

## **Excision of Endometriosis**

Endometriosis by itself is one of the most perplexing and painful disorders ever to be catalogued in the annals of medical history. Yet, making matters worse is the fact that there exist almost as many opinions on how to treat the disorder as there are specialists. Faced with such a bewildering array of often contradictory information, it's easy to understand how medical misconceptions can sometimes slip into the narratives and be mistaken as scientific fact or simply differences of opinion. Recently, however, there seems to have been an uptick in misleading claims being circulated on the internet, particularly concerning laser and excision surgery. Patients with endometriosis are already burdened with a devastating disease; yet now it seems they face even more hardship by having to navigate through a minefield of misinformation at a time when they are making some of the most critical medical decisions of their lives.

It was clearly time for an information intervention.

Considering that over 500 new articles on endometriosis are published each year, not to mention the thousands of others overflowing from archives, attempting to summarize such a vast and ponderous range of opinions and theories is, needless to say, quite difficult, if not impossible. Add to that the fact that so many lingering unknowns and enigmas are still limiting our understanding of endometriosis, then it becomes all the more clear that we have a colossal task before us in trying to find coherence amidst the confusion. All the same, here's our best effort to provide unvarnished, jargon-free explanations to common misconceptions about the various surgical options for treating endometriosis. As the references demonstrate, the information is based on recommendations by national medical regulatory agencies and gynecological surgery's most well-respected textbooks and medical journals.

### **Laser? Excision?**

One of the most peculiar misconceptions currently prevailing is the idea that excision surgery is able to treat deeply-infiltrating endometriosis better than laser-based modalities. As misinformation goes, this type is especially sophisticated, as it relies on a nearly imperceptible blend of fact and fiction which makes it especially effective in misleading patients into believing that only one type of surgical tool and or instrument is more capable of removing all of the endometriosis, relieving pain, and reducing recurrence rates. However, did you know that some tools and or instruments used for excision can cause far more permanent, life-risking, pain-causing, and fertility-compromising damage to organs than others? Did you know that in EXPERIENCED hands the CO2 laser can perform excisions much safer, faster, cleaner and with less blood loss than electrocautery or scissors?: and that studies have found that laser surgeries lead to fewer complications than other methods? Well, if these tiny little factoids were never mentioned on all of those anti-laser websites, then read on for the really true, research-supported kinds of facts, as opposed to the almost-true-but-not-quite versions.

## **Basic Facts**

Because CO2 laser surgery is one of the most difficult techniques to learn, it's not uncommon for others to simply rely on older methods, even though newer technologies have proven to offer many advantages over those from the past. In this situation, Abraham Maslow's famous observation, "If you only have a hammer, you tend to see every problem as a nail," is particularly apropos, for it highlights just how these sorts of hidden biases can affect the quality of surgical options endometriosis patients are offered. If a surgeon is only capable of performing excision with older technologies, what this means for patients is that they are offered medical care based on the limited training of a particular surgeon, rather than on the latest scientific evidence which suggests that other options may be in their best interest. As the old saying goes, choices like this are really not choices at all.

However, before plunging headlong into the debate, let's start with basic definitions of the terms "excision" and "laser", so that we can ensure we're all actually referring to the same concepts.

## **Excision**

The first thing to know about excision is that it simply means to remove something by cutting it out. In the case of surgery, it's tissue or pathological growths that are cut out; excised out. Excisions (also sometimes referred to as resections) can be performed in many different ways and with many different instruments. In the 19th century, surgeons even resorted to using their own fingernails to "dig out" (aka, excise) deeply infiltrating endometriosis nodules. Thankfully, now we at least have a few more options than that! In fact, today surgeons have at their disposal not only old-fashioned surgical scissors, scalpels, or electrosurgical instruments, but also a wide range of newer technologies, such as lasers, ultrasonic devices such as the Harmonic Scalpel, plasma lasers, such as the Plasma Jet, and robotic technologies like the Da Vinci Robot. What remains constant is that, if something is cut away and removed from the body - such as tumors, lesions, or tissue - then that counts as excision, no matter what method facilitated the end result. (Vaporization, fulguration, ablation, desiccation, and coagulation methods do not technically fall under the definition of excision and so will be reviewed in a different section)

## **Laser**

To simplify matters, we'll focus on the carbon dioxide (CO2) laser, which has become one of the most preferred types of lasers utilized, not only by gynecologic surgeons, but by the majority of surgeons from other disciplines. Contrary to what some suggest, laser technologies are capable of many things, including the excision of deeply infiltrating endometriosis. In fact, as multiple studies have demonstrated since laser technologies were first introduced into medicine in 1961<sup>(1)</sup>, not only can it perform excisions for deeply-infiltrating endometriosis, it can do so with greater precision, less post-operative pain, fewer adhesions, less bleeding, and faster wound healing than any other method currently available.<sup>(2, 3, 4, 5, 6, 7, 8, 9)</sup> And, this is the conclusion that surgeons from essentially every single discipline of medicine have made, too<sup>(10)</sup> In addition to excisions, the laser can also cut, coagulate, fulgurate, or vaporize. Later, we'll provide more detail about these various approaches and why they are sometimes utilized for the treatment of endometriosis.

## **WHERE'S THE PROOF?!**

Of course, it just wouldn't be fair to deliver such big claims without offering any supporting evidence! So, below are the details and statistics derived from the peer-reviewed medical literature.

### **Excisions with monopolar electrosurgical instruments pose greater risks for damaging tissue and organs**

For over a century now, various forms of electrosurgical technologies have been utilized in mainstream medical settings. Despite such a long tradition of use, nevertheless its history is strewn with tales of woe involving exploding uteruses, burned-out bowels, and electrified organs, just to name a few of the many unfortunate mishaps to have occurred over the years. Although we've come a long way since early experiments with electrosurgery, nevertheless these technologies – specifically monopolar instruments - continue to pose grave risks, even when all precautions and protocols are observed.

In terms of monopolar technologies for excisional surgery, studies present especially stark statistics, suggesting that this electrosurgical instrument in particular carries a greater risk of causing injury to internal organs and tissues when compared to laser techniques. As one expert on the subject recently described it, monopolar devices have an “increased potential for undesired burns and stray currents.”<sup>(11)</sup>

This is because, unlike the laser, the electric currents produced by monopolar instruments have a tendency to produce errant sparks of energy (referred to as arcs), which can propel their tissue-damaging heat energy throughout the body in extremely unpredictable ways. Even with the best aim on the planet, there is no surgeon in the world who can force electrons to obey human commands. Just as electrostatic energy in the winter can fill our days with surprise shocks and levitating hair, so too can these electrosurgical devices generate waves of charged electrons which move about in erratic patterns. And, as I'm sure you can imagine, unpredictable, tissue-damaging devices represent a definite 'what not to do' in surgery, especially in the pelvic area where nearly all the body's most critical major organs, arteries, and blood vessels are headquartered. (As a result of these significant shortcomings, bipolar electrosurgical instruments were eventually introduced which do not pose the same risks as their monopolar cousins).

In contrast, the co2 laser poses absolutely no danger of having its energy heat arc out in unpredictable ways. This means that, if the surgeon aims the laser beam at point X, then the laser energy will travel directly to point X, within a predictable degree of accuracy measuring in the microns.

## FAQ Typical monopolar setup

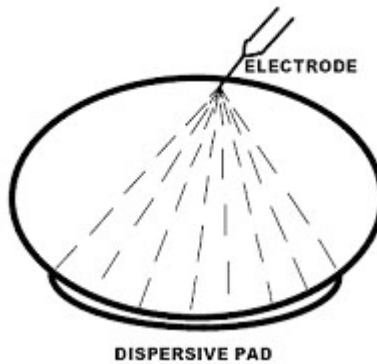


Figure 1: In this figure the dotted lines represent the electrical current that disperses from the tip of the monopolar instrument and then throughout your body, until it reaches one of those large pads you've probably seen attached to defibrillators, for example. However, there is no guarantee that those currents of heat energy will remain in formation; instead, the energy can jump to other nearby tissues or organs, thereby causing organ damage from unintended burns.

### **Monopolar electrosurgical devices can potentially deliver tissue-damaging heat too deeply & widely**

The other unpredictable aspect about monopolar instruments is that the heat energy generated travels deeper and wider than laser heat. What this means in a surgical setting is that surgeons have less control over how much tissue is damaged as they attempt to excise a pathological lesion. For example, the lesion itself may only be 5 millimeters deep, yet the electric heat may travel to a depth of 10 millimeters, as well as several thousand microns wider than the surgeon intended, thereby inadvertently damaging underlying healthy tissue or organs. Often referred to as collateral thermal damage, studies and textbooks abound with unequivocal warnings concerning the many unfortunate outcomes that can occur as a result of this common complication. Jean Luc Pouly, a well-regarded surgeon specializing in endometriosis, didn't mince words on the subject, stating point blank that "Monopolar electrocoagulation must be avoided because of the risks of accidents and of a complete coagulation of the ovarian vascularization."<sup>(12, 13)</sup>

In one of the largest and longest trials to compare laser to electrosurgery, which followed 1000 patients for 10 years, electrosurgical procedures were found to cause serious complications in as many as 20% of the cases, while laser surgeries led to serious complications in only approximately 1% of cases.<sup>(14)</sup> As a result of these findings, the American Urological Association has recently recommended that lasers be used for prostate surgeries instead of the traditional electrosurgical method (referred to as TURP).

## Tissue Necrosis

In another recent comparative study, the severe tissue necrosis caused by monopolar instruments was made especially apparent, as Figure 2 below reveals. Such cases of tissue necrosis, described as a “significant source of post-operative morbidity”, occur in as many as 20% of mastectomy surgeries when monopolar instruments are used. Tissue necrosis also leads to significantly more pain and several weeks or even months delay in wound healing.(15,16)

In a rare instance, this study also included the patient’s perspective, who described her experience as follows: "I had such a hard time with the left side. The pain was terrible. I was horrified and very depressed. My left side is still sore. My right side is perfect, no pain at all." (17)

As a result, general surgeons are replacing traditional electrosurgical devices with safer technologies, such as the laser, plasma lasers, and ultrasonic devices.



**FIGURE 2:** A painful and severe case of tissue necrosis, believed to be caused by excessive tissue damage with monopolar instruments, and a complication which is significantly reduced with the use of lasers and other non-electrical technologies. This is what “collateral thermal damage” or unintended tissue damage actually looks like.

In contrast, the CO2 laser is renowned for the accuracy of its beam, which can be controlled in terms of its depth and width of penetration within a range as small as 150 microns in diameter or depth. Contrast this to monopolar energy, which can travel in excess of 7000 microns (7 millimeters). In experienced hands, this means that the laser can reduce or eliminate entirely unintended tissue or organ damage peripheral to the target pathological lesion. Of course, as you may already know, these are not new findings at all. In fact, Dr. Nezhat began using the CO2 laser as early as of early 1980s, (videolaseroscopy) not only because of the known risks associated with monopolar electrosurgery, but because he realized very quickly that laser was unequivocally providing safer and superior results.<sup>(18, 19, 20, 21)</sup>

As for the laser's ability to reduce and control blood loss during surgery, it's able to do this by sealing (cauterizing) the body's tiny capillaries and small veins at the same time as it cuts. Cutting and sealing at the same time; it's a dream come true as far as surgeons are concerned and only the laser, as well as some of the newer devices, such as ultrasonic or Plasma Jet technologies, can boast such a dynamic duo of indispensable talents with the laser's record of safety.

Through all of these mechanisms, the laser can excise endometriosis, as well as other pathologies, with greater precision, less post-operative pain, fewer complications, faster wound healing, and reduced edema (swelling), inflammation, and tissue necrosis than any other method currently available, with the exception of the latest generation technologies, such as the Plasma Jet.  
<sup>(22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32)</sup>

As a result of the reduced damage and trauma to surrounding tissue and organs, one final highly-coveted outcome can be achieved; a modest, but nevertheless measurable decrease in one of the endometriosis patient's greatest nemeses: adhesions (think "pain" when you hear the word adhesions).<sup>(33)</sup> In fact, adhesions are actually one of the main culprits of long-term, chronic post-operative pain. Even in women with endometriosis, adhesions – and not endometriosis - are often the reason for post-operative pain.

These are just some of the compelling reasons why some of the world's most preeminent surgeons, from such disciplines as ophthalmology, oncology, cardiology, urology, and dermatology have all chosen to go through the trouble of training in laser techniques.

In the aggregate, what all of this means in terms of surgical outcomes is that the chance for complications can be significantly reduced when using laser techniques.<sup>(34)</sup> What this means for the endometriosis patient is that a greater chance for reducing long-term pain can be achieved.

### **When laser is the safest and most effective means for removing endometriotic lesions.**

We've addressed the question of whether the laser can excise as deeply as other methods. Yet, the question that many non-laser surgeons fail to bring up is, when is deep excision actually dangerous? Here are the facts. As mentioned earlier, the laser can penetrate to a depth as small as 150 microns or as deeply as the surgeon wants it to. However, it's crucial to understand when it's necessary to limit the depth of penetration rather than increase it. For endometriosis, limiting the depth of penetration is absolutely medically necessary when a lesion is located on, for example, an artery, which, even at its thickest, has a wall width of only 1 centimeter thick. In such cases, excision with scissors or monopolar instruments would actually be dangerous in a life-threatening kind of way. If those excisional techniques were used, the artery could burst open and become irreparably damaged, an outcome that could leave you dead on the operating table in minutes. Sorry to be so graphic; but that's just one example of the very serious types of potentially dangerous outcomes that are being left out of the excision-laser debate. As you can see, it's not a trivial difference of opinion; it's a matter of life and death. Endometriosis which is located on arteries, blood vessels, and a host of other similarly delicate anatomic structures and organs like the bowel, bladder, ureters etc, can be removed with the laser more quickly and with a significantly greater margin of safety & precision than other methods.

The laser is also the preferred method for treating endometriosis of the ovaries (endometriomas). In fact, for decades now, studies have demonstrated that the laser is better able to remove endometriomas without permanently destroying the reservoir of eggs nestled inside the ovary, which in turn can compromise future fertility.<sup>(35, 36, 37)</sup>

And finally, the laser beam can reach areas difficult to access in a minimally invasive way. In areas where the anatomy is particularly convoluted or inaccessible, it's extremely difficult for surgeons to bring other instruments close enough to the target tissue. Not so with the laser. This is because – well- it's a laser, meaning that it's a beam of light that, as your friendly neighborhood quantum physicist will tell you, will continue traveling into eternity until it actually hits something. And in the case of endometriosis, that something is a lesion, tucked away in an inaccessible area of the anatomy that cannot be reached safely through any other means – unless, of course, you'd prefer the tissue-damaging, 8-12 inch incision and OMG pain of laparotomy.

### **IMPORTANT CAVEATS**

#### **Caveats #1: It's not the technique or technology, it's the surgeon**

As with all things in medicine, there are some important caveats to be mentioned. The first is that laser excision, like any surgical treatment, is only as safe, accurate and efficacious as the surgeon using it. In short, surgical outcomes ultimately depend entirely on the skill and experience of the surgeon, not the techniques or technologies being utilized.<sup>(38, 39)</sup>

### **Caveat #2: When methods other than laser are best**

Although you wouldn't want to use a screw driver to hammer a nail, this doesn't mean that the screw driver is bad; it just means that it's not the right tool for that particular task. The analogy proves useful in the case of analyzing surgical modalities: you wouldn't want to perform laser excision when excision with scissors may be the better option. For example, bipolar electrosurgical instruments (which, again, are not associated with the same risk levels for which monopolar instruments are famous) can be great instruments for controlling bleeding in areas as large as 2 millimeters in diameter. Meanwhile, too, dense adhesions can also be excised quite nicely with traditional surgical scissors, as Dr. Nezhat mentions in his surgical textbooks.<sup>(40)</sup>

Moreover, we wouldn't want to mislead the reader into thinking that the laser doesn't have drawbacks and risks. Like any surgical instrument, lasers can lead to injury in inexperienced hands. In fact, there have been many cases reported of inexperienced surgeons attempting to use the laser with very unfortunate results. Just as with electrosurgical devices, for example, excessive coagulation of adjacent tissue can occur with the laser, too, if it's wielded by a surgeon with limited experience or improper technique. <sup>(41)</sup>

Conversely, studies have found that the laser imparts superior results for the treatment of superficial endometriotic implants.<sup>(42)</sup> In other words, all surgical techniques and technologies have both advantages and disadvantages and experienced surgeons will understand in which situations each should be applied to achieve the safest and most optimal results.

### **Caveat #3: The best surgeon in the world cannot stop endometriosis pain from returning**

One of the most devastating aspects about endometriosis is that it is usually chronic; meaning that all the medical interventions in the world, by all the world's greatest doctors, cannot prevent endometriosis from returning. Unfortunately, due to the highly unpredictable and inexplicable nature of endometriosis, reported recurrence rates are all over the map. However, the average recurrence rate after surgical intervention falls somewhere between about 25% to as high as 55% within 5-7 years after surgery.<sup>(43, 44, 45, 46, 47)</sup>

Even with women who have had total hysterectomy, meaning that their uterus and ovaries were removed, the recurrence rate is not zero as you would expect it to be; rather, approximately 0.5% of patients per year experience recurrence, while as many as 9.1% of those taking hormone replacement therapy will experience recurring symptoms.<sup>(48)</sup> Unfortunately, too, for more severe stages of endometriosis, including the deeply infiltrating type, the recurrence rates are even higher.<sup>(49)</sup> Worse still, in addition to this high recurrence rate, as many as 20% actually do not gain any relief at all from surgical excision procedures, despite the fact that some of the world's leading surgeons performed the surgeries.<sup>(50, 51)</sup>

When compared to other options, such as no treatment at all or pharmacological medications, surgery still offers the best chance for relieving pain and improving fertility, a conclusion supported by multiple studies, as well as the National Institute of Health.<sup>(52)</sup> An ACOG panel of

experts summed up these paradoxical surgical outcomes well when it said “there is significant short-term improvement in pain with conservative surgery; however there is also significant recurrence of pain.”<sup>(53)</sup>

This is why endometriosis is still considered an incurable, chronic disorder. So, next time you hear someone saying that your pain returned because your endometriosis returned because your other surgeon left some seeds of the disease behind, because he didn't excise it all, because he performed inadequate surgery; now you'll recognize these claims for what they actually are: misguided misinformation.

## **FREQUENTLY ASKED QUESTIONS**

### **Okay, so the laser has some clear benefits; But what I really want to know is, can the laser treat deeply infiltrating endometriosis better or as well as other excisional methods?**

Okay, you may be saying, so fewer adhesions form from the use of laser. But, isn't the real test of its true metal whether it can completely remove deeply infiltrating endometriosis, and, if so, can it do so as well or better than other excisional techniques? The answer is a resounding yes and yes.

As usual, to get to the truth, we'll need to start with the basics. One of the most important facts to know about the laser is that it can penetrate as deeply as the surgeon wants it to. It's just that it does so in a more controlled manner, about a hundred micron layers at a time. And, just like appliances in our kitchen, laser instruments can be set to different strengths, depending on what level of penetration the surgeon deems necessary. In cases of deeply infiltrating endometriosis, the laser can be adjusted to achieve deeper penetration depths.

Another point to bear in mind is that most organs and structures inside the body are not that thick. For example, in normal patients, the average bowel wall measures about 0.5 centimeters in thickness. In some areas, it is only 1.1 millimeters thick.<sup>(54)</sup> To give a point of reference, the average adult finger nail is about 1 centimeter wide. (1 millimeter is 1/10th of a centimeter, while 1000 microns is 1 millimeter). Even when the bowel wall has thickened due to disease, such as in the case of bowel endometriosis, its thickness rarely exceeds 1-2 centimeters; still very small measurements.

So, when others speak about deeply-infiltrating endometriosis, now you'll know that there is nothing in the body so deep that the laser cannot reach it.

### **What about laser vaporization? Why would a surgeon only vaporize a lesion instead of excising it?**

Here's another especially misleading claim being bandied about; the myth that laser vaporization is an ineffectual method for treating endometriosis. Here are the real facts. Endometriosis comes in all shapes and sizes and depths. To date, in fact, there are over 30 different morphologies that endometriosis is known to take, and deeply-infiltrating endometriosis is only one of many. However, as mentioned already, there are also superficial lesions, those which have not yet

infiltrated into deeper layers; and these can be best treated through laser vaporization. These types of superficial lesion have very precise characteristics, ones that can be easily distinguished from other, more deeply infiltrating lesions. And for surgeons like Dr. Nezhat, who has specialized in endometriosis for more than thirty years, and who has performed just about the largest number of surgeries for endometriosis in the world, his extensive experience makes it that much easier for him to recognize at surgery the various types of lesions and how best to treat them.

Laser coagulation and/or vaporization of certain types of endometriomas (endometriosis on the ovaries) has also proven safer and more effective treatment when compared to other methods. As one study author noted “Ovarian endometriomas of less than 1 cm...can also be removed safely by tissue vaporization,” which, as the author goes on to explain, has “little danger of damaging adjacent structures, as one might experience with [electrosurgery].” And, since the ovaries are one of the most common sites in which endometriosis occurs, it makes sense to have available the instrument that has the safest and most effective track record for that area.

**Okay, but, if you vaporize the lesion, then doesn't that mean there's no chance to biopsy it?**

The biopsy red herring is another especially sneaky fallacy, yet one of the more difficult to disprove. Here are the facts. First, when it comes to biopsies, what is considered the standard of care? The American College of Obstetricians and Gynecologists (ACOG) long ago established that attempting to biopsy every single endometriotic lesion would be, not only unnecessary and essentially impossible, but would actually be detrimental to the health and safety of the patient. And what the ACOG says is considered the gold standard in medical care; in fact, ACOG edicts are observed as policy in such renowned medical universities such as Stanford Medical School, Johns Hopkins, Harvard, Yale, and all of the top medical centers throughout the US. Many other disciplines hold similar views concerning excessive biopsying, due to the inherent risks it carries relative to any potential benefits. For example, except in unusual cases, lung surgeons actually refrain from biopsying the lung altogether, due to the risks involved.

We know this seems quite counterintuitive; after all, we've been told for years that the only way to definitely know what some pathological growth is in medicine is to get it sent to a pathologist, who will then perform biomedical tests to determine with molecular accuracy the precise nature of the sample. If there were fewer risks associated with biopsying, then biopsying as much as possible would indeed be preferable. However, with endometriosis often presenting with hundreds of lesions, scattered across multiple organs, attempting to make excisions for biopsies on each suspicious lesion would run the risk of prolonging the duration of surgery to a dangerous degree and would lead to bleeding wounds in multiple areas throughout the body, which poses even greater risks, can lead to uncontrollable bleeding, and, again, can cause more adhesions and long-term permanent damage to vital organs. This is why ACOG and other regulatory medical bodies have concluded that the empirical observations of an experienced surgeon will be taken as sufficiently accurate, even though 100% will never be possible. <sup>(55, 56)</sup>

But, don't despair too much; Dr. Nezhat takes an appropriate amount of biopsies from each affected area before excising all of the lesions.

### **Final thoughts on the excision-laser great debate**

As you can see, the simplified excision-laser stories presented on so many websites are misleading in ways that are actually potentially perilous to patients. One instrument or technique is not better than another; rather, there are simply different techniques and technologies, all of which have their advantages and disadvantages, depending on the unique medical circumstances of each individual and each situation.

What's also clear is that, in order to provide the best care possible, surgeons must have, not only all the instruments currently available, but should have undergone all the relevant advanced training in these technologies so that patients can receive the best and most appropriate care possible.

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<sup>38</sup> Operative techniques in endometriosis are dependent upon the type and extent of the lesions. (Canis, et al 1989, Cook and Rock, 1991, Koninckx et al 1991, Bruhat et al, 1992).

<sup>39</sup> Operative management of deeply infiltrating endometriosis: Results on pelvic pain symptoms according to a surgical classification. Nicolas Chopin MDa, Marco Vieira MDa, Bruno Borghese MDa, Hervé Foulot MDa, Bertrand Dousset MDb, Jöel Coste MDc, Alexandre Mignon MDd, Arnaud Fauconnier MDa, Charles Chapron - *Journal of Minimally Invasive Gynecology*, Volume 12, Issue 2, April 2005, Pages 106-112

<sup>40</sup> (269 cn endo )

<sup>41</sup> Grainger *et al.* (1990) reported certain cases of ureteral injuries that were induced mainly by improper use of lasers.

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<sup>43</sup> Sutton C, Hill D. Laser laparoscopy in the treatment of endometriosis. A 5-year study. *Br J Obstet Gynaecol* 1990;97:181-185.

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<sup>47</sup> (Shakiba K, Surgical treatment of endometriosis: a 7-year follow-up on the requirement for further surgery. *Obstet Gynecol* 2008;112:710 and 2008, 111: 1285-92. (published erratum )

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<sup>49</sup> (pg 298 cn endo book

<sup>50</sup> P 293 cn endo, and also Sutton study

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<sup>52</sup> Sutton CJ, Pooley AS, Ewen SP, Haines P. Follow-up report on a randomized controlled trial of laser laparoscopy in the treatment of pelvic pain associated with minimal to moderate endometriosis. *Fertil Steril* 1997;68:1070-1074.

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