

# The Role of Laparoscopic Uterine Nerve Ablation (LUNA) and Presacral Neurectomy (PSN) of Pelvic Pain Management

Ashon Sa'adi

Gynecological Specialist and Laparoscopic Surgeon, Department of Obstetrics and Gynecology, Dr Soetomo Hospital of Surabaya, Indonesia

## Abstract

**Background:** The chronic pelvic pain as non-cyclical pain is serious enough to cause disability or lead to medical care. While these treatments are very successful there is still a 20 to 25% failure rate and surgery has been an option for such cases. Effectiveness of laparoscopic uterosacral nerve ablation (LUNA) and presacral neurectomy (PSN) can be useful for alleviating chronic pelvic pain.

**Objectives:** To assess the effectiveness of surgical interruption of pelvic nerve pathways in primary and secondary dysmenorrheal in the chronic pelvic pain.

**Data sources:** Various watchfulness sources related to surgically chronic pelvic pain treatment from various causes and journals, also involve the Cochrane Menstrual Disorders and Subfertility Group Trials Register (9 June 2004), CENTRAL (The Cochrane Library, Issue 2, 2004), MEDLINE (1966 to Nov. 2003), EMBASE (1980 to Nov. 2003), CINAHL (1982 to Oct. 2003), MetaRegister of Controlled Trials, the citation lists of review articles and included trials.

**Methods:** Review and analyzed of prospective study of laparoscopy presacral neurectomy / PSN or laparoscopy uterosacral nerve ablation / LUNA (both open and laparoscopic procedures) for the treatment of pelvic pain ( primary and secondary dysmenorrheal). The main outcome measures were pain relief and adverse effects.

**Results:** We have got 13 sources analysis extracted data on characteristics of the study quality and the population, intervention, and outcome independently. Nine randomized controlled trials were included in the systematic review. There were two trials with open presacral neurectomy; all other trials used laparoscopic techniques. For the treatment of primary dysmenorrhea, laparoscopic uterosacral nerve ablation at 12 months was better when compared to a control or no treatment. The comparison of laparoscopic uterosacral nerve ablation with presacral neurectomy for primary dysmenorrhea showed that at 12 months follow-up, presacral neurectomy was more effective. In secondary dysmenorrhea, along with laparoscopic surgical treatment of endometriosis, the addition of laparoscopic uterosacral nerve ablation did not improve the pain relief, while comparing to presacral neurectomy. Side effects were more common for presacral neurectomy than procedures laparoscopy uterine nerve ablation.

**Conclusion:** Currently, we have showed that LUNA and PSN can be an option in primary or secondary menstrual pain without endometriosis; LUNA has not been shown to reduce dysmenorrhea and, therefore, should not be advocated as a mainstream treatment except who have persistent dysmenorrhea.

**Keywords:** Chronic pelvic pain; laparoscopy uterine nerve ablation; presacral neurectomy; dysmenorrheal.

## INTRODUCTION

The chronic pelvic pains of more than a year's duration have been suffering of approximately 15-20 % of women between 18 and 50 years of age. Survey in Europe has showed prevalence of dysmenorrhoea (12 studies) is 59% (95% CI 49.1-71%), of dyspareunia (11 studies) is 13.3% (95% CI 8.8-20.3%) and of noncyclical pain (2 studies) is 6.2% (95% CI 3-12.6%).<sup>1,2</sup> CPP refers to menstrual or nonmenstrual pain of at least six months' duration occurring below the umbilicus. Pain syndromes are caused by activation of nociceptors and transmission of signals in pain pathways. Thus, they are expected to respond to interruption or modulation of that transmission at any level above the site of activation. Chronic pelvic pain includes primary and secondary dysmenorrhea.<sup>3,4,5</sup>

Endometriosis is the most common gynecological cause of chronic pelvic pain. Other causes of chronic pelvic pain include pelvic inflammatory disease, psychologically stress, pelvic congestion syndrome, nerve entrapment related to muscular spasm, interstitial cystitis, and pelvic floor pain. Treatment for chronic pelvic pain depends on the underlying cause, severity of symptoms, the extent and location of disease, the desire for pregnancy, and the age of the patient. Laparoscopic presacral neurectomy has been extensively studied and considered as an effective technique for the treatment of chronic pelvic pain and dysmenorrhea in selected cases. If conservative medical treatments fail to relieve symptoms, second-line pharmacologics, such as hormonal treatment, may be indicated, conservative surgery ( LUNA or PSN ) and hysterectomy may be considered for patients with severe symptoms that do not respond to conservative treatment (20-25% of failure rate). This precise

estimation of disease burden should be considered by policy makers when planning gynecological services.<sup>6,7</sup>

**AIM/OBJECTIVES**

The aim of this review is to analyse role and useful technique of laparoscopic *presacral neurolysis* (PSN) and *laparoscopic uterine nerve ablation* (LUNA) to report followed cases on symptom resolution. What LUNA and PSN still useful for pain treatment performance and it has dangerous side effects?

**METHODS**

A literature search was performed using Google, Yahoo, Springerlink and Highwire Press. The following search terms were used: *Laparoscopic uterine nerve ablation (LUNA) and Presacral Neurectomy (PSN), complications of LUNA and complication Presacral Neurectomy (PSN)*. The 13 number of quality citations reviewed was selected for this review. The criteria for selection were:

- At least 13 sources should be included in the study especially for evaluation.
- *Method of analysis:* Retrospective analysis RCT.
- *Type of operative:* Laparoscopic procedure
- The institution where the procedure was practiced (preference for those specialized for laparoscopic surgery).

**OPERATIVE TECHNIQUE**

**Procedure Specific for Laparoscopy Uterine Nerve Ablation and Presacral Neurectomy<sup>8</sup>**

The use of nerve transection procedures has been investigated for the treatment of chronic pelvic pain. They are often carried

out during the course of other surgical treatment for endometriosis. The most common of these nerve transection procedures are laparoscopic uterine nerve ablation (LUNA) and presacral neurectomy (PSN).

**Laparoscopic Uterine Nerve Ablation (LUNA) Procedure**

The goal is the interruption of uterine nerve fibers traveling down the ligament and relief of uterine pain. During a LUNA procedure, the uterosacral ligaments (USL) are transected near their insertion into the posterior cervix. Laparoscopic uterine nerve ablation involves the destruction of the uterine nerve fibers that exit the uterus through the uterosacral ligament. Recent anatomical studies by Fujii *et al* showed that the majority of uterosacral nerve fiber bundles were found at a distance of 6.5–33 mm and at a depth of 3–5 mm distal to the site of attachment of the uterosacral ligaments to the cervix.<sup>(9,10)</sup> (Fig. 1).

**Presacral Neurectomy (PSN)**

Laparoscopic electrosurgical PSN through an umbilical approach was developed in 1988. The technique and results have been described in detail. This technique was later adapted for use with a carbon dioxide laser.<sup>11,12</sup> The patient is placed in steep Trendelenburg position and rolled to the left, displacing the sigmoid laterally. A blunt probe also retracts the sigmoid laterally, effectively removing the sigmoid from the operative site. Presacral neurectomy is performed on the anterior aspects of vertebral bodies L5 and S1. The superior hypogastric plexus is the main pathway of neural transmission from the pelvis.

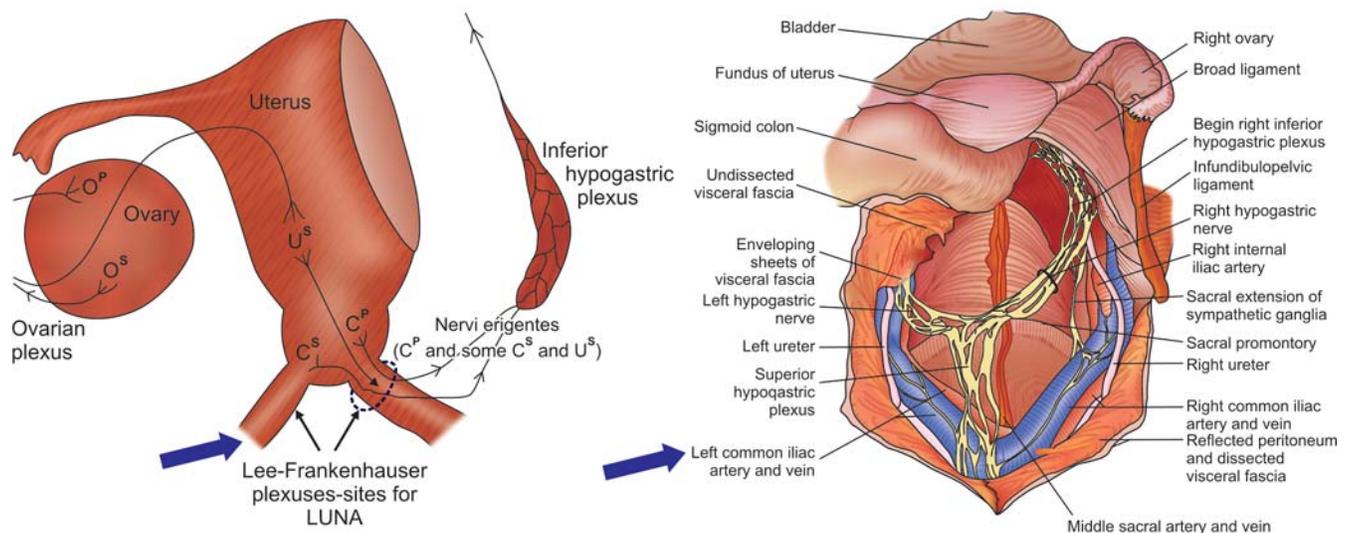


Fig. 1: Nerve slice position scheme of LUNA and PSN

While in neurectomy the plexus is exposed and the nerves are either cut or excised to interrupt the neural input, means the interruption of the sympathetic innervation of the uterus at the level of the superior hypogastric plexus (see Fig. 1). Adjacent vital structures which could be injured include the common iliac veins, the ureters, and the sigmoid mesentery. Presacral neurectomy is technically more challenging than LUNA because of the presence of large vessels and the ureters near the field of dissection.<sup>13,14</sup>

### Variations in LUNA Methods

LUNA are the procedure interrupts/ablation of pelvic afferent sensory nerve fibers of the Lee-Frankenkauser nerve plexus. In a 1955 study of Doyle et al, vaginal transection of the nerves was effective for dysmenorrhea. Wide variations in the practice of LUNA have been shown by comparing the UK group with the rest of Europe. The latter were more likely to completely transect the uterosacral ligaments (56% vs 36%) at a distance 2 cm or more from its cervical insertion (50% vs 21%) than the UK group. Even the tools for ablation varied between these 2 groups, i.e. laser cutting (3% vs 32%), electrodiathermy (78% vs 75%), scissors cutting (22% vs 15%), and harmonic scalpel for cutting (8% vs 11%). There is widespread clinical uncertainty in the techniques, with insufficient evidence of effectiveness, thereby making it both harder to determine the optimal time, depth, and site of LUNA procedures, and the opinions regarding its use uncertain and variable.<sup>15</sup>

### Effectiveness Measures of LUNA and PSN

A method structured survey was used to analyze gynecologists "prior beliefs" on the effectiveness for LUNA and PSN on pelvic pain by both numeric response (on a 10-point visual analog scale/VAS) and by responses to a questionnaire. The most widely held "prior belief" was that LUNA would have small beneficial effect on pain.<sup>16</sup> The secondary outcome measures will be assessment of sexual function and quality of life. The Sexual Activity Questionnaire (SAQ) will replace the Brief Index of Sexual Satisfaction (BISS) for the assessment sexual function.<sup>17</sup> Third measure is health-related quality of life (HRQL) instruments are becoming powerful tools for outcome assessments in randomised trials. Quality of life has to be defined clearly and patient's perception of normal performance serves a pivotal role in this context. HRQL instruments are administered with questionnaires assessing a number 1 of different domains, i.e. areas of behavior or experience that the instrument is attempting to measure.<sup>18</sup>

### Intraoperative and Postoperative Complications

The adverse events of PSN were significantly more common than those of LUNA. In general, LUNA is extremely safe except

for a few complications reported in the literature. The bowel is usually not at risk during a LUNA procedure, unless partial or complete obliteration of the cul-de-sac due to endometriosis is present. In this condition, a LUNA procedure with bowel adherent to a USL is inappropriate. One complication of a LUNA procedure would be the risk of damage to the ureter laying lateral to the uterosacral ligament / USL. Regardless of the surgical energy being used, damage to the ureter could occur in at least three ways, each avoidable.

#### *First Way*

Damage occurring as a consequence of extending the LUNA incision too laterally. This complication can be avoided by strong anterior placement of the uterus with an intrauterine manipulator, which puts the USLs on stretch and helps define them better.

#### *Second Way*

Damage occurring as a consequence of bipolar or monopolar electrocoagulation for hemostasis. Pelvic vessels lie lateral to the USL. The thick-walled, pulsating uterine artery is usually easily visible through the peritoneum and usually lies anterolaterally to the location of a LUNA procedure. Irrigation or retroperitoneal hydroinjection may help protect the ureter during electrocoagulation of a bleeder by providing heat sink (a site for cooling of the thermal spread).

#### *Third Way*

Damage occurring during transection of a uterosacral ligament involved by invasive endometriosis which has resulted in retroperitoneal fibrosis around the ureter. The avoidance of this complication is simple: It is inappropriate to transect a USL invaded by significant nodular endometriosis because the nodular endometriosis can still transmit pain along unsevered proximal nerves. The proper therapy is resection of the involved portion of the USL, which accomplishes a LUNA procedure simultaneously.

LUNA usually should not be repeated for two reasons: (1) If it was properly performed and did not work the first time, there is no reason to think it would work a second time; (2) The crater left by previous transection gives a spurious impression that a wide USL is present, and this can lead the transection more lateral.

Laparoscopic presacral neurectomies have been performed in over 220 by the author, one patient required repeat laparoscopy to evaluate continuing postoperative pain. A small hematoma was found in the presacral space which was evacuated and the patient recovered uneventfully. There have been no cases of injury to the bowel, ureter or great vessels.<sup>19</sup> Long-term complications with PSN are uncommon. An

occasional patient will report alteration of the sensation of bladder fullness due to interruption of sympathetic fibers carrying bladder sensation. Some patients may report a decrease of vaginal lubrication with sexual arousal. Constipation is not a predictable consequence of presacral neurectomy since the parasympathetic fibers which stimulate evacuation of the rectosigmoid pass through the inferior hypogastric plexus (also termed the pelvic plexus) and are not interrupted by PSN. Chen FP, Soong YK, 1997: There are 485 (74%) of 655 patients complained of constipation after laparoscopic presacral neurectomy, which was relieved easily by medication. There were 0.6% major complications that required further surgery, including injury of the right internal iliac artery and chylous ascites. And 0.5% cases had laceration of the middle sacral vein controlled during laparoscopy.<sup>20</sup> Chen FP, Soong YK, 1997 (Table 1). In patients undergoing laparoscopic PSN, follow-up observation has shown evidence of long-term efficacy, similar to that seen after laparotomy PSN.<sup>21,22</sup>

## RESULTS

**TABLE 1: The randomized controlled trials using LUNA or PSN for surgical treatment of pain management have been published**

Author	Year	Patients	Result of research	Others
Litchen E, et al <sup>23</sup>	1987	21	Decrease efficacy 4th year LUNA	LUNA 1st and 4th year
Tjaden, et al. <sup>22</sup>	1990	26	There is some evidence of the effective	LUNA vs control of no treatment
Candiani, et al. <sup>24</sup>	1992	71	No statistically significant differences RCT	More complication
Chapron C, et al <sup>25</sup>	1996	21	94% improvement of pain	LUNA deep endometriosis
Chen FP, Chang, et al. <sup>26</sup>	1996	68	PSN was better in 1 year	PSN and LUNA
Chen FP, Soong YK et al <sup>20</sup>	1997	655	Significant for 12th month RCT	PSN more complication
Zullo, et al. <sup>27</sup>	2003	141	More effective PSN, RCT	PSN and LUNA
Soysal ME, et al <sup>28</sup>	2003	15	Significant resolution pain and sexual 3,6,12 months Prospective observational	Baseline and PSN
Vercellini, et al. (29)	2003	180	Recurrent dysmenorrhea was similar for both groups RCTL	LUNA for pain endometriosis
Johnson NP, et al. <sup>30</sup>	2004	123	Significant reduction of dysmenorrheal. No significant difference in non-menstrual pelvic pain, deep dyspareunia or dyschezia	LUNA and medicine RCT
Proctor, et al, <sup>6</sup>	2005	Data Collection and Meta-analysis: 7 RCTs	No significant symptom by LUNA-PNS Unuseful	Case : Primary dysmenorrhea Endometriosis
Juang, et al <sup>31</sup>	2006	12	Increase in satisfactory rate 3th and decrease in 12th months prospective observational	LUNA for deep dyspareunia Pilot study
Latthe PM, et al <sup>32</sup>	2007	Data collection and Meta-analysis: 9 RCTs	LUNA still effective PSN more effective Not significant in endometriosis	LUNA vs No surgical LUNA vs PSN

## DISCUSSION

### Comparisons between LUNA and PSN

In a randomized study, Tjaden, et al., 1990; Candiani, et al; 1992; Zullo, et al., 2003 have been published three randomized controlled trials using PSN along with other surgical treatment of endometriosis.<sup>22,24,27</sup> A randomized controlled trial comparing outcomes of PSN to LUNA has also been published Chen FP, et al 1996. The comparison between laparoscopic presacral neurectomy (LPSN) and LUNA for control of primary dysmenorrhea showed effectiveness of 87.9% and 82.9%, respectively, at the 3-month postoperative follow-up, whereas, long-term LPSN was shown to be more effective than LUNA (81.8% vs 51.4 % at the 12-month visit).<sup>26</sup> Another study showed that the efficacy of LUNA declined from 72% in the first year to 39% in the fourth year.<sup>23</sup> However, only PSN but not LUNA was beneficial for alleviating secondary dysmenorrhea associated with endometriosis in some randomized

studies.<sup>30</sup> For the treatment of primary dysmenorrhea there is some evidence of the effectiveness of uterine nerve ablation LUNA when compared to a control of no treatment. Long term PSN was shown to be significantly more effective. Nevertheless, the comparison between presacral neurectomy (PSN) with LUNA for primary dysmenorrhea in the short term showed no significant difference in pain relief. Adverse events were significantly more common for presacral neurectomy, however, the majority were complications such as constipation, which may spontaneously improve.<sup>6</sup> Adverse events were more common for PSN than procedures without PSN (or 14.6; 95% CI 5-42.5).<sup>32</sup> In the primary dysmenorrhea showed no significant difference in pain relief of the comparison between LUNA and laparoscopic presacral neurectomy (LPSN) in the short term; however, long-term LPSN was shown to be significantly more effective than LUNA.<sup>33</sup>

### LUNA for Chronic Pelvic Pain without Endometriosis

The preliminary randomized study using LUNA as an adjuvant therapy for treating patients with secondary dysmenorrhea caused by uterine myoma also showed the effect of LUNA in alleviating pain.<sup>12</sup> Another randomized study by Johnson et al included 123 patients with chronic pelvic pain. Both uncontrolled and randomized double-blind studies had claimed support for LUNA with either complete relief or substantial reduction in menstrual pain in the majority of patients.<sup>30</sup> In 56 patients with no laparoscopic evidence of endometriosis, there was significant reduction of dysmenorrhea, with a median change in VAS / visual analog scale from baseline - 4.8 versus - 0.8 ( $p = 0.039$ ), or 42.1% versus 14.3% experiencing successful treatment ( $p = 0.045$ ). However, there is no evidence that LUNA is beneficial for non-menstrual pelvic pain. In a recent meta-analysis of 5 randomized trials, the authors have approached a consensus on the effectiveness of LUNA for menstrual pain. Similar findings were reported by 4 other randomized trials.<sup>23,26</sup> Tjaden et al 1990 : The addition of PSN to standard surgical therapy by laparotomy enhanced pain relief for midline/central pain. However, only eight of 26 patients were randomized and the study was terminated before completion because of significant reduction in midline pain by the patients undergoing PSN.<sup>22</sup> Nine RCTs were included in the systematic review. There were two trials with open presacral neurectomy (PSN); all other trials used laparoscopic techniques. For the treatment of primary dysmenorrhea, laparoscopic uterosacral nerve ablation (LUNA) at 12 months was better when compared to a control or no treatment (Odds Ratio or OR 6.12; 95% confidence interval / CI 1.78-21.03). The comparison of LUNA with PSN for primary dysmenorrhea showed that at 12 months follow-up, PSN was more effective (OR 0.10; 95% CI 0.03-0.32).<sup>32</sup>

A recently published guidance on Laparoscopic Uterine Nerve Ablation (LUNA) for Chronic Pelvic Pain from the

National Institute for Health and Clinical Excellence (NICE, 2007) concluded: "The evidence on laparoscopic uterine nerve ablation (LUNA) for chronic pelvic pain suggests that it is not efficacious and therefore should not be used." Like in the criteria for quality of evidence and classification of recommendations for LUNA is III-C (Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees that there is insufficient evidence to support the recommendation for use of a diagnostic test, treatment, or intervention).<sup>7,34</sup>

### LUNA for other Cases

Johnson et al<sup>30</sup> revealed no beneficial effect for dyspareunia and dyschezia by double-blind randomized study of LUNA. Also, another Vercellini et al<sup>29</sup> randomized study showed that LUNA had no additional effect for improvements in health-related quality of life, psychiatric profile, and sexual satisfaction. On the contrary a pilot study was undertaken to evaluate the effect of laparoscopic uterosacral nerve ablation (LUNA) for treatment of primary deep dyspareunia between July 2002 and June 2003, overall, 8 (66.7%) patients in this trial were very satisfied or satisfied at the initial postoperative evaluation and 6 of them (50.0%) remained satisfied at the final evaluation at 12 months.<sup>31</sup>

### LUNA for Endometriosis

In a randomized trial of 180 patients with symptomatic endometriosis, the addition of LUNA to conservative laparoscopic surgery for endometriosis did not reduce the medium- or long-term frequency and severity of recurrent dysmenorrhea.<sup>29</sup> Another randomized study of 67 patients with chronic pelvic pain and laparoscopic evidence of endometriosis found no significant difference in pain outcome.<sup>30,35</sup> For the treatment of secondary dysmenorrhea the identified RCTs addressed only endometriosis. The treatment of LUNA combined with surgical treatment of endometrial implants versus surgical treatment of endometriosis alone showed that the addition of LUNA did not aid pain relief, the mentioned equal to PSN combined with endometriosis treatment versus endometriosis treatment alone there was also no overall difference in pain relief, although the data suggest a significant difference in relief of midline abdominal pain. In secondary dysmenorrhea, along with laparoscopic surgical treatment of endometriosis, the addition of LUNA did not improve the pain relief (OR 0.77; 95% CI 0.43-1.39) while PSN did (OR 3.14; 95% CI 1.59-6.21).<sup>32</sup> A cochrane systematic evidence review of clinical trials on surgical interruption of pelvic nerve pathways for primary and secondary dysmenorrhea found there was only limited evidence to support the use of LUNA for primary dysmenorrhea. Guidelines on chronic pelvic pain from ACOG (2004) concluded. Adding uterine nerve ablation to

surgical treatment of endometriosis-associated pelvic pain or dysmenorrhea does not improve the outcome of surgical treatment. Although Chapron *et al* 1996 concluded LUNA/laparoscopic surgery is efficient for the treatment of patients presenting painful symptoms related to deep endometriotic implants located on the uterosacral ligaments. Patients who benefited from an improvement rated it excellent or satisfactory in over 80% of cases.<sup>25</sup> Soysal ME *et al* noted a significant reduction in total pelvic symptom score as compared from baseline with postoperative at the 3rd, 6th and 12th month ( $P < 0.001$ ), also observed a significant improvement in Sabbatberg Sexual Rating Scale as compared with baseline mean (SD) of 30.9 (4.3). The mean difference (95% CI) of increase was 33.4 ( $30.3 \pm 36.4$ ), 33.2 ( $30.1 \pm 36.2$ ) and 33.2 ( $30.1 \pm 36.3$ ) from the baseline at the 3rd, 6th and 12th postoperative month that performed laparoscopic presacral chemical neurolysis with phenol in 15 patients with pelvic pain and minimal  $\pm$  moderate endometriosis.<sup>28</sup>

The guidelines recommended the following: Presacral neurectomy may be considered for treatment of centrally located dysmenorrhea but has limited efficacy for chronic pelvic pain or pain that is not central in its location.<sup>2</sup> Ablation of endometriotic lesions plus laparoscopic uterine nerve ablation (LUNA) in minimal–moderate disease reduces endometriosis-associated pain at 6 months compared to diagnostic laparoscopy, the smallest effect is seen in patients with minimal disease. However, there is no evidence that LUNA is a necessary component, as LUNA by itself, has no effect on dysmenorrhea associated with endometriosis.<sup>29,36</sup>

## CONCLUSION

We have now showed that LUNA and PSN can be an option in a few circumstances, especially in primary or secondary menstrual pain without endometriosis. Finally, LUNA has not been shown to reduce dysmenorrhea and, therefore, should not be advocated as a mainstream treatment except who have persistent dysmenorrhea despite medical therapy.

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