

A Systematic Review of Elective Laser Therapy during Pregnancy



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Received: March 13, 2020

Accepted: June 26, 2021

Published online September 19, 2021

Abstract

Introduction: Currently, lasers are used to treat many diseases and their complications. However, the use of lasers in pregnant patients is still controversial.

Methods: In this review, the application of lasers in the fields of urology, surgery, obstetrics, dermatology, and musculoskeletal disorders is evaluated. The following keywords were used to search through PubMed, Google Scholar, and Scopus: pregnancy, laser, urolithiasis, endovenous laser ablation (EVLA) or treatment, leg edema, varicose vein, venous insufficiencies, hair removal, pigmentation, telangiectasia, vascular lesions, Q switch laser, diode laser, holmium, holmium-YAG laser, erbium laser and Pulsed dye laser, low-level laser therapy, high-intensity laser therapy, pain, musculoskeletal disorders, twin to twin transfusion syndrome (TTTS), amnioreduction, and safety.

Results: Totally, 147 articles were found, and their abstracts were evaluated; out of 53 articles extracted, 14 articles were about dermatology, 24 articles were about urology, 12 articles were about obstetrics and gynecology, 10 articles were about musculoskeletal disorders and three articles were related to surgery.

Conclusion: Laser therapy can be used as a safe treatment for urolithiasis, skin diseases, TTTS and varicose veins of the lower extremities. However, the use of laser therapy for musculoskeletal disorders during pregnancy is not recommended due to lack of evidence, and also we cannot recommend endovenous ablation.

Keywords: Laser; Urology; Pregnancy; Surgery; Obstetrics and gynecology; Dermatology; Physical medicine and rehabilitation; Musculoskeletal disorders



Introduction

Lasers were first used in pregnancy in 1973 to treat cervical erosions. It was then used in the treatment of cervical intraepithelial neoplasia and fallopian tube microsurgery.^{1,2} Although lasers are used to treat some diseases in non-pregnant patients,³ selective laser therapy during pregnancy is generally not recommended by health care professionals and is therefore recommended to be performed after delivery.⁴ Conditions such as acne, granuloma gravidarum, other vascular

lesions, condyloma, keloids, verrucae, hypertrichosis, hyperpigmentation or even other cosmetic cases can benefit from laser treatment during pregnancy.^{5,6} Due to the lack of standard guidelines and a misunderstanding of the potential risks to the fetus, the use of lasers is postponed as much as possible during pregnancy until after delivery. However, it is recommended that essential laser treatment be performed during the second and early third trimesters of pregnancy to prevent spontaneous abortion and preterm delivery as much as possible.⁷ These

recommendations are based on the physiological stages of development of the fetus, which provide physicians with the necessary information for counseling and treatment of pregnant patients. The first trimester of pregnancy is an important stage of organogenesis in the fetus and the risk of miscarriage during this period is 12%, which is reduced to 5% during the second and third trimesters of pregnancy.⁸ After the twentieth week, the fetus is more resistant to growth defects, but the risk of preterm birth increases in the third trimester.⁷ There is a great deal of controversy about unnecessary physiological stress on the fetus by selective laser therapy during pregnancy. Any change in the mother's heart rate, body temperature, and blood pressure can stress the fetus and alter uterine perfusion and oxygenation.^{9,10} Although there have been no reports of maternal laser therapy that has caused fetal stress, the use of this method in patients is controversial among specialists.^{11,12}

Due to the limited data related to laser therapy during pregnancy and experts' doubts about its use, this study reviews the information and data of studies on the use of lasers in dermatology, urology, vascular surgery, obstetrics and gynecology to reach a conclusion about the use of lasers in pregnancy.

Materials and Methods

Published articles on the use of lasers in pregnant patients in five areas including dermatology, urology, vascular surgery, physical medicine and rehabilitation, obstetrics and gynecology were evaluated (Figure 1). The main

keywords used in the field of urology were pregnancy, laser, holmium, holmium-YAG laser, urolithiasis, and lithotripsy. In the field of vascular surgery, the keywords used include endovenous laser ablation (EVLA), endovenous laser treatment (EVL), Diode laser, leg edema, pregnancy, varicose vein, and venous insufficiencies. To evaluate the application of lasers in the field of skin, the keywords laser, pregnancy, hair removal, pigmentation, telangiectasia, vascular lesions, Q switch laser, Erbium laser, and Pulsed dye laser were used. To review studies on physical medicine and rehabilitation, the search was based on such keywords as pregnancy, laser, low-level laser therapy, high-intensity laser therapy, pain, and musculoskeletal disorders. Finally, the main keywords in the field of obstetrics and gynecology included laser, pregnancy, twin to twin transfusion syndrome (TTTS), amnioreduction, and safety, searched in PubMed, Google Scholar and Scopus. Abstracts of the obtained articles were reviewed, and appropriate articles were extracted. Search time was considered until the end of 2020. Only English articles were included in this review.

Results

Totally, 147 articles were found, and their abstracts were evaluated. 53 articles were identified as relevant based on their abstract; of them, 14 articles were about dermatology, 24 articles were about urology, 12 articles were about obstetrics and gynecology, 10 articles were about musculoskeletal disorders and three articles were related to surgery. The PRISMA flow diagram is

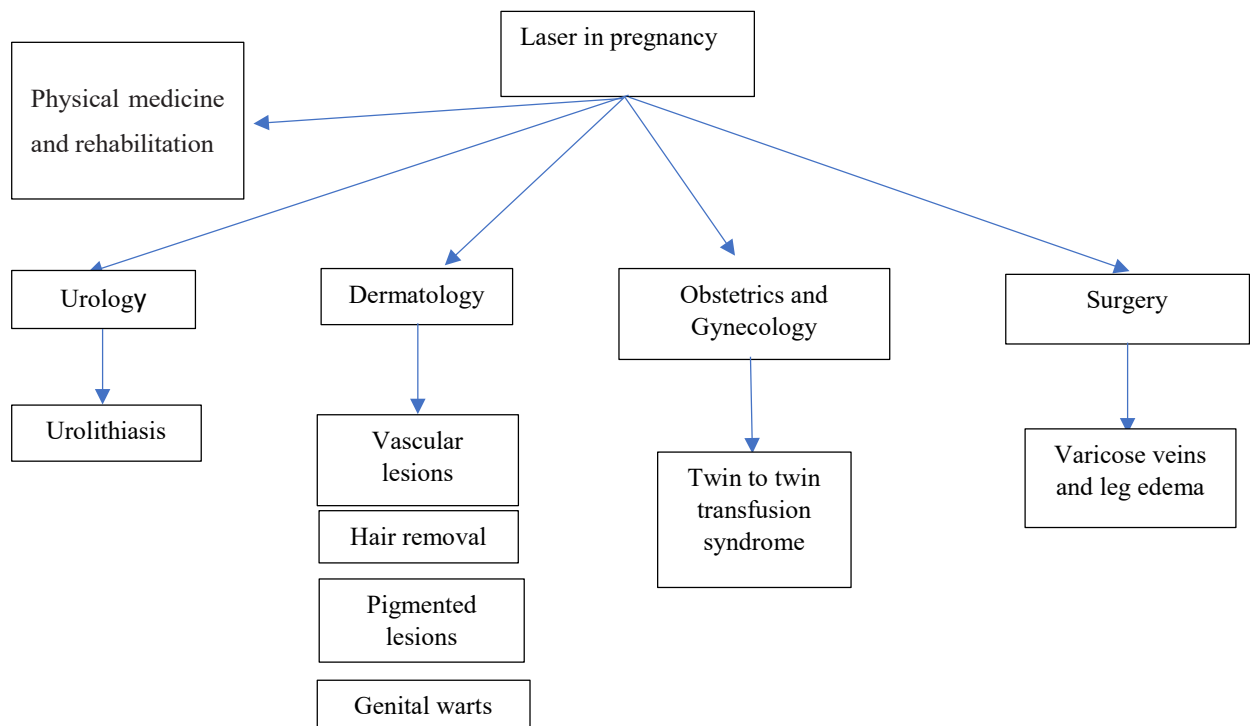


Figure 1. Medical Fields Evaluated in Relation to Laser Therapy in Pregnancy.

demonstrated in Figure 2.

Vascular Lesions

Although many vascular lesions such as hemangioma and telangiectasias develop during pregnancy and resolve spontaneously after delivery, some remain and require laser treatment.^{13,14} Research has shown that the neodymium-doped yttrium aluminum garnet (Nd:YAG) laser and flashlamp-pumped pulsed dye laser are the treatment of choice for vascular lesions but not during pregnancy.^{15,16} A case report is available on this topic during pregnancy, in which a 19-year-old pregnant woman with capillary hemangiomas was treated with the Nd:YAG laser. No complications were reported after delivery in this case.¹¹ A review of studies showed that using laser therapy during pregnancy poses no risk to the mother or fetus, and it is a nonviolent procedure during pregnancy. However, there is no more information about the laser therapy of vascular lesions during pregnancy.¹⁷

Hair Removal

Currently, there is no data available regarding the safety

of hair removal lasers during pregnancy. Most of the current guidelines do not recommend the use of cosmetic procedures such as hair removal during pregnancy.¹⁸

Pigmented Lesions

Hyperpigmentation is seen in almost all pregnant women. These changes are more common in women with dark skin. Melasma is an example of this hyperpigmented lesion. Although no particular cure is needed during pregnancy, doctors can assure patients that melasma resolves after delivery in most pregnant mothers. However, it may relapse with future pregnancies, which is generally treated with a mixture of topical tretinoin, hydroquinone, and corticosteroids.¹⁴ The use of lasers is beneficial and harmless in the treatment of hyperpigmented lesions such as melasma. Combined laser therapy of melasma with the pulsed CO₂ laser followed by the Q-switched alexandrite laser was highly effective in non-pregnant patients.¹⁹ On the other hand, studies showing the advantages of the use of laser therapy in pregnant women for hyperpigmented lesions are not available.²⁰

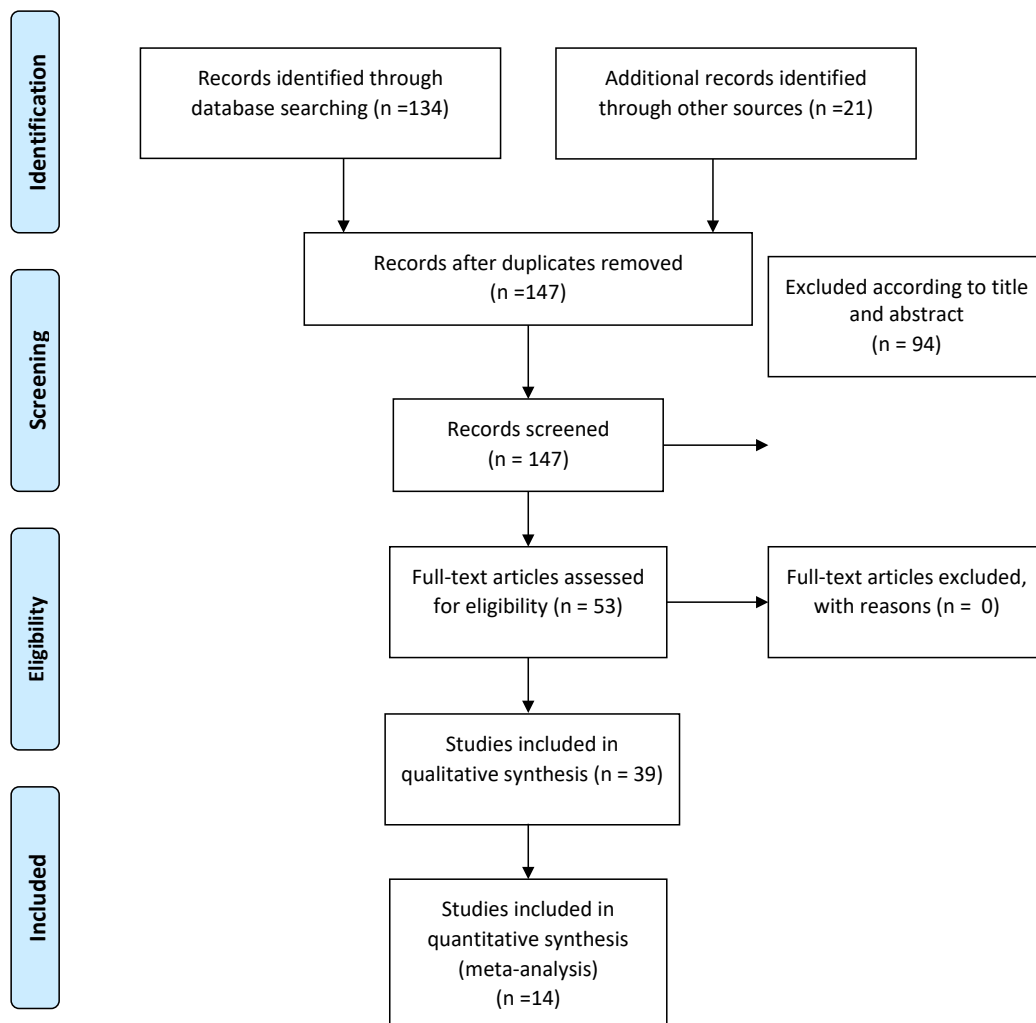


Figure 2. PRISMA Flowchart.

Genital Warts

Different types of lasers, including CO₂ lasers and Nd-YAG lasers, are used to treat genital warts such as condyloma acuminatum. Studies indicate that the use of laser therapy in a pregnant woman with condyloma reduces the risk of recurrence and intrapartum morbidity. Also, it can prevent fetal infection.²¹⁻²³

Complications of Pregnancy

Some studies demonstrate that the use of an ablative fractional laser for restrictive scarring of the abdomen is appropriate with minimal side effects for pregnant women and their fetuses, and mothers with similar complaints can deliver a healthy term newborn without any abnormalities.^{3,24}

Gestational Urolithiasis

Although urolithiasis is rare in pregnancy, it can have a negative effect on pregnancy and lead to preterm labor.^{25,26} Also, stones in pregnancy due to the physiological dilation of the collecting ducts may migrate to the ureter and cause symptoms.²⁷ The most common type of stone in pregnant women is calcium phosphate.²⁸ At present, ultrasound is the best method for assessing pregnant women with flank pain although the sensitivity of this method is operator-dependent.^{29,30} Magnetic resonance imaging (MRI) without gadolinium injection has been proposed as a second-line imaging modality.³¹ One of the safest methods for treating these patients is urethroscopy.³² There are several methods for stone fragmentation, including electrohydraulic, pneumatic, and laser lithotripsy. Holmium: yttrium-aluminum-garnet (holmium-YAG) has been commonly used for laser lithotripsy.^{33,34} The comparison between pneumatic and laser lithotripsy revealed that both methods are described as effective for treating stones. However, the stone-free rate (SFR) in the laser method was slightly higher than that in the pneumatic treatment. If the access or the cost of laser treatment is an issue, pneumatic lithotripsy can be a safe alternative.^{35,36} In addition, the comparison of laser lithotripsy and extracorporeal shock wave lithotripsy showed that laser treatment is more effective due to shorter surgery duration and higher SFR.³⁷ Between 2000 and 2019, 1110 pregnant women were treated with urolithiasis by urethroscopy. The treatment in 412 patients was laser lithotripsy. The mean gestational age was 24.39±4.15 weeks. The most common symptoms were flank pain and renal colic. [Table 1](#) summarizes the characteristics of the considered studies, including the percentage of stone-free cases and complications.

In a study, Bozkurt et al compared the effectiveness and safety of urethroscopy between 41 pregnant women and 62 non-pregnant women. SFR in pregnant and non-pregnant women was reported to be 87.7% and 85.5% respectively ($P = 0.737$). Also, the rate of postoperative

complications in the two groups was not significantly different. Therefore, urethroscopy can be used as a safe method in urolithiasis in pregnant and non-pregnant women.³⁸ In another study, three methods including percutaneous nephrostomy (PCN), double-J stent insertion, and urethroscopy for lithotripsy in pregnant women were compared. Although all three methods were reported to be effective and safe in the treatment of urolithiasis in pregnancy, postoperative tolerance for PCN and double-J stent insertion was poor. Therefore, urethroscopy (especially holmium laser lithotripsy) was selected as the preferred method of treatment.³⁹

In some studies, pneumatic or laser lithotripsy has been used for stone fragmentation. Both treatments for urolithiasis have been reported to be effective and safe in pregnancy.⁴⁰⁻⁴² However, laser lithotripsy has been mentioned in many studies as the first line of treatment for urolithiasis in pregnant patients. This method can be performed in all stages of pregnancy. The unpleasant features of ureteral stents and nephrostomy tubes can be avoided by using laser lithotripsy. This method is also recommended to be performed in medical centers with appropriate equipment.⁴³⁻⁴⁸ In addition, the use of laser lithotripsy in ureteral stones larger than 1 cm in obese people and in individuals with one failed shock wave lithotripsy treatment is reported to have a higher SFR rate than other methods.⁴⁷

Twin to Twin Transfusion Syndrome

Monochorionic diamniotic (MCDA) twin pregnancies can be complicated by TTTS and twin anemia polycythemia sequence that are due to vascular anastomoses between fetuses. TTTS occurs in 5% to 15% of MCDA twin pregnancies, with 80% to 100% of prenatal mortality if untreated. Because of the high mortality rate, several treatments for TTTS, such as expectant management, serial amnioreduction, fetocide, and laser photocoagulation, have been suggested. Laser ablation is the only method that corrects the underlying pathophysiologic problem in TTTS. Indeed, the laser ablation of placental anastomoses is the first choice of treatment for Quintero stage 2 or greater TTTS before 26 weeks. This procedure is performed percutaneously under regional or local anesthesia. An endoscopic cannula, under ultrasound guidance, is inserted into the amniotic cavity of the recipient fetus to presume vascular equator, and a fetoscope is inserted via the cannula. After visualization and mapping the entire vascular equator and anastomoses, an operator coagulates all visible anastomoses (selective technique), a thin line of tissue at the placental surface was coagulated which functionally separates the placenta at the level of the vascular equator (Solomon technique).⁴⁹⁻⁵³

A study showed that endoscopic laser therapy had better outcomes in overall survival, neurologic morbidity, and

neonatal death compared with serial amnioreduction.⁵⁴⁻⁵⁷ Behavioral problems did not increase in twins treated with laser ablation compared with the general population.⁵⁸

After fetoscopic laser surgery, complications such as placental abruption, preterm premature rupture of the membranes, persistent trophoblastic disease, and intrauterine fetal death may increase.⁵³ Severe separation of chorioamnion membrane is associated with worse pregnancy outcomes.⁵⁹ Maternal complications are not reported and do not seem to affect maternal future fertility, obstetric, or gynecologic outcomes.⁶⁰

Varicose Veins

Varicose veins and leg edema (venous insufficiency) are common during pregnancy. The most common symptoms of varicose veins and edema are substantial pain, night cramps, numbness, and tingling, and the legs may feel heavy, achy, and possibly unsightly.⁶¹

Treatments for varicose veins are usually divided into three main categories: surgical and minimally invasive interventions, pharmacological treatments, and non-pharmacological treatments. EVLA is one of the minimally invasive approaches, which is gaining popularity. In this approach, different pulse waves of the diode laser (810 nm-1470 nm) are used to treat insufficient greater saphenous

veins after appropriate tumescent administration.⁵⁹ Some patient-related factors could make EVLA inappropriate, and pregnancy is one of these factors. In clinical trials on EVLT, pregnant women are generally excluded, and the procedure has not been studied in this cohort of patients.⁶⁰

In a study on pregnant women with leg edema and varicose veins, including seven trials (involving 326 women), only phlebotonic and compression therapies were used to alleviate the symptoms.⁶¹

In conclusion, venous insufficiency during pregnancy should be treated with non-invasive methods. Treatments of leg edema comprise mostly symptom reduction rather than a cure with the use of pharmacological and non-pharmacological approaches.⁶²

Physical Medicine and Rehabilitation

Biomechanical, hormonal and vascular adaptations during pregnancy may cause different musculoskeletal symptoms⁶³ with significant physical and psychosocial consequences. About 25% of pregnant women experience musculoskeletal symptoms during pregnancy,⁶⁴ ranging from mild discomfort to severe debilitating pain.

Although the musculoskeletal system involvement can occur at any time during pregnancy, it is more prominent in the third trimester. Low back pain (LBP) is the most

Table 1. Details of Considered Studies in Field of Laser Therapy in Urolithiasis

Study	Year	Mean Gestational Age	Samples	Primary Symptoms	Stone Free %	Complication (n)
Akpınar	2006	25	7	Renal colic	85	Low weight child (1)
Adanur	2014	24.8	19	Renal colic	100	Preterm uterine contraction (1) UTI (1)
Atar	2012	24	15	Renal colic	100	Ureteral perforation (1) Ureteral mucosal injury (1) Dysuria (5) UTI (1)
Georgescu	2014	22	54 (17)	Flank pain	-	Ureteral edema, mild ureteral laceration or bleeding (5) UTI (4) Renal colic (2) Prolonged hematuria (1)
Abedi	2017	27.3	45	Renal colic	93.3	UTI (2)
James	2002	22	8	Renal colic	91	0
Akpınar	2006	-	7	Renal colic	75	Full-term baby with low gestational weight (1)
Wang	2013	29	87 (52)	Flank pain Renal colic	81.3	Threatened abortion (1) Mild Bleeding (5) Mild ureteric laceration (1)
Sofer	2002	-	598 (9)	Renal colic	94.75	0
Atar	2012	24	19	Renal colic Hematuria	100	Ureteral perforation (1) Dysuria (5) UTI (1)
Zhang	2016	23	117	Renal colic	83.5	Uterine contractions (12)
Bozkurt	2012	24	32 (17)	Renal colic	-	Ureteral laceration (2) UTI (4)

common musculoskeletal complaint in pregnancy. Furthermore, in the lower limb, muscle spasms and pain in the hip, knee and foot have commonly been reported.⁶⁵ Hand and wrist problems such as carpal tunnel syndrome are also common among pregnant women.⁶⁶ Treatment of LBP in pregnancy is mostly conservative, with specific exercises,⁶⁷ activity modifications, bed rest and using pain relief medications and pelvic belts.^{68,69} There are also some modalities which are safe and effective according to the literature. They include transcutaneous electrical nerve stimulation,⁷⁰ spinal manipulation,⁷¹ acupuncture,⁷² and yoga.⁷³

Recently, laser therapies including low-level laser therapy (LLLT) and high-intensity laser therapy (HILT) have been used in the management of musculoskeletal disorders. The most prominent treatment effects on the musculoskeletal system are anti-inflammation, antiedema, muscle relaxation, analgesia, tissue repair, and biostimulation. HILT has the advantage that can target deep joints and tissues and stimulate a wider area compared to LLLT.⁷⁴⁻⁷⁷ Laser therapy has been shown to be successful in treating different musculoskeletal disorders such as non-specific LBP⁷⁴, neck pain,⁷⁸ foot and ankle pain⁷⁹ and knee osteoarthritis.⁸⁰

Despite strong evidence for laser therapy in musculoskeletal conditions, there is insufficient knowledge about musculoskeletal laser treatment during pregnancy. Laser therapy is considered an absolute contraindication in pregnant women⁸¹ and an exclusion criterion in some musculoskeletal studies.⁷⁴ North American Association for Laser Therapy conference has also recommended not using LLLT directly over the developing fetus during pregnancy.⁸²⁻⁸³

Conclusion

It was manifested that the use of lasers is safe and effective in the treatment of skin vascular lesions, hair removal, pigmented lesions, genital warts, and complications of pregnancy in pregnant patients. Moreover, in the laser treatment of urolithiasis and TTTS, no side effects have been reported in mothers or fetuses, and therefore, the use of laser therapy is safe and appropriate. Although laser therapy is used for musculoskeletal pain and the varicose veins of the lower extremities, no study has been done to evaluate the possibility of using this treatment in pregnant patients. Clinical trials may assess the possibility of using the laser in the treatment of these cases in pregnant patients.

Ethical Considerations

Not applicable.

Conflict of Interests

The authors declare that they have no conflict of interest.

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