Review Article

Dermatologic and Cosmetic Procedures in Pregnancy

Adit Mohan Garg, Venkataram Mysore[1]

Department of Dermatology, Venereology and Leprosy, Alok Hospital, Centre for Advanced Skin, Cosmetic and Plastic Surgery, Kota, Rajasthan, [1]Department of Dermatology, Venereology and Leprosy, The Venkat Center for Skin and Plastic Surgery, Post Graduate Training Center (RGUHS), Bengaluru, Karnataka, India

Abstract

Background: Patients may develop a need to undergo procedures while being pregnant and this requires a certain risk-benefit profiling to be done by the clinician. Skin changes during pregnancy such as melasma, striae, varicose veins, hirsutism, and increased skin growths may raise concerns for the lady. Although pregnancy-induced physiologic changes may prompt a surgeon to delay nonessential procedures until after delivery, certain skin conditions may require urgent intervention. Others that may be nonurgent, elective, or cosmetic may need careful analysis. **Materials and Methods:** Data were extracted from available literature through a PubMed search for the following keywords: "dermatological procedures in pregnancy," "dermatosurgical procedures during pregnancy," "aesthetic procedures in pregnancy," "safety in pregnancy," "teratogenicity of drugs," "local anesthesia during pregnancy," "physiological changes in pregnancy," "cosmetic procedures during pregnancy," and "lasers in pregnancy." **Results:** Only procedures which are safe and necessary should be carried out in a pregnant woman. Electrocautery, radiofrequency, cryotherapy, and lasers for warts, particularly genital, surgical interventions for skin malignancies, and other small growths should be performed. Safe but cautious outlook is required for intralesional steroid injections, aesthetic procedures such as chemical peeling, botulinum toxin, microdermabrasion, and biopsies for questionable lesions. Absolutely contraindicated procedures include fillers, sclerotherapy, and liposuction.

Keywords: Cosmetic procedures, dermatosurgical procedures, pregnancy, safety

Introduction

Dermatologic surgery includes a variety of procedures such as essential and cosmetic procedures, lasers, and surgical procedures. Undertaking anyone of them requires the dermatosurgeon to take into account the risk/benefit analysis for every individualized patient. This is particularly so in a pregnant woman. Patients may seek treatment for skin changes that occur in pregnancy, such as melasma, striae, varicose veins, hirsutism, and increased skin growths. In the current changing times, for many women, being pregnant may not be a barrier to undergoing aesthetic/dermatologic procedures either for a professional need or personal satisfaction. In such situations, it is for the physician to evaluate advantages and disadvantages of such an intervention. The ethics of performing such procedures in pregnancy needs very careful consideration.

Although a lot of data pertaining to the safety of drugs in pregnancy are available, data on different dermatologic procedures in pregnancy are lacking as it is ethically problematic to perform large-scale randomized trials in pregnant women. However, certain conclusions can be drawn from retrospective studies, meta-analyses, and expert consensus. In this article, we review the latest information on safety and necessity of different procedures pertaining to aesthetics and dermatological diseases.

Materials and Methods

An extensive search for articles was made on PubMed with the following keywords: "dermatological procedures in pregnancy," "dermatosurgical procedures during pregnancy," "aesthetic procedures in pregnancy," "safety in pregnancy," "teratogenicity of antibiotics," "local anesthesia during pregnancy," "physiological changes in pregnancy," "cosmetic procedures during pregnancy," and "lasers in gestation," which generated 67 articles, out of which 24 were shortlisted according to relevance.

Access this article online

Quick Response Code:

Website: www.jcasonline.com

DOI: 10.4103/JCAS.JCAS_226_20

Address for correspondence: Dr. Venkataram Mysore, The Venkat Center for Skin and Plastic Surgery, 3411, 1st Floor, Service Road, Next to BTS Bus Depot, Vijayanagar 560040, Bengaluru, Karnataka, India.
E-mail: mnvenkataram@gmail.com

How to cite this article: Garg AM, Mysore V. Dermatologic and cosmetic procedures in pregnancy. J Cutan Aesthet Surg 2022;15:108-17.

Categorization of procedures

Dermatologic procedures during pregnancy can be divided into three categories: *urgent, nonurgent*, and *elective. Urgent* procedures include taking a biopsy and/or treating a lesion suspicious of melanoma or an aggressive nonmelanoma skin cancer. A friable, bleeding pyogenic granuloma also needs to be managed promptly. *Nonurgent* procedures include procedures such as treating a nodular BCC, which may be undertaken during the second trimester. Lastly, *elective* procedures are those which can be deferred until after delivery, such as scar excision and chemical peeling and other cosmetic procedures.[1]

Physiological Skin Changes in Pregnancy

Pregnancy-induced physiological and hormonal changes in the body can alter a dermatosurgeon's approach to undertake different procedures during that period. Increase in circulating blood volume decreased hematocrit, increased flushing, increased melanocyte stimulation (risk of hyperpigmentation), and altered wound healing (increased tendency to develop hypertrophic scars and keloids) are among the few.[2-4] The hormonal fluctuations can induce other skin manifestations such as melasma (or the mask of pregnancy, which is the second most common complaint after striae and may resolve within 1 year of delivery in 70% women without taking any treatment),[5,6] hypertrichosis, striae and certain growths over the skin such as acrochordons, angiomas, nevi, and warts. These may increase in number, grow in size, or even darken.[5,7]

Pregnancy is associated with physiological immunosuppression, which can be a cause of multiple warts and may increase the risk of bacterial and viral infections during and after the procedures [Table 1].[5]

Local Anesthesia

Local anesthesia is needed for most dermatological procedures and includes topical, infiltration, blocks, and tumescent anesthesia

Injectable local anesthetics

The commonly used injectable anesthetics are as follows:

Lidocaine, prilocaine, etidocaine (pregnancy Category B);

Bupivacaine and mepivacaine (pregnancy Cat C).[8]

Bupivacaine and mepivacaine are not indicated in pregnancy unless the potential benefits outweigh the risks. Mepivacaine is associated with fetal bradycardia, preterm labor, and twice the incidence of congenital abnormalities.[8,13]

What is the risk?

Local injectable anesthetic (predominantly lignocaine) usage during pregnancy leads to an estimated 11%–23% exposure to the fetus.[8] A relative acidosis with poor protein binding increases the free drug exposure to the fetus.[14] However, this exposure may not always cause toxicity as the fetal liver is well capable of metabolizing lignocaine.[15]

Pregnancy-induced rise in progesterone enhances the membrane sensitivity of nerves to local anesthetics (LA), thereby lessening the required anesthetic dosage in early pregnancy.[14] Rarely, lignocaine toxicity arises when there is accidental arterial injection or excessive high doses being used (>4.5 mg/kg up to a maximum of 300 mg, which is rare in dermatologic procedures).[8,10,13,16] The symptoms of lignocaine toxicity mimic aortocaval compression syndrome such as dizziness, tachycardia, agitation, headaches, sweating, and cephalea.[2,4,10]

Once these symptoms appear in the mother, chances of fetal exposure increase in the form of cardiac or central nervous system (CNS) toxicity.[7,8] There is a theoretical risk of inhibiting neutrophil chemotaxis, cell division, and neural development in the newborn when LA concentration exceeds 100 µg/mL.[17,18]

To decrease the systemic spread of LA, adrenaline (Cat C) is used alongside lignocaine. Although this increases the safety profile of LA, inadvertent intra-arterial absorption of high doses of adrenaline could lead to uterine artery spasms resulting in fetal compromise and prematurity. Thankfully, the doses used in dermatologic indications are very low with a high dilution of 1:200,000 which negates this risk.[8,10,19,20] Safe use of lignocaine with adrenaline in pregnant and lactating women has been documented.[21]

In a study, 210 pregnant women were analyzed for adverse pregnancy outcomes who underwent dental procedures with lignocaine. They reported a slight but insignificant increase (4.8% vs. 3.3%) in adverse fetal outcomes (such as septal cardiac anomalies, cerebral palsy, twin-to-twin transfusion syndrome, Turner syndrome, cleft lip and palate, umbilical hernia) compared to control population.[22]

Therefore, lignocaine with or without adrenaline is considered the safest option to provide local injectable anesthesia.

Topical anesthesia

Different forms of topical anesthetics are available such as EMLA cream (lidocaine 2.5% + prilocaine 2.5%), EMLA anesthetic disc (lidocaine 2.5% + prilocaine 2.5%), ELA-Max topical anesthetic cream (lidocaine 4% cream), and Lidoderm (lidocaine 5% patch).[23] Unlike injectable forms, topical creams are considered much safer. However, anecdotal reports advise us to be vigilant with some topical agents as follows:

1. Prilocaine in high doses holds a risk of methaemoglobinemia in the fetus, because of which, lidocaine-prilocaine (both Cat B) cream should be used in moderation.[24] Occlusion should be avoided as should the use near periocular and mucosal

Table 1: Systemic physiologic changes relevant to a dermatosurgeon in pregnancy

System	Physiologic changes	Implication
1.Cardiovascular system	1. Hemodilution due to proportional increase of plasma volume compared to red cell volume.[8]	- Monitor BP regularly
	2. BP: Decreases and remains low up to week 24; returns to prepregnancy levels in 3rd trimester.[8,9]	- False impression of infection[2]
	3. Uterus causes compression of abdominal vessels resulting in decreased venous return.[8,10]	- Increased risk of thromboembolic events late in gestation[2]
	4. WBCs increase.[2]	
	5. Platelets reduce, but aggregation coupled with reduced vascular resistance and increased production of coagulation factors may occur.[2]	
B. Gastrointestinal	1. Decreased tone of GE sphincter due to progesterone.[8,10]	-Reflux symptoms during supine position. - Head elevation advised
C. Renal	1. Urinary volume and frequency increases because of high renal blood flow with increased GFR and pressure effect by uterus.[10]	- Frequency of micturition should be taken into consideration during a procedure
D. Endocrine	1. Insulin antagonists such as estrogen, progestin, adrenocorticoids, and human placental lactogen progressively increase	- Starvation may predispose woman to ketosis, relevant during a dermatological procedure
	2. Fasting sugar levels decrease 10–15 mg/dL compared to nonpregnant levels as there is transplacental drainage of glucose to the fetus.[2,11]	- Ensure adequate hydration along with slow movement in getting on and off the procedure table.[1]
	3. Progesterone-mediated vasodilatation may predispose a pregnant woman to postural hypotension and fainting.[1]	
E. Musculoskeletal	1. Muscular cramps and pelvic discomfort can occur due to ligament laxity caused by progesterone and relaxin.[2,4,8]	- Frequent repositioning with or without pillow support may be required to relieve this discomfort
F. Miscellaneous	1. Compression syndrome: after 20 weeks of gestation, the growing uterus can cause aortocaval compression leading to delirium, cephalea, nausea, vomiting, intense sweating, hypotension, and tachycardia.[8,10,12]	- Adjust the patient in a left lateral decubitus position with the support of a pillow beneath her hip or between the knees.[8,10,12]

surfaces, as this can increase systemic absorption and irritation.[16,25,26] Tetracaine is the preferred topical anesthetic for periocular procedures because of its low risk of irritation.[25,26]

2. Tetracaine and benzocaine (both Cat C) are associated with fetal methaemoglobinemia.[25,27]

Therefore, a lidocaine/prilocaine mixture (in moderation) is the preferred choice for topical anesthesia and for those concerned about its safety profile, liposomal lidocaine can be used as it provides a longer duration of anesthesia than nonliposomal preparations.[16,26]

Procedures for Dermatologic Conditions

Certain infective conditions such as warts and other benign growths such as acrochordons, seborrheic keratoses, pyogenic granulomas, hemangiomas, keloids, and nevi can be removed via different procedures such as electrocautery, laser ablation, cryotherapy, intralesional steroid, and minor surgical procedures under LA. Available data about their safety in pregnancy are limited and are summarized as follows.

Electrocautery and radiofrequency

Electrocautery is considered harmless to the fetus when used in the mother. However, measures should be taken to reduce smoke plume exposure which can be mutagenic and carcinogenic.[28] This risk is the same for both nonpregnant and pregnant patients by extension to the fetus.[8,26] Masks are considered poor barriers for this plume; therefore, a smoke evacuator is preferred for reducing smoke exposure.[4]

Intralesional steroid injections

Intralesional steroid in hypertrophic scars, keloids, and alopecia areata is not recommended until benefits outweigh risk, as corticosteroids are considered Cat C and have been reported to cause cleft lip and palate, along with the risk of hypoadrenalism in newborns.[29]

Lasers

The limited data available suggest safe use of most lasers in pregnancy.

CO_2 laser

CO_2 lasers have a good efficacy and low complication rate for the treatment of human papillomavirus (HPV) genital condyloma and verrucose carcinoma in pregnant females.[30-32] Since this laser has only limited penetration into the skin with the added advantage of bloodless destruction due to coagulation property, no harmful effects on the fetus are reported unless a direct exposure occurs.[30,32,33]

Some concern arises regarding exposure of mother to possibly mutagenic aerial particles generated as a result of vaporization by the laser, which can be eliminated using aspirators, smoke evacuators, and masks used both by the patient and doctor.[10] Er:YAG (erbium-doped yttrium aluminum garnet) laser is even more limited in penetration into skin and hence can be considered safe.

Nd:YAG laser

Limited data suggest safe use of Nd:YAG (neodymium-doped yttrium aluminum garnet) laser for dermatological indications in pregnancy. Genital condylomas have also been treated successfully with Nd:YAG laser therapy without any maternal or fetal complications.[34] For nongenital indications, individual case reports showed Nd:YAG laser for severe inflammatory acne and pyogenic granuloma during gestation without any adverse effects.[35,36] A single instance of full-thickness skin loss over left calf and thigh has been reported from a study wherein Nd:YAG laser was used for fetoscopic laser photocoagulation of placenta at 16-week gestation for treatment of twin-twin transfusion syndrome. This presumably occurred secondary to the specific location of laser therapy within the placenta, although complete recovery was seen after standard burn care management was done for the child.[37,38]

Pulsed dye laser (PDL)

PDL (585 nm) specifically targets Hb within a lesion, therefore it has been used for a variety of indications.[39] In a study, PDL was used to treat pyogenic granulomas and warts during pregnancy and reported a good safety profile with this laser.

Among nondermatological indications, few authors have used PDL to treat symptomatic urolithiasis, without any reported adverse events.[40,41]

Therefore, the available medical evidence suggests good safety profile for PDL in pregnancy except for few minimal side effects such as mild erythema and pain.[42]

Other lasers

Compelling medical evidence for lasers such as other nonablative lasers and IPL is not available.[43,44]

Procedures for Aesthetic Indications

Generally, the advice is to postpone all aesthetic procedures in pregnancy. However, aesthetic concerns in a patient, although not an urgent indication during pregnancy, can be quite distressing in a female patient, especially if she is from the entertainment industry or show business. Some actresses even are open and willing to carry their pregnant look on-screen. Weighing the risk–benefit ratio, a dermatologist can give treatment options for the specific indications provided he/she has in-depth knowledge regarding the same. Ethically, an apt justification can be done by explaining to the patient all the risks involved in writing as well as receiving informed consent from her. A video consent is also recommended in selected cases. It should be noted that the principle of "cause no harm" applies to the pregnancy situation more than any other situation.

Different facial pigmentations, acne scars, aging changes of the face such as rhytids or wrinkles, unwanted facial hair, and visible veins are some of the common indications for which cosmetic procedures are sought for. Their safety during gestation is discussed as follows.

Chemical peeling

Glycolic acid (GA) peel

GA induces epidermolysis and exfoliation of the skin. It is a superficial peel and is considered safe in pregnancy due to negligible dermal penetration.[7,45,46]

Lactic acid (LA) peel

LA induces keratolysis. Anecdotal reports suggest the usage of 2% LA peel for gestational acne without any fetal risks as there is negligible dermal penetration.[7]

Salicylic acid (SA) peel

SA is a β-hydroxy acid with comedolytic and keratolytic properties. It is classified as pregnancy Cat C (Fabbrocini *et al.*, 2009). Up to a 25% dermal penetration is reported with usage of SA peel for large areas or when applied under occlusion.[25] However, low doses of acetylsalicylic acid (aspirin) have been studied for their safety profile in gestational indications such as pre-eclampsia, and there was no increase in adverse effects noted in the fetus.[34,47] Therefore, it is recommended that if SA peels are used in a pregnant patient, the area of application should be small and proper counseling should be done.

Jessner's peel

It is a combination of SA, LA, and resorcinol. Because of the presence of SA, it should be used with caution.

Trichloroacetic acid (TCA) peel

TCA peels can act both as superficial as well as medium depth peel. There is a possibility of dermal penetration when used in and around ocular and oral mucosal surfaces.[25] High doses of TCA (i.e., >1,000 mg/kg/day) found in drinking water disinfection-by-products (DBPs) have been associated with fetal growth retardation and low birth weight; however, such high concentrations are not attained in dermatologic surgery procedures.[48] TCA has been safely used in pregnancy to treat genital condylomata.[25,49]

Energy-based devices (lasers, IPL, and electrosurgery)

As already mentioned above, theoretically, lasers for cosmetic purposes act on the very principle of selective

photothermolysis, which prevents their action to go beyond the deep dermis, thereby precluding any harm to the fetus. Still, due to a lack of satisfactory safety data, cosmetic lasers should be avoided until after the delivery.

Hair removal by means of laser, IPL, or electrolysis is not recommended due to unavailability of safety data. The hormonal changes continue to stimulate new hair growth, leading to unsatisfactory treatment responses.[6] Also, amniotic fluid is considered to be a good conductor of galvanic current, which poses risk to the fetus during electroepilation.[7] Women are recommended to treat excess hair using waxing, shaving, threading, and chemical depilation.[6,7]

Treatment of striae during pregnancy lack evidence-based trials. PDL has shown some promising results, but it is recommended to wait until postpartum period to start any treatment.[50,51] After delivery, different ablative (CO_2 fractional laser)[52] and non-ablative (1540 nm Er-doped glass fractional nonablative,[53] PDL,[50,51] Nd:YAG,[54] and copper bromide[55]) lasers have been tried with varying results.

Platelet-rich plasma therapy for hairloss

The hormonal fluctuation during gestation causes the anagen phase of hair cycle to be prolonged leading to hair looking fuller and healthy. Upon childbirth, there is a major shift to telogen phase causing increased hairfall and thinning. In maximum cases, the hair cycle normalizes within about a year. Therefore, Platelet Rich Plasma therapy which involves extracting and concentrating platelets from whole blood and injecting them into the scalp is only beneficial post-delivery and is not indicated in pregnancy, with an added risk of sepsis, putting the fetus at risk.[56,57]

Botulinum toxin

Botulinum toxin type A has been used for both cosmetic and medical indications.[58] Correct intramuscular or intradermal administration of botulinum toxin does not lead to significant systemic concentrations.[58] Furthermore, the size of the toxin molecule prevents it from crossing the placental barrier.[58,59] The doses used in aesthetic purposes (up to 100U) are significantly lower than the hazardous doses of 600U.[59] Further in one study on pregnant women who contracted botulism while being treated with onabotulinum antitoxin, all have been reported to deliver normal healthy children suggesting that both the toxin and antitoxin possibly does not cross the placenta.[6,60]

Case reports are available where the toxin has been used for medical indications such as achalasia, cervical dystonia, and migraine prophylaxis during pregnancy.[16] No complications (such as infant neuromuscular blockade or weakness)[25] have been noted in the delivery or health of the infants born to these mothers even after few years.[61-63] A single case of a 39-year-old pregnant woman who had a twin pregnancy miscarriage at ten weeks is reported. She received 500U of onabotulinum toxin at 4 weeks of gestation for cervical dystonia. The woman was on concomitant benztropine (Cat C), clonazepam (Cat D), and fluoxetine (Cat C) during the toxin injection. She also had a history of one miscarriage prior to this episode. It is difficult to determine whether the toxin had any role to play in the fetal demise, as she had many collateral risk factors associated with the same.[64]

In a report, botulinum toxin type A was used for cosmetic indications in two pregnant women and the authors did not observe any fetal adverse effects.[65,66]

Studies exploring use of abobotulinum and incobotulinum toxin are lacking and also secretion of toxin into breast milk is unknown.[25,67]

Botulinum toxin type A is a Cat C drug and in view of the above inconclusive data, more research is needed to make a concrete statement on its cosmetic usage in pregnancy and is recommended to be avoided in the present scenario.

Fillers

The most commonly used cosmetic filler is hyaluronic acid, which has much similarity with the intrinsic hyaluronic acid of the human body. This property makes it a safe compound to be injected into the skin during pregnancy. However, lignocaine (the amount used is far lower than recommended maximum dosage), is generally mixed with the filler, and this needs to be taken into consideration, as discussed previously.[68]

Theoretically, fillers rarely may cause hypersensitivity or injection site infection.[69] Also, after injecting a filler, there is some local inflammation followed by collagen remodeling. Vascularity is also increased and there is increased susceptibility to hyperpigmentation encountered in pregnancy.[4] Looking upon these issues, manufacturer recommendations include fillers in pregnancy as a relative contraindication.

Sclerotherapy

Varicose veins that develop during pregnancy, have high chances of resolving within 6–12-month postpartum.[70] A divided opinion exists in the literature, where the German Society of Phlebology and Rabe *et al.* suggested that sclerosants can cross the placenta and are absolutely contraindicated in pregnancy.[70,71] On the other hand studies done by Abramowitz[72] and Reich-Schupke *et al.*[73] showed that sclerotherapy is a safe procedure in pregnancy and no complications were observed in either the mother or the baby. Of all the commonly used agents (i.e., sodium tetradecyl sulfate, polydocanol, and hypertonic saline), hypertonic saline is considered to have the lowest risk of causing adverse reactions.[25] A very limited data over safety of sclerosants in pregnancy prevents us from

making a concrete statement about whether they can be used during gestation or not.

Miscellaneous

Microdermabrasion

It is a safe procedure to perform during pregnancy as it is a physical noninvasive procedure.[74]

Cryotherapy is considered safe during pregnancy[67] and may be the preferred treatment of genital warts. Cryotherapy or electrocautery is preferred over chemical treatments for removal of acrochordons, angiomas, nevi, and warts [Table 2].[5]

When to perform a procedure?

Dermatological procedures, in general, should be conducted preferably during the second trimester or the postpartum period, because the first 12 weeks of gestation are critical for organogenesis and increases the risk of spontaneous abortion, whereas surgery during the third trimester may predispose to premature delivery.[1,10]

Post-procedural Care

The majority of dermatological procedures warrant post-procedural care in the form of antibiotics, analgesics, or cleaning of the wound with antiseptics. Safety in pregnancy has to be looked into to attain an optimum benefit. An overview of these medications is provided in Table 3.

Antibiotics

Topical antiseptics

Alcohol preparations and chlorhexidine gluconate are not associated with any risk to the fetus; however, these should be avoided in the periocular region in general (risk of keratitis and corneal opacity).[2,77,78] Povidone iodine is contraindicated as it can be absorbed through mucous membranes and is associated with fetal hypothyroidism.[8,10] Hexachlorophene is associated with CNS toxicity in fetuses and is avoided.[8,10,20] Therefore, alcohol or chlorhexidine solutions should be preferred for sterility purposes in pregnant patients.

Analgesics

Acetaminophen (Cat B) is a safe option. Although it can cross the placenta, limited usage has negligible risk. Prolonged or high dosage can lead to hemolytic anemia in the newborn and/or renal toxicity in the mother as well as the fetus.[1,2]

Short-term use of opioids is considered safe for intense pain. Larger doses are associated with neonatal respiratory depression.[1,8,10]

Ibuprofen and salicylates are known to cause platelet dysfunction, leading to an increased risk of postpartum hemorrhage in the third trimester. They can also cause a delay in the onset of labor, abruption placenta, and/or a premature closure of ductus arteriosus.[1,8] In addition, salicylates are known to occasionally cause birth defects

Table 2: List of procedures and their safety in pregnancy

Sr. no.	procedure	Safety profile
Procedures for dermatologic conditions		
1.	Electrocautery and radiofrequency	Safe Note: Smoke plume can be carcinogenic, use smoke evacuators
2.	Intralesional steroid injection	Indicated only if benefits outweigh risk
3.	Lasers (CO_2, Nd:YAG, and PDL)	Safe
4.	Cryotherapy	Safe
Procedures for aesthetic indications		
5.	Chemical peeling	Safe Note: Caution with salicylic acid (SA) and trichloroacetic acid (TCA) peel. Not to be used over large areas, under occlusion or over very thin skin
6.	Lasers, IPL, Electroepilation	Not indicated (due to lack of satisfactory safety data) Note: Hormonal changes stimulate new hair growth; hence, hair removal should be done only via depilation
7.	PRP therapy	Not indicated
8.	Botulinum toxin	?Safe (warrants more research)
9.	Fillers	Relative contraindication
10.	Sclerotherapy	Contraindicated
11.	Microdermabrasion	Safe
Dermatosurgical procedures		
12.	Surgical resection of neoplasms	See text
13.	Vitiligo surgery	Inadequate data to comment
14.	Liposuction and Fat grafting	Contraindicated
15.	Suturing and suture removal	Leave sutures for 5–7 days longer than normal

Table 3: Antibiotics

Sr. no.	Antibiotic (pregnancy cat.)	Safety profile	Risk	Special points	References
1.	Penicillin (B)	Safe	–	–	[1,13,75]
2.	Cephalosporin (B)	Safe	–	–	[1,13,75]
3.	Azithromycin (B)	Safe	–	Used when penicillin allergy suspected	[1,13,75]
4.	Erythromycin base (B)	Safe	Estolate form asso. with risk of cholestatic jaundice in mother	Used when penicillin allergy suspected	[1,13,75]
5.	Metronidazole (B)	Safe	–	–	[13]
5.	Cotrimoxazole (D)	Unsafe	Fetal hyperbilirubinemia	Esp in second trimester	[1,76]
6.	Doxycycline (D)	Unsafe	Brown discoloration of teeth	–	[1]
7.	Tetracycline (D)	Unsafe	Brown discoloration of teeth, Enamel toxicity, decreased bone development in infant	–	[1,8,13]
8.	Fluoroquinolones (C)	Unsafe	Cartilage defects	–	[1,8]
9.	Clindamycin (B)	Avoided	Abnormal LFT, pseudomembranous colitis in mother	–	[8]
10.	Sulphonamides (C)	Unsafe	Fetal hyperbilirubinemia with kernicterus	–	[8]
11.	Aminoglycosides (D)	Unsafe	Fetal ototoxicity	–	[8,13]
12.	Chloramphenicol (C)	Unsafe	Grey baby syndrome, fetal death, maternal blood dyscrasias	–	[8]

and delayed fetal growth.[10] Therefore, Ibuprofen and salicylates are contraindicated during pregnancy.

Dermatosurgical Procedures in Pregnancy

Surgical resection of tumors and malignant lesions

Commonly seen tumors and malignant lesions in pregnancy are nevi, pyogenic granuloma, dermatofibroma/dermatofibrosarcoma, melanoma, basal cell carcinoma (BCC), and squamous cell carcinoma (SCC).[4,21]

During pregnancy, surgical intervention for malignant lesions is most likely to be performed for melanoma (95%), followed by SCC (67%), and least likely for BCC (45%).[21] Second trimester is considered to be the optimal period for surgical intervention; however, under local anesthesia, surgery can be performed in any trimester.[21]

Benign nevi may undergo morphological changes in gestation such as an increase in size and/or pigmentation[79] along with dermoscopic alterations like new dot formation (6%), thicker pigment network, dark globules, and an increase in vascularity which may revert to normal post-delivery.[80] These changes, regardless of pregnancy state, warrant immediate biopsy.[4,81]

Melanoma accounts for 8% of all malignancies diagnosed in pregnancy and has a poor prognosis.[1,21,82] Although transplacental transmission is unusual, melanoma represents 31% of metastases to the placenta and 58% of those involve the fetus.[1,82] Fetal involvement is always associated with placental involvement, but vice versa may not be true.[83] In another study, 27 cases of melanoma involving the placenta were reported, out of which 22% (i.e., six cases) were transmitted to the fetus and developed melanoma in the infant.[84]

Treatment of cutaneous melanoma is primarily surgical and is similar in both pregnant and nonpregnant patients. Early diagnosis and thickness of the lesion are predictors of therapeutic prognosis.[4] Lesions 1 mm or less in thickness should be excised with a 1 cm margin; intermediate lesions (1–4 mm thickness) should be excised with a 2 cm margin and lesions that warrant lymph node dissection, should be operated under GA, preferably in the second trimester.[85]

Staging of melanoma in a pregnant woman has enormous importance, as less thick lesions can be excised under local anesthesia. Biopsy of sentinel lymph node during gestation is subjected to a debate among various authors, as some advocate for delay until the postpartum period in view of risk to the fetus,[86] whereas the majority recommend that sentinel lymph node biopsy can be conducted anytime after the 1st trimester to avoid complications during organogenesis.[83,87,88]

Basocellular carcinoma (if not growing) in the thorax or abdomen can be removed after delivery whereas an aggressive SCC on the nose may require urgent micrographic surgery.[10]

Vascular tumors: Hormonal status in pregnancy has a stimulant effect on vascular structures, which may cause growth in pyogenic granulomas, glomus tumors, and hemangioendotheliomas.[35] Pyogenic granulomas can be very symptomatic in a pregnant woman and necessitate treatment through shave removal with cauterization of the feeder's vessel. Lasers such as nonablative Nd:YAG and PDL can also be used according to few reports.[4,36]

Therefore, when a suspicious lesion is detected which shows signs of malignancy such as bleeding, change in size, and pigmentation, most dermatologists prefer a biopsy followed by necessary intervention such as an excision.

The risk of leaving such a lesion untouched is greater than that of conducting a procedure for its removal.[2]

Vitiligo surgery

The course of vitiligo during pregnancy is variable and unpredictable and hence surgery is not recommended.

Hair transplantation

Generally, hair loss tends to improve during pregnancy. This, the cosmetic nature of the surgery and the prolonged duration of surgery necessitates any consideration of HT only after pregnancy.

Liposuction and fat grafting

Since the fetus places increased nutritional demand on the mother, liposuction and fat grafting may compromise the fetus' nutritional requirements. Risk of fat embolism and occlusion also cannot be ruled out. Therefore, fat transfer surgery is not recommended during pregnancy and it is advised that the woman waits until her weight stabilizes after delivery.[25]

Suturing and suture removal

Due to delayed cicatrization in pregnant women, it is advised to use longer lasting absorbable sutures or nonabsorbable sutures with high tensile strength, especially over the trunk and abdomen. They should be left 5–7 days longer than usual.[1] Also, removal of sutures should be in stages to prevent any chances of dehiscence.[10]

Conclusion

It is important to understand that only procedures which are safe and necessary should be performed in a pregnant woman. These may include electrocautery, radiofrequency or cryotherapy for warts, surgical intervention for skin malignancies, and lasers such as CO_2 and Nd:YAG for verrucae and other small growths. Procedures that are safe but need caution along with proper risk assessment include intralesional steroid injections, aesthetic procedures such as chemical peeling, botulinum toxin, microdermabrasion, and biopsies for suspicious lesions. Finally, some procedures which are contraindicated include fillers, sclerotherapy, and liposuction including adipocyte transfer.

The review outlined above suggests that many procedures are safe and can be performed but with extra caution. An assessment of the patient, both medical and psychological needs to be carried out. Patients need to be counseled about the procedures and the concerned gynecologist may be involved in a decision where necessary. As stated above the principle of maleficence "Above all, do no harm" applies in pregnancy more than in any other situation.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Oakes K. Pregnancy not a barrier to providing cutaneous surgery [Internet]. Mdedge.com; 2017. Available from: https://www.mdedge.com/dermatology/article/144443/dermatologic-surgery/pregnancy-not-barrier-providing-cutaneous-surgery. [Last accessed on 2020 Sep 25].
2. Gontijo G, Gualberto GV, Madureira NA. Dermatologic surgery and cosmetic procedures during pregnancy: A systematic review. Surg Cosmet Dermatol 2010;2:39-45.
3. Talakoub L, Wesley N. Cosmetic procedures in pregnancy [Internet]. Mdedge.com; 2015. Available from: https://www.mdedge.com/obgyn/article/98661/aesthetic-dermatology/cosmetic-procedures-pregnancy. [Last accessed on 2020 Sep 25].
4. Goldberg D, Maloney M. Dermatologic surgery and cosmetic procedures during pregnancy and the post-partum period. Dermatol Ther 2013;26:321-30.
5. Meyer E. When the patient is pregnant. The Dermatologist 2010;18. Available from: https://www.the-dermatologist.com/content/when-patient-pregnant. [Last accessed on 2020 Sep 25].
6. Nussbaum R, Benedetto AV. Cosmetic aspects of pregnancy. Clin Dermatol 2006;24:133-41.
7. Trivedi MK, Kroumpouzos G, Murase JE. A review of the safety of cosmetic procedures during pregnancy and lactation. Int J Womens Dermatol 2017;3:6-10.
8. Richards KA, Stasko T. Dermatologic surgery and the pregnant patient. Dermatol Surg 2002;28:248-56.
9. O'Day MP. Cardio-respiratory physiological adaptation of pregnancy. Semin Perinatol 1997;21:268-75.
10. Sweeney SM, Maloney ME. Pregnancy and dermatologic surgery. Dermatol Clin 2006;24:205-14, vi.
11. Rudolf MC, Sherwin RS. Maternal ketosis and its effects on the fetus. Clin Endocrinol Metab 1983;12:413-28.
12. Gianopoulos JG. Establishing the criteria for anesthesia and other precautions for surgery during pregnancy. Surg Clin North Am 1995;75:33-45.
13. Moore PA. Selecting drugs for the pregnant dental patient. J Am Dent Assoc 1998;129:1281-6.
14. Steinberg ES, Santos AC. Surgical anesthesia during pregnancy. Int Anesthesiol Clin 1990;28:58-66.
15. Kuhnert BR, Knapp DR, Kuhnert PM, Prochaska AL. Maternal, fetal, and neonatal metabolism of lidocaine. Clin Pharmacol Ther 1979;26:213-20.
16. Jakharia-Shah N, Chadha P, Watson L. A review of the safety of common aesthetic procedures during pregnancy. J Plast Reconstr Aesthet Surg 2018;71:1362-80.
17. Gasparoni A, De Amici D, Ciardelli L, Autelli M, Regazzi-Bonora M, Bartoli A, *et al*. Effect of lidocaine on neutrophil chemotaxis in newborn infants. J Clin Immunol 1998;18:210-3.
18. Fujinaga M, Mazze RI. Reproductive and teratogenic effects of lidocaine in Sprague-Dawley rats. Anesthesiology 1986;65:626-32.
19. Fayans EP, Stuart HR, Carsten D, Ly Q, Kim H. Local anesthetic use in the pregnant and postpartum patient. Dent Clin North Am 2010;54:697-713.
20. Gormley DE. Cutaneous surgery and the pregnant patient. J Am Acad Dermatol 1990;23:269-79.
21. Nagappan P. Surgeons defer procedures during early stage pregnancy [Internet]. Dermatology Times; 2018. Available from: https://www.dermatologytimes.com/view/surgeons-defer-procedures-during-early-stage-pregnancy. [Last accessed on 2020 Sep 25].
22. Hagai A, Diav-Citrin O, Shechtman S, Ornoy A. Pregnancy outcome after in utero exposure to local anesthetics as part of dental treatment: A prospective comparative cohort study. J Am Dent Assoc 2015;146:572–80.
23. Physicians' Desk Reference. 50th edition medical consultant: Ronald Arky. Montvale, NJ: Medical Economics Co.; 1996. vi + 2879 pp. 23×28 cm. ISBN 1-56363-152-0. $69.95. J Med Chem 1996;39:2278.

24. Chen BK, Eichenfield LF. Pediatric anesthesia in dermatologic surgery: When hand-holding is not enough. Dermatol Surg 2001; 27:1010-8.
25. Lee KC, Korgavkar K, Dufresne RG Jr, Higgins HW 2nd. Safety of cosmetic dermatologic procedures during pregnancy. Dermatol Surg 2013;39:1573-86.
26. Friedman PM, Mafong EA, Friedman ES, Geronemus RG. Topical anesthetics update: EMLA and beyond. Dermatol Surg 2001;27:1019-26.
27. Guay J. Methemoglobinemia related to local anesthetics: A summary of 242 episodes. Anesth Analg 2009;108:837-45.
28. Gatti JE, Bryant CJ, Noone RB, Murphy JB. The mutagenicity of electrocautery smoke. Plast Reconstr Surg 1992;89:781-4; discussion 785-6.
29. Triamcinolone use during pregnancy [Internet]. Drugs.com; 2019. Available from: https://www.drugs.com/pregnancy/triamcinolone.html. [Last accessed on 2020 Sep 25].
30. Adelson MD, Semo R, Baggish MS, Osborne NG. Laser vaporization of genital condylomata in pregnancy. J Gynecol Surg 1990;6:257-62.
31. HSU CK, Lee JYY, Yu CH, Hsu MML, Wong TW. Lip verrucous carcinoma in a pregnant woman successfully treated with carbon dioxide laser surgery. Br J Dermatol 2007;157:813-5.
32. Arena S, Marconi M, Frega A, Villani C. Pregnancy and condyloma: Evaluation about therapeutic effectiveness of laser CO_2 on 115 pregnant women. Minerva Ginecol 2001;53:389-96.
33. Ferenczy A. Treating genital condyloma during pregnancy with the carbon dioxide laser. Am J Obstet Gynecol 1984;148:9-12.
34. Buzalov S, Khristakieva E. [The treatment of neglected cases of condylomata acuminata in pregnant women with the Nd:Yag laser]. Akush Ginekol (Sofiia) 1995;34:38-9.
35. Ballin JS, Uebelhoer NS. The use of the low-fluence 1064 nm Nd:Yag laser in a female with contraindications to systemic anti-acne therapy. J Drugs Dermatol 2009;8:1025-6.
36. Powell JL, Bailey CL, Coopland AT, Otis CN, Frank JL, Meyer I. Nd:Yag laser excision of a giant gingival pyogenic granuloma of pregnancy. Lasers Surg Med 1994;14:178-83.
37. Yamashita H, Matsumiya K, Masamune K, Liao H, Chiba T, Dohi T. Miniature bending manipulator for fetoscopic intrauterine laser therapy to treat twin-to-twin transfusion syndrome. Surg Endosc 2008;22:430-5.
38. Stone CA, Quinn MW, Saxby PJ. Congenital skin loss following Nd:YAG placental photocoagulation. Burns 1998;24:275-7.
39. Richards KA, Garden JM. The pulsed dye laser for cutaneous vascular and nonvascular lesions. Semin Cutan Med Surg 2000;19:276-86.
40. Carlan SJ, Schorr SJ, Ebenger MF, Danna PA, Anibarro GB. Laser lithotripsy in pregnancy. A case report. J Reprod Med 1995;40:74-6.
41. Scarpa RM, De Lisa A, Usai E. Diagnosis and treatment of ureteral calculi during pregnancy with rigid ureteroscopes. J Urol 1996;155:875-7.
42. Erceg A, Bovenschen HJ, van de Kerkhof PC, de Jong EM, Seyger MM. Efficacy and safety of pulsed dye laser treatment for cutaneous discoid lupus erythematosus. J Am Acad Dermatol 2009;60:626-32.
43. Kim SG, Kim EY, Kim YJ, Lee SI. The efficacy and safety of ablative fractional resurfacing using a 2,940-nm er:Yag laser for traumatic scars in the early posttraumatic period. Arch Plast Surg 2012;39:232-7.
44. Hasegawa T, Matsukura T, Mizuno Y, Suga Y, Ogawa H, Ikeda S. Clinical trial of a laser device called fractional photothermolysis system for acne scars. J Dermatol 2006;33:623-7.
45. Andersen FE. Final report on the safety assessment of glycolic acid, ammonium, calcium, potassium, and sodium glycolates, methyl, ethyl, propyl, and butyl glycolates, and lactic acid, ammonium, calcium, potassium, sodium, and TEA-lactates,methyl, ethyl, isopropyl, and butyl lactates, and lauryl, myristyl, and cetyl lactates. Int J Toxicol 1998;17:1-241.
46. Grimes PE. Microdermabrasion. Dermatol Surg 2005;31:1160-5; discussion 1165.
47. James AH, Brancazio LR, Price T. Aspirin and reproductive outcomes. Obstet Gynecol Surv 2008;63:49-57.
48. Costet N, Garlantézec R, Monfort C, Rouget F, Gagnière B, Chevrier C, *et al*. Environmental and urinary markers of prenatal exposure to drinking water disinfection by-products, fetal growth, and duration of gestation in the Pelagie birth cohort (Brittany, France, 2002-2006). Am J Epidemiol 2012;175:263-75.
49. Schwartz DB, Greenberg MD, Daoud Y, Reid R. Genital condylomas in pregnancy: Use of trichloroacetic acid and laser therapy. Am J Obstet Gynecol 1988;158:1407-16.
50. McDaniel DH, Ash K, Zukowski M. Treatment of stretch marks with the 585-nm flashlamp-pumped pulsed dye laser. Dermatol Surg 1996;22:332-7.
51. Jiménez GP, Flores F, Berman B, Gunja-Smith Z. Treatment of striae rubra and striae alba with the 585-nm pulsed-dye laser. Dermatol Surg 2003;29:362-5.
52. Yang YJ, Lee GY. Treatment of striae distensae with nonablative fractional laser versus ablative Co(2) fractional laser: A randomized controlled trial. Ann Dermatol 2011;23:481-9.
53. de Angelis F, Kolesnikova L, Renato F, Liguori G. Fractional nonablative 1540-nm laser treatment of striae distensae in fitzpatrick skin types Ii to Iv: Clinical and histological results. Aesthet Surg J 2011;31:411-9.
54. Goldman A, Rossato F, Prati C. Stretch marks: Treatment using the 1,064-nm Nd:Yag laser. Dermatol Surg 2008;34:686-91; discussion 691-2.
55. Longo L, Postiglione MG, Marangoni O, Melato M. Two-year follow-up results of copper bromide laser treatment of striae. J Clin Laser Med Surg 2003;21:157-60.
56. Mike. Can you have PRP hair loss treatment whilst pregnant? [Internet]. Belgravia Centre Hair Loss Blog; 2020. Available from: https://www.belgraviacentre.com/blog/can-you-have-prp-hair-loss-treatment-whilst-pregnant/. [Last accessed on 2020 Sep 25].
57. Cosmetic MD - Platelet rich plasma (PRP) Sydney [Internet]. Beauty outside and inside; 2020. Available from: http://cosmeticmd.com.au/Treatments/PRP-FAQ.php. [Last accessed on 2020 Sep 25].
58. Tan M, Kim E, Koren G, Bozzo P. Botulinum toxin type A in pregnancy. Can Fam Physician 2013;59:1183-4.
59. Morgan JC, Iyer SS, Moser ET, Singer C, Sethi KD. Botulinum toxin A during pregnancy: A survey of treating physicians. J Neurol Neurosurg Psychiatry 2006;77:117-9.
60. Hatheway CL. Toxigenic clostridia. Clin Microbiol Rev 1990;3:66-98.
61. Wataganara T, Leelakusolvong S, Sunsaneevithayakul P, Vantanasiri C. Treatment of severe achalasia during pregnancy with esophagoscopic injection of botulinum toxin A: A case report. J Perinatol 2009;29:637-9.
62. Robinson AY, Grogan PM. Onabotulinumtoxina successfully used as migraine prophylaxis during pregnancy: A case report. Mil Med 2014;179:e703-4.
63. Newman WJ, Davis TL, Padaliya BB, Padaliya BB, Covington CD, Gill CE, *et al*. Botulinum toxin type A therapy during pregnancy. Mov Disord 2004;19:1384-5.
64. Bodkin CL, Maurer KB, Wszolek ZK. Botulinum toxin type A therapy during pregnancy. Mov Disord 2005;20:1081-2; author reply 1082.
65. Chacon AH. Fillers in dermatology: From past to present. Cutis 2015;96:E17-9.
66. Monteiro E. Botulinum toxin and pregnancy. Skinmed 2006;5:308.
67. Manela-Azulay M, Issa MCA, Tamler C, Pinheiro AMC, Costa A. Procedimentos esteticos. In: Costa A, Alves G, Azulay L, editors. Dermatologia e gravidez. Rio de Janeiro: Elsevier; 2009. p. 449-53.
68. Dix SK, Rosner GF, Nayar M, Harris JJ, Guglin ME, Winterfield JR, *et al*. Intractable cardiac arrest due to lidocaine toxicity successfully resuscitated with lipid emulsion. Crit Care Med 2011;39:872-4.
69. Lolis M, Dunbar SW, Goldberg DJ, Hansen TJ, MacFarlane DF. Patient safety in procedural dermatology: Part Ii. Safety related to cosmetic procedures. J Am Acad Dermatol 2015;73:15-24; quiz 25-6.
70. Rabe E, Pannier F. Sclerotherapy of varicose veins with polidocanol based on the guidelines of the German Society of Phlebology. Dermatol Surg 2010;36:968-75.
71. Rabe E, Pannier-Fischer F, Gerlach H, Breu FX, Guggenbichler S, Zabel M; German Society of Phlebology. Guidelines for

sclerotherapy of varicose veins (Icd 10: I83.0, I83.1, I83.2, and I83.9). Dermatol Surg 2004;30:687-93; discussion 693.
72. Abramowitz I. The treatment of varicose veins in pregnancy by empty vein compressive sclerotherapy. S Afr Med J 1973;47:607-10.
73. Reich-Schupke S, Leiste A, Moritz R, Altmeyer P, Stücker M. Sclerotherapy in an undetected pregnancy: A catastrophe? Vasa 2012;41:243-7.
74. Bhalla M, Thami GP. Microdermabrasion: Reappraisal and brief review of literature. Dermatol Surg 2006;32:809-14.
75. Babcock MD, Grekin RC. Antibiotic use in dermatologic surgery. Dermatol Clin 2003;21:337-48.
76. Garland SM, O'Reilly MA. The risks and benefits of antimicrobial therapy in pregnancy. Drug Saf 1995;13:188-205.
77. Stott WG. Antiseptic (Hibiclens) and eye injuries. Med J Aust 1980;2:456.
78. Driscoll MS, Grin-Jorgensen CM, Grant-Kels JM. Does pregnancy influence the prognosis of malignant melanoma? J Am Acad Dermatol 1993;29:619-30.
79. Hu W, Nelson JE, Mohney CA, Willen MD. Malignant melanoma arising in a pregnant African American woman with a congenital blue nevus. Dermatol Surg 2004;30:1530-2.
80. Driscoll MS, Grant-Kels JM. Nevi and melanoma in the pregnant woman. Clin Dermatol 2009;27:116-21.
81. Baergen RN, Johnson D, Moore T, Benirschke K. Maternal melanoma metastatic to the placenta: A case report and review of the literature. Arch Pathol Lab Med 1997;121:508-11.
82. Jhaveri MB, Driscoll MS, Grant-Kels JM. Melanoma in pregnancy. Clin Obstet Gynecol 2011;54:537-45.
83. Alexander A, Samlowski WE, Grossman D, Bruggers CS, Harris RM, Zone JJ, *et al*. Metastatic melanoma in pregnancy: Risk of transplacental metastases in the infant. J Clin Oncol 2003;21:2179-86.
84. Teplitzky S, Sabates B, Yu K, Beech DJ. Melanoma during pregnancy: A case report and review of the literature. J La State Med Soc 1998;150:539-43.
85. Broer N, Buonocore S, Goldberg C, Truini C, Faries MB, Narayan D, *et al*. A proposal for the timing of management of patients with melanoma presenting during pregnancy. J Surg Oncol 2012;106:36-40.
86. Pagès C, Robert C, Thomas L, Maubec E, Sassolas B, Granel-Brocard F, *et al*. Management and outcome of metastatic melanoma during pregnancy. Br J Dermatol 2010;162:274-81.
87. Schwartz JL, Mozurkewich EL, Johnson TM. Current management of patients with melanoma who are pregnant, want to get pregnant or do not want to get pregnant. Câncer 2003;97:2130-3.
88. Kroumpouzos G, Cohen LM. Dermatoses of pregnancy. J Am Acad Dermatol 2001;45:1-19; quiz 19-22.