorionic gonadotropin (hCG), oestrogen and pro-

gesterone, but also thyroid hormones, could be involved in the aetiology [4]. As pregnancy progresses, mechanical changes in the alimentary tract also occur, caused by the growing uterus. The stomach is increasingly displaced upwards, leading to an altered axis and increased intra-gastric pressure, predisposing to symptoms of reflux, as well as nausea and vomiting [11].

Endocrine changes

First and most important, pregnancy is characterized by an increase in circulating hormones or other mediators that are secreted by ovaries and/or placenta, including oestrogens, progesterone, human placental lactogen and placental growth factor (PIGF).

There is an increase in the production of thyroxine-binding globulin (TBG) by the liver, resulting in increased levels of thyroxine (T_4) and tri-iodothyronine (T_3). Serum free T_4 (f T_4) and T_3 (f T_3) levels are slightly altered but are usually of no clinical significance [12]. Pregnancy is also associated with a relative iodine deficiency, and for this reason the World Health Organisation recommends an increase in iodine intake in pregnancy from 100 to 150–200 mg/day [12].

Concerning changes at the level of adrenal gland, there is an increase in serum levels of deoxycorticosterone, corticosteroid-binding globulin (CBG), adrenocorticotrophic hormone (ACTH), cortisol and free cortisol: these changes cause a state of physiological hypercortisolism and may be clinically manifested by the striae, facial plethora, rising blood pressure or impaired glucose tolerance [13]. The pituitary gland enlarges in pregnancy and this is mainly due to proliferation of prolactin-producing cells in the anterior lobe. The posterior pituitary produces oxytocin and arginine vasopressin (AVP). Oxytocin levels increase in pregnancy and peak at term [4].

Metabolic changes

Pregnancy is a diabetogenic state and the adaptations in glucose metabolism allow shunting of glucose to the foetus to promote development, while maintaining adequate maternal nutrition [14]. Maternal insulin resistance begins in the second trimester and peaks in the third trimester and results in lipolysis, allowing the pregnant mother to preferentially use fat for fuel, preserving the available glucose and amino acids for the foetus and minimising protein catabolism [4]. Concerning lipid metabolism, there is an increase in total serum cholesterol and triglyceride levels in pregnancy, accommodate the needs of the developing foetus [4]. Pregnant women require an increased intake of

protein during pregnancy. Amino acids are actively transported across the placenta to fulfill the needs of the developing foetus [4]. There is a decrease in total serum calcium concentration during pregnancy, as an average foetus requires about 30 g of calcium to maintain its physiological processes [4].

2. Physiological skin changes in pregnancy

It is important to recognize and differentiate physiological changes from diseased states in order to explain them to the patient and avoid unnecessary investigations or treatments. All physiological changes depend solely on the condition of pregnancy, affect a majority of women, they commonly manifest early on in the course of gestation and often resolve after delivery. These signs may be discrete or, by contrast, severe and, therefore, may distress the patient and may require an appropriate treatment.

Pigmentary changes

They are the most common and affect up to more than 90 % of pregnant women [15]. They take place early, usually during the first trimester. Changes are more pronounced in women with a high phototype. Generalized, but usually mild, hyperpigmentation can be observed [16]. However, more localized hyperpigmentation is usually observed, more commonly on areolae (up to 78 % of patients [15]), axillae and genitalia. Linea negra is a dark line appearing on the abdomen, running straight down from the umbilicus, and occurs in up to 90 % of pregnant women [15]. Recent scars, nevi and freckles may also darken during gestation. Increase of the pigmentary demarcation lines is frequently observed in black pregnant women, but very rarely in white subjects [17].

Melasma

Melasma deserves a special mention, as it is now considered as due to a combination of pigmentary and vascular factors. It was reported to affect up to 70 % of pregnant women [16]. However, this prevalence can decrease to 5 % in white females living in countries devoid of sun exposure [18]. The most common pattern is centrofacial melasma developing on the forehead, cheeks, upper lip, and chin. Maxillary and mandibular patterns are less frequent [19]. Its diagnosis is visual and very easy and does not need any further investigation. Treatment of melasma during pregnancy may include topical tranexamic acid 3 %, which has no teratogenic properties, but must exclude triple combination, including 4 % hydroquinone, 0.05 % retinoic acid and 0.01 % flucinolone acetonide, which should never be given during gestation but only after delivery. Daily use of sunscreen is compulsory.

Vascular changes

Spider telangiectasias develop in approximately 60 % of white pregnant women but are found much less frequently in dark-skinned women [18]. They typically appear at the end of the first trimester in the area of skin drained by the superior vena cava, namely the face, neck, arms and hands [16]. They often disappear within weeks after delivery; however persistent lesions can be treated by laser or intense pulsed light devices.

Palmar erythema appears within the first trimester along with spider telangiectasias. It is more frequent and noticeable in white than black women [16] and may affect up to 10 % of patients [15]. It features a mottled diffused redness of part of the palms, and sometimes entire palm.

Starting from the second month of pregnancy, varicose veins and venous telangiectasias are reported to appear in 40 % of women [20]. They are localized on the legs, the pelvis and the perineum. Thrombosis can complicate the situation in less than 10 % of cases [19]. However, other authors report a much lesser incidence, around 0.33 % [15]. Use of elastic stockings and surelevation of the legs are therefore recommended to prevent such situations.

Nonpitting oedema is frequent, mainly affecting the legs but possibly also affecting the face and the eyelids.

Vasomotor instability is frequently observed and includes alternating episodes of pallor, facial flushing, hot and cold sensations and dermographism [16].

Superficial or subcutaneous hemangiomas are reported in 5 % of pregnant women [20].

They develop at the beginning of the third month of gestation, particularly affecting the hand and neck and grow slowly until delivery, followed in most cases by spontaneous involution. Unsatisfactory sequela may be treated with vascular lasers [16].

Hyperemia and hyperplasia of the gingival mucosa is observed in pregnant women [21]. It may present with various degrees of severity, ranging from mild asymptomatic inflammation to intense pain with bleeding. It develops in the third trimester of pregnancy and progressively resolves postpartum.

Pyogenic granulomas appear to be relatively frequent during pregnancy [21] and usually develop during the second trimester. They are painless but may bleed. Spontaneous regression is observed in the months after postpartum.

Structural changes

The mechanical properties of the skin are affected by pregnancy.

Performing suction tests using a cutometer on the abdomen and thighs of 15 non-pregnant women

and 26 pregnant women at 8 months of pregnancy and 4 months after delivery [22], significant differences between the non-pregnant and 8-month pregnant groups were observed. The results demonstrate that skin becomes less elastic and less deformable on the abdomen during pregnancy. On the thighs, a loss of elasticity and firmness was also observed. At 4 months after delivery, the skin did not return to its initial state.

These changes are explaining the occurrence of *Striae distensae* (*striae gravidarum*, stretch marks) which are a cause of great concern for pregnant women. They appear in 60–90% of white women, but less commonly in black or Asian women [18]. However, a study on Indian skins reports around 80% of occurrence in these patients [15].

The most significant risk factors for striae in primiparous women include young maternal age and elevated maternal BMI, as well as maternal weight gain and high neonatal birth weight [23]. Their aetiology remains poorly known, and they seem to be multifactorial and include physical trauma, such as stretching of the skin, and hormonal mediation through steroids, oestrogens and relaxin, leading to reduction in the elastic fibre network. During the third trimester, striae begin as red-to-purple linear lesions, fade gradually over time and manifest initially as white atrophic bands. They develop on the abdomen and sometimes on the breasts, thighs, arms, buttocks and inguinal areas. They may cause burning or itching but usually the unique symptoms are the anxiety of women fearing that these will never disappear completely [16]. A preventive treatment with creams is recommended, as they rarely disappear spontaneously and need further treatments after delivery.

Hair changes

During pregnancy, hair cycle changes resulting in fewer anagen hair follicles entering the telogen phase. This leads to thickening and brightening of hairs [16]. In addition to the thickening of scalp hair, body hair follicles increase in size and number, especially on the face, and less often on the arms, legs, and back. This kind of hirsutism is reversible within 6 months postpartum [19]. Postpartum, scalp hair enters a prolonged telogen phase causing increased shedding (telogen effluvium), that may begin 2–4 weeks after delivery and last 3–4 months. After this period, hair completely grows again within 6–15 months [20].

Nail changes

It is known that nails grow faster during pregnancy and rapidly become brilliant and brittle. However, a recent study determined that pregnancy did not

affect the growth rate and the morphology of the nails but increased the thickness of the nail plates [24].

Gland changes

Sebaceous gland activity appears to increase in the third trimester since many pregnant women complain of greasy skin, especially on the face, and in many of these, acne develops for the first time during pregnancy [16]. However, the effect of gestation and hormonal disturbances is unpredictable on pre-existing acne [19]. When treating this acne it is very important to avoid local (and of course systemic) retinoids, as well as cyclins. Topical benzoyl peroxide, topical erythromycin or oral zinc salts are allowed [16].

In approximately half of pregnant women, the sebaceous glands on the areola enlarge and appear as multiple elevated brown papules called Montgomery's glands or tubercles [19]. They are visible starting from the sixth week of gestation, representing an early sign of pregnancy [20]. Regression is classical after delivery.

Eccrine sweat-gland activity progressively increases during pregnancy all over the body, except the palms, accounting for hyperhidrosis and increased frequency of miliaria [20].

3. Specific dermatoses of pregnancy

Some dermatologic disorders only appear during pregnancy, and not out of this period. They are listed below.

Polymorphic eruption of pregnancy (PEP)

Polymorphic eruption of pregnancy (PEP), previously known as pruritic urticarial papules and plaques of pregnancy (PUPPP), is the most common rash in pregnancy. Its incidence is 1 in 40 to 1 in 300 [15, 25], and is most often observed in primigravida and multiple pregnancies [16, 26]. Its aetiology is unknown. The classical signs are itch and red papules appearing prominently on the striae of the abdomen (especially on *striae distensae*), with sparing of the periumbilical area. This occurs mainly during the third trimester of pregnancy [16]. It is polymorphous with eczematous features, papules, urticaria, plaques, purpura and erythema multiforme-like lesions and vesicles [26]. It can spread to the arms, upper thighs and breasts. The itch is intractable and severe, and it usually clears after delivery, within 2 weeks postpartum. Treatment with topical steroids is usually successful [16], as well as antihistamines such as chlorpheniramine (4 mg 3 per day) [26].

Pemphigoid gestationis (PG)

Previously known as herpes gestationis, PG is an autoimmune disease of the skin that appears to be

immunologically similar to bullous pemphigoid but develops only during pregnancy and postpartum [16]. It is uncommon, occurring in 1 in 50,000 pregnancies [26]. It appears in the second to third trimester and presents as generalized urticarial papules and plaques, always preceded by pruritus [16, 26] and mostly develops initially on the abdomen and the umbilical skin (50–80% of cases) [16]. The lesions can turn into target-like, annular or polycyclic lesions. Exacerbation at the time of delivery and postpartum is characteristic and occasionally, it may flare up in subsequent pregnancies [26]. The mainstay of treatment is with oral steroids. Treatment with 1 mg/kg of oral prednisolone should control the pruritus, with cessation of blister formation and clearing within 10 days. With a good response, the dose is held for 1 to 2 weeks and tapered by 5 mg/week when control is achieved [26].

Prurigo of pregnancy (Besnier's prurigo)

First described in 1904 by Besnier, it affects from one in 300 to one in 450 pregnancies [26, 27]. It appears by the end of gestation and can persist for up to 3 months postpartum. It occurs as prurigo nodules on the extremities, legs, arms and abdomen. Treatment permits to clear it gradually, usually with antihistamines, such as chlorpheniramine 4 to 12 mg/day, and potent topical steroids such as betamethasone valerate 0.1% cream for the persistent pruritus [26].

Pruritic folliculitis of pregnancy (PPF)

A very rare eruption developing during the third trimester of pregnancy, it is characterized by papules and sterile follicular pustules on the trunk and sometimes the upper limbs [28]. It spontaneously clears up by 2 weeks post-partum. Treatment includes the use of 5% benzoyl peroxide cream, oral antihistamines, and moderately potent topical steroids [26].

Intrahepatic cholestasis of pregnancy (ICP)

The incidence of ICP varies between 0.02 and 2.4% of pregnancies, the higher incidence being found in Chile and China, and is approximately 0.5% in France [16]. The aetiology of ICP is complex and badly known, and it is usually seen in the third trimester, about 4 weeks near term. Patients present with severe intractable itch with or without jaundice. There are multiple excoriations, no skin lesions, and liver function tests show cholestasis with raised bilirubin and increased alkaline phosphatase [26]. Cholestyramine may be given, a partial response being observed in 70% of patients. Several days of treatment are required before pruritus improves [16]. Ursodeoxycholic acid seems to

work faster than cholestyramine and also controls pruritus and plasma abnormalities [16]. Let's note that pruritus is non-responsive to chlorpheniramine and emollients [26].

Impetigo herpetiformis (IH)

This is a very rare but severe form of pustular psoriasis whose onset is in the 3rd trimester of gestation. IP is acute, usually febrile, with a rash in the form of grouped pustules on erythematous background, beginning on flexures [29]. Large areas of the skin may be involved, sparing the face, hands and feet. Clearing occurs spontaneously on delivery, but foetal death is not uncommon due to placental deficiency. Treatment is with oral steroids (oral prednisolone 40–60 mg per day) [29].

Atopic eczema of pregnancy (AEP)

AEP begins most often during the first and second trimesters of pregnancy, unlike the common third-trimester onset in PEP. Women are all described to have an atopic background, and AEP may affect all parts of the body [16].

The treatment is the classical one for atopic dermatitis.

4. Cutaneous infections during pregnancy

A wide array of infectious diseases of viral, fungal, bacterial, or parasitic origin may occur in pregnancy. Here we are making a brief review of them.

Varicella zoster virus infections (VZV)

Herpes zoster in the pregnant woman. Herpes zoster is caused by reactivation of a latent VZV infection with the mother being seropositive. In such case, with the exception of generalized herpes zoster, there is no viremia and no transplacental infection as mother's VZV antibodies are passed on to the foetus through the placenta and therefore there are no significant risks for the mother and infant associated with herpes zoster in pregnancy [31]. Treatment is to be disregarded and intravenous treatment with acyclovir 10–20 mg/kg 3 times a day is only recommended in case of herpes zoster in extensive dermatitis, herpes zoster oticus, herpes zoster ophthalmicus, hemorrhagic zoster, mucosal involvement or disseminated VZV infection [32].

Exposure of a seronegative pregnant woman without manifestations of the disease. A significant exposure towards VZV is defined as (a) living together with a patient suffering from varicella or herpes zoster in the same home, (b) a direct («face-to-face») contact for more than 5 minutes with a patient suffering from varicella or uncovered herpes zoster, or (c) staying in the same room for more than 15 minutes with a patient suffering from vari-

cella or herpes zoster [33]. If the pregnant patient has not developed an exanthem following a significant contact, an immediate evaluation of her serostatus has to be performed, usually with an ELISA test [30]. In case the result is negative (IgG titer < 1 : 64), it has to be assumed that the pregnant woman is susceptible to the infection and passive immunization with VZIG should be performed immediately (within 96 hours of exposure) at any point of pregnancy at a dose of 1 ml/kg [34], which may prevent the outbreak or at least a serious manifestation of varicella in the mother in up to 90% of cases. However, a milder course of potential neonatal varicella can be accomplished [34]. Prophylactic treatment with acyclovir is not indicated in this situation [30].

Varicella in the expectant mother. Varicella tends to have a more serious course in pregnant women, especially during the third trimester [31]. Pneumonia, hepatitis and encephalitis can occur [30]. Therapy depends on the severity of the disease. In case of uncomplicated exanthem (duration of less than 24 hours and pregnancy beyond the 20th week of gestation), the woman should be treated with acyclovir 800 mg orally 5 times a day. In case of complications, such as pneumonia, persisting or hemorrhagic exanthema, or fever, the patient should be treated with intravenous acyclovir (10–15 mg/kg/day, 3 times a day for 7–10 days) [32].

Congenital varicella syndrome. The risk of congenital infection is highest between gestational weeks 13 and 20, which may induce in the foetus malformations in several systems, including scars and skin contractures, limb hypoplasia, ocular disturbances or involvement of central nervous system [33]. Although the mortality rate in the first months is 30%, the long-term prognosis is favourable [16].

Condylomata acuminata (genital warts)

During pregnancy, particularly between 12 and 14 weeks' gestation, genital warts may grow more rapidly and reach a very large size compared to non-pregnant women [35]. Genital warts also become more friable during pregnancy, when irritation and bleeding are common and become so big that they lead to obstruction or dysfunction of the birth canal, warranting caesarean delivery [35]. Surgical treatments options for genital warts comprise electrocautery, tangential excision, cryotherapy (regarded as first-line therapy), and CO₂ laser [16]. They are preferred to non-surgical ones, including application of trichloroacetic acid by the physician, or podophyllotoxin, imiquimod 5% cream (3 times a week for a maximum of 16 weeks), and sinecate-

chins as 10% ointment (3 times a day for a maximum of 16 weeks) by the patient herself [36]. None of these non-surgical options appear to be totally safe during pregnancy [16].

Candida vulvovaginitis

Candida vulvovaginitis is more prevalent during pregnancy: up to 50% of pregnant women are affected [37]. At least 80% of candida vulvovaginitis cases are caused by *Candida albicans*, but non-*albicans* *Candida* infections, such as *Candida tropicalis*, *Candida glabrata*, and *Candida parapsilosis*, are becoming more common [38].

Topical treatment with azole antifungal agents is usually sufficient to treat *Candida vulvovaginitis* in pregnancy, and effective for *Candida albicans* infections and achieve a clinical and mycologic cure rate of 80–90% [16]. As the clinical response is slower and recurrences are more common in pregnancy, a 1- to 2-week course is advisable [37]. Non-*albicans* *Candida* infections may be relatively resistant to these antifungals and the use of amphotericin B vaginal suppositories may then be an acceptable option [16].

Oral azole treatment is only indicated in severe primary infections. In this case, fluconazole (150 mg/d for 7–14 days) is the treatment of choice [16].

Lyme borreliosis (LB)

LB, an infectious disease caused by *Borrelia burgdorferi s. l.* (Bb) is less frequent in pregnancy than in non-pregnant women [16].

Its clinical presentation is comparable to that noted in non-pregnant patients [39].

The management for LB in pregnancy is similar to that in non-pregnant women with one major exception: doxycycline must be avoided during pregnancy due to possible adverse outcomes in the foetus and/or the mother [40]. The recommended antibiotics for pregnant women with LB are amoxicillin (500 mg 3 × day – 2–3 weeks), cefuroxime axetil (500 mg 2 × day – 2–3 weeks), azithromycin (250 mg 2 × day – 5–10 days), or ceftriaxone (2 g intravenous daily for 14 days) [16].

Scabies

Studies indicate that scabies accounts for 2–6% of all skin diseases in pregnancy [41], but crusted scabies seems to be rare in pregnancy [42].

Permethrin 5% cream is the treatment of choice in pregnancy [35], whilst precipitated sulphur and benzyl benzoate 25% lotion are second-line treatments, although less efficient [16]. Crotamiton and malathion are third-line treatment options [16]. Lindane and ivermectin should not be used in pregnancy [16].

5. Dermatoses affected by pregnancy

When the pregnant patient was already affected before the beginning of gestation by a chronic dermatological disease, this one may be influenced by this physiological condition, and may be either worsened, or improved.

Skin diseases aggravated by pregnancy

Table features the skin diseases commonly aggravated by pregnancy.

Skin diseases improved by pregnancy

The only dermatological disease which appears to be improved during pregnancy is psoriasis [56].

6. Safety of Cosmetic Dermatologic Procedures During Pregnancy

At the time of undergoing a dermatologic cosmetic procedure, it must be asked the female patients about an eventual pregnancy. Most physicians, who want to avoid any risk for the foetus and the mother, prefer waiting the postpartum to conduct such procedures.

Anesthetics

The first question arising is about the use of topical anesthetics during such procedures. Topical application of benzocaine is not recommended because of associations with methemoglobinemia in infants and children [57]. On the contrary, lidocaine 2.5%/prilocaine 2.5% combination cream is pregnancy category B and is considered safe to use for short periods of time [58].

As regards injectable anesthetics, lidocaine is commonly found premixed with cosmetic filler products. Inadvertent arterial injection may pose cardiac risks to the mother and foetus, and for this reason it should be avoided during gestation [58].

Cosmeceuticals

The safety of cosmeceuticals must also be a major concern. Topical retinoids are one of the most common ingredients used in prescription and over-the-counter cosmeceutical products. It requires extreme caution during pregnancy, with tretinoin and adapalene posing possibly teratogenic risks during the first trimester if systemically absorbed [58]. Tazarotene is pregnancy category X and is contraindicated in pregnancy, posing significant teratogenic risk during the entire pregnancy [59]. Hydroquinone also requires caution during pregnancy, falling in pregnancy category C [58].

Peelings

The question arising is not about the procedure itself, but more like concerns the type of peeling.

Table. **Dermatological diseases aggravated by pregnancy**

Diseases	References
<i>Inflammatory diseases</i>	
Atopic dermatitis	43,44
Chronic plaque psoriasis	45
Psoriatic arthritis	46
<i>Infections</i>	
Trichomoniasis	47
Pityrosporum folliculitis	48
AIDS	49
Leprosy	50
<i>Autoimmune diseases</i>	
Pemphigus variants vulgaris, vegetans, or foliaceus	51
<i>Metabolic disorders</i>	
Porphyria cutanea	52
Acrodermatitis enteropathica	53
<i>Connective tissue diseases</i>	
Ehlers-Danlos syndrome	54
<i>Skin tumours</i>	
Dermatofibromas, leiomyomas, and keloids	47
Melanocytic nevi	55

Salicylic acid is pregnancy category C, but there is a lack of clinical trials examining the safety of salicylic acid peels used in pregnancy. Salicylic acid face washes have been available over the counter for decades, and no adverse events during pregnancy have been reported in the literature. If salicylic acid peels are performed, it is recommended that they be used in limited areas, because large areas under occlusion can result in consequent systemic absorption [58]. The same applies to Jessner's solution, which contains salicylic acid. Glycolic acid has minimal dermal absorption, making it theoretically safe during pregnancy, in spite of a lack of relevant literature. Topical application of trichloroacetic acid (TCA) is also likely safe during pregnancy [58].

Injectable neuromodulators

Various studies in the literature support the safety of onabotulinum toxin type A (BOTOX®) during pregnancy [58]. Conversely, there is a lack of similar studies about the use of abobotulinum (DYSPORT®) and incobotulinum toxin (XEOMIN®).

Fillers

No reports have examined outcomes of pregnant women and their children after use of hyaluronic acid, poly-L-lactic acid, calcium hydroxylapatite, or collagen fillers during pregnancy. For this reason, the consensus among fillers manufacturers is that they are best avoided during pregnancy because of lack of research [58].

Fat transfer

Fat transfer is not recommended during pregnancy, first because removal of fat may put the foetus' nutritional requirements at risk, and secondly due to risks of fat embolism and occlusion [58].

Sclerotherapy

Sclerotherapy is not recommended during pregnancy, as not necessary because vascular lesions such as leg varicosities can develop and resolve on their own during the course of gestation and postpartum [58].

Liposuction

Liposuction is absolutely contraindicated during any stage of pregnancy, as its cosmetic nature does not justify the undue risks to the foetus, and adequate stores of fat are needed to nurture the growing demands of mother and foetus [60].

Lasers and light therapies

Since the beginning of use of lasers, pregnancy has been an exclusion criterion for most of them, resulting in a deficiency of studies evaluating the safety of these procedures during gestation [58].

CO₂ laser therapy

Several studies have shown that CO₂ laser therapy for genital condyloma during pregnancy is safe and effective [58]. For instance, a large study of 115 pregnant women treated with CO₂ laser for this condition had no resulting maternal or foetal complications [61].

Nd: YAG Laser therapy

For general dermatologic conditions outside of pregnancy, the Nd: YAG laser is considered safe because it is well tolerated with common side effects of transient pain and temporary hyperpigmentation [62]. Its use during pregnancy for condylomas also suggests that it is safe to use for dermatologic conditions [58].

Pulsed Dye Laser

Safety for use during pregnancy of PDL for dermatologic conditions has not been extensively studied, nevertheless it has been studied and shown to be safe during pregnancy for other nondermatological conditions such as ureteral calculi [63]. Therefore it could conceivably be used during pregnancy based on a compelling medical indication [58].

Conclusions

Skin is modified during pregnancy and/or postpartum. These changes are usually only physiological, expressing changes in hormones or other factors secreted through the placenta, ovaries or enlarged pituitary gland. However, various dermatoses may specifically develop during this period and may influence the foetal outcome or, more rarely, the mother's health. Therefore, being able to diagnose and manage them is of high importance. Further, the increasing demand about cosmetic procedures, even during pregnancy, makes necessary to adapt our knowledge about their safety during this period.

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Шкіра під час вагітності

Під час вагітності може відбуватися багато системних змін, таких як гематологічні, серцеві, ниркові, респіраторні, шлунково-кишкові, ендокринні або метаболічні. Деякі інші модифікації можуть впливати на шари шкіри. Логічно, що під час вагітності гормональні або інші менш пояснені чинники можуть впливати на один або кілька типів клітин шкіри. Пігментні зміни, такі як меланодермія, а також судинні або структурні зміни можуть впливати на шкіру вагітних. Серед останніх найбільш поширені стрії. У цей період часто виникають проблеми, пов'язані з випадінням волосся. Ендокринні зміни часто впливають на шкірні залози, особливо сальні, що провокують появу вугрового висипу. Навпаки, деякі специфічні захворювання, що виникають у шкірі, також можуть виникати під час вагітності. Більшість із них мають симптоми свербіжів і тому впливають на якість життя вагітних. Шкірні інфекції, такі як вірус вітряної віспи, генітальні бородавки, зараження *Candida*, хвороба Лайма або короста, можуть спостерігатися в період вагітності.

Шкіра модифікується під час вагітності та/або після пологів. Ці зміни зазвичай є тільки фізіологічними, що виражається гормональними змінами або іншими факторами, що виділяються через плаценту, яєчники чи збільшену гіпофізарну залозу. Однак протягом цього періоду можуть розвиватися різні дерматози, які можуть вплинути на розвиток плода або, рідше, на здоров'я матері. Отже, можливість діагностувати і управляти змінами організму має велике значення. Крім того, зростаючий попит на косметичні процедури, навіть під час вагітності, зумовлює необхідність адаптації наших знань про їхню безпеку в цей період.

У цьому огляді шкірні зміни будуть класифікуватися як фізіологічні зміни, специфічні дерматози вагітності, шкірні інфекції, які можуть змінити прогноз вагітності, різні шкірні захворювання, на які може вплинути вагітність. Наприкінці буде розглянуто безпеку косметичних дерматологічних процедур під час вагітності, щоб запропонувати дерматологам оновлену інформацію, яка дасть їм можливість надавати якісну допомогу вагітним.

Ключові слова: вагітність, шкіра, зміни, дерматози, інфекції, процедури.

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Кожа во время беременности

Во время беременности могут происходить многие системные изменения, такие как гематологические, сердечные, почечные, респираторные, желудочно-кишечные, эндокринные или метаболитические. Некоторые другие модификации могут влиять на слои кожи. Логично, что во время беременности гормональные или другие менее объяснимые факторы могут влиять на один или несколько типов клеток кожи. Пигментные изменения, такие как меланодермия, а также сосудистые или структурные изменения могут влиять на кожу беременных. Среди последних наиболее распространены стрии. В этот период часто возникают проблемы, связанные с выпадением волос. Эндокринные изменения часто влияют на кожные железы, особенно сальные, провоцирующие появление угревой сыпи. Напротив, некоторые специфические заболевания, возникающие в коже, также могут возникать во время беременности. Большинство из них имеют симптомы зуда и поэтому влияют на качество жизни беременных. Кожные инфекции, такие как вирус ветряной оспы, генитальные бородавки, заражение *Candida*, болезнь Лайма или короста, могут наблюдаться в период беременности.

Кожа модифицируется во время беременности и/или после родов. Эти изменения обычно являются только физиологическими, что выражается гормональными изменениями или другими факторами, выделяемыми через плаценту, яичники или увеличенную гипофизарную железу. Однако в течение этого периода могут развиваться различные дерматозы, которые могут повлиять на развитие плода или, реже, на здоровье матери. Следовательно, возможность диагностировать и управлять изменениями организма имеет большое значение. Кроме того, растущий спрос на косметические процедуры, даже во время беременности, обуславливает необходимость адаптации наших знаний об их безопасности в этот период.

В этом обзоре кожные изменения будут классифицироваться как физиологические изменения, специфические дерматозы беременности, кожные инфекции, которые могут изменить прогноз беременности, различные кожные заболевания, на которые может повлиять беременность. В конце будет рассмотрена безопасность косметических дерматологических процедур во время беременности, чтобы предложить дерматологам обновленную информацию, позволяющую им оказывать качественную помощь беременным.

Ключевые слова: беременность, кожа, изменения, дерматозы, инфекции, процедуры.

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