Chapter

Uterosacral Nerve Ablation and Presacral Neurectomy in the Treatment of Chronic Pelvic Pain in Women

Funda Gungor Ugurlucan and Cenk Yasa

Abstract

Chronic pelvic pain affects 2–24% of women in the reproductive period. There are various causes of chronic pelvic pain in women including gynecologic, urologic, gastrointestinal, and musculoskeletal problems. The treatment of pain is directed toward the underlying pathology. However, in some cases, no pathology can be found, and sometimes, more than one underlying pathology may be found in the same patient. Surgical denervation methods may be used in the treatment of chronic pelvic pain in women including uterosacral nerve ablation and presacral neurectomy. Uterosacral nerve ablation has been used as a treatment method for uterine causes of pelvic pain. It has been used widely in the treatment of dysmenorrhea- and endometriosis-related pain. But recent randomized studies and meta-analysis have questioned the effect of uterosacral nerve ablation in the treatment of chronic pelvic pain. Presacral neurectomy involves damage of the uterine sympathetic innervation at the level of superior hypogastric plexus. It is effective in the treatment of midline pelvic pain. It has been found to be more effective than laparoscopic uterosacral nerve ablation in a randomized study. The method, effect, and studies evaluating uterosacral nerve ablation and presacral neurectomy will be discussed in this chapter.

Keywords: uterosacral nerve ablation, presacral neurectomy, LUNA, chronic pelvic pain, dysmenorrhea

1. Introduction

Chronic pelvic pain (CPP) is a constant or recurrent pain and generally defined as lasting for more than 6 months, and clinically carries significant physical, functional, and psychological impacts that have an adverse effect on quality of life. This pain frequently localized to the pelvis, the anterior abdominal wall at or below the umbilicus, lumbosacral back, and the buttocks. Its prevalence ranges from 6.4 to 25.4% in different countries, and about 18% of women take 1 day of sick leave annually due to CPP [1].

The etiology of CPP has not been clearly defined and explained. This disorder has multifactorial overlapping etiology, and more than 70 causes are associated with CPP [2]. Acute pain is a result of tissue damage and reveals simultaneously with healing, but chronic pain persists long after the tissue has healed or remains stable

in the absence of etiological factors. In chronic pain, some lesions affect the central and peripheral nervous system. Sometimes immunologic factors like cytokines and chemokines activate normally inactive fibers and cause peripheral nervous system dysfunction. Also, long-term pain could increase pain stimulus which is called visceral hyperalgesia.

Etiological factors of CPP can be divided into gynecological or non-gynecological causes. Endometriosis, adenomyosis, leiomyomas, ovarian tumors, pelvic inflammatory disease, surgery related adhesions, and pelvic congestion syndrome are mostly encountered gynecologic causes. Also, surgical, urological, gastrointestinal, musculoskeletal, psychosomatic, and neurological problems could be causative factors of CPP.

The etiology of CPP is complex and multifactorial; therefore, extensive diagnostic procedures are required. The first but maybe the most important step consists of history-taking and physical examination. In history-taking, the factors that induce or aggravate pain should be clarified. Also, effects of pain on the quality of life should be assessed. With the results of this initial step, imaging studies such as transvaginal ultrasound of the pelvis, computerized tomography (CT), magnetic resonance imaging (MRI), and venography could direct diagnosis and management. Blood tests, bacteriological tests, and cystoscopy also may be useful in the differential diagnosis [3]. Last of all, diagnostic laparoscopy may be performed keeping in mind that in 1/3 of the patients etiologic factors cannot be identified by laparoscopy.

The aim of therapy in CPP is to improve quality of life and overall function. Treatment is focused mainly on symptomatic relief. In the presence of obvious etiological factors, it should be treated. But even in these patients, targeted therapy may not result in resolution of pain. Because pain generators involve multiple mechanisms, treatment should include physical, behavioral, psychological, and sexual components. In the first-line management, if the underlying disease process is known, treatment should be directed according to specific management of this cause. If treatment is inadequate or the cause of pain is not known, with the pharmacological therapy, symptomatic relief should be targeted. To do this, analgesics, hormonal therapy (e.g., oral contraceptive, progesterone, levonorgestrel-releasing intrauterine system, gonadotropin-releasing hormone agonist), tricyclic antidepressants, serotonin-norepinephrine reuptake inhibitors, anticonvulsants, and opioids are potentially useful medications. Surgical interventions, sometimes may be diagnostic, should be guided by the underlying diagnosis. Diagnostic laparoscopy, conscious laparoscopic mapping, adhesiolysis, surgical excision of ovarian remnant, and hysterectomy are the among the most common surgical procedures in the management of chronic pelvic pain [4].

For the patients with CPP who desire to retain their reproductive potential, surgical pelvic denervation procedures may be useful. First, presacral neurectomy was described by Jourboulay and Ruggi in 1899 [5]. These procedures showed decrement after the increase in the use of analgesics and hormonal contraceptives. With the introduction of minimal invasive surgical techniques, pelvic denervation procedures had become popularized especially in the medical treatment-resistant patients.

Superior and inferior hypogastric nerve plexuses carry pelvic visceral pain through the sympathetic nervous system [6]. These afferent fibers that carry pain signals from the upper vagina, cervix, and uterus should be targeted for pelvic denervation. The sacrouterine ligament is the point that inferior hypogastric nerve plexus exits the uterus. At the sacral promontory in the interiliac triangle bilateral inferior, hypogastric nerves come together to form the superior hypogastric plexus which return to the spinal cord through lumbar splanchnic nerves. Especially, the pain fibers from the ovary and distal fallopian tubes go through the ovarian plexus to the vagus nerve. Because these fibers join with the superior hypogastric plexus, pelvic denervation procedures are only indicated for patients with midline pelvic pain.

Pelvic denervation procedures are indicated in women with chronic pelvic pain with a predominant midline component who desire to maintain their reproductive potential and fail or have contraindications to medical management [7]. Patients with endometriosis who have midline chronic pelvic pain, pelvic denervation interventions also improve pain when combined with surgical excision of endometriosis [8].

2. Presacral neurectomy

Presacral neurectomy is the surgical procedure that transects the superior hypogastric plexus to denervate the sensorial communication of the pelvic viscera and abdominal wall in order to treat refractory pelvic pain [9].

In this surgical procedure, experienced surgeons in the presacral space are essential. Due to known benefits of minimally invasive surgery and the advantage of identify potential etiologies of pelvic pain, conventional or robot-assisted laparoscopy is the preferred route for presacral neurectomy. Presacral space has close proximity to major vascular structures such as aortic bifurcation, common iliac arteries, left common iliac vein, and inferior mesenteric artery and ureters (**Figure 1**). The parietal peritoneum overlying the sacral promontory is incised transversely. Original opening is extended proximally to the point just above aortic bifurcation and distally to the sacral promontory. Especially, complete removal of fibrous and adipose tissue located between the iliac vessels is crucial because modification of procedure leads to lower than expected success rates [10]. Visualization of vasculature and ureters all during procedure prevents major complications.

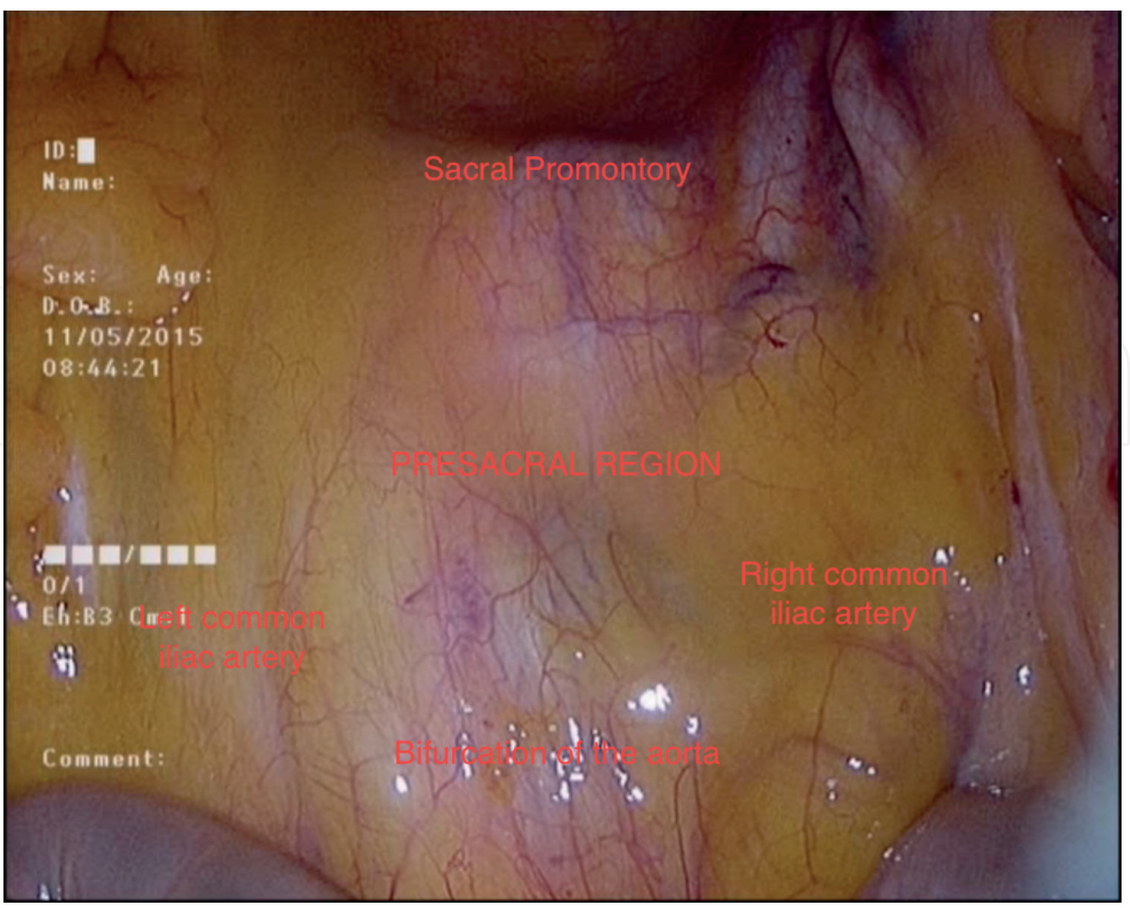

Figure 1.
The appearance of the presacral space.

Cadaveric studies have revealed numerous anatomic variations of the localization and morphology of the superior hypogastric plexus [11]. Ripperda et al. found that the superior hypogastric plexus was located inferior to the aortic bifurcation in 83% of the cases and it was located superiorly in the rest [12]. Correia et al. reported six different morphologies of the superior hypogastric plexus [13]. These anatomic variations are a challenge for surgeons during presacral neurectomy.

There are no randomized controlled trials regarding presacral neurectomy in the treatment of CPP. Retrospective studies report success rates of 62–73% with this intervention, especially in patients with CPP unresponsive to other treatments [14, 15]. Regardless of pathologic features, improvement in midline pelvic pain is observed more than lateral pelvic pain [16].

Presacral neurectomy is also used in combination with endometriosis surgery. In these patients, additional midline pain relief related with menses but not dyspareunia or nonmenstrual pain was demonstrated [17, 18]. In one randomized controlled trial, addition of presacral neurectomy to conservative laparoscopic surgery in endometriosis patients reported improvement in dysmenorrhea, dyspareunia, and quality of life of patients than endometriosis surgery alone [19]. Patients with midline pelvic pain associated with endometriosis have greater improvement in pain if presacral neurectomy is added to surgical treatment of endometriosis.

Middle sacral vessels and left common iliac veins are major vascular structures more prone to injury. In order to prevent ureteral injury, identification of the ureter prior to nerve dissection is important. With the careless transection of lymphatic vessels, chylous ascites may be encountered. This complication could be prevented with sealing of the lymphatic vessels. There have been limited reports about bowel and bladder dysfunction with respect to this procedure. Among them constipation is very well known [20].

Hagg et al. evaluated the sexual functions of women who underwent anterior fusion and denervation of the superior hypogastric plexus [21]. The authors found disturbance in orgasm and genital sensation of 20% women who underwent surgery. Martin-Alguacil et al. studied the neuronal tracing from the clitoris to the spinal tracts in female mice and found that pudendal and hypogastric nerves had a major role in the innervation of the external genitalia and neuronal pathologies, and trauma may lead to sexual dysfunction [22]. The possible effect of presacral neurectomy on sexual functions should be evaluated in randomized studies.

3. Uterosacral nerve ablation

The presence of nerve fibers and ganglia in the uterosacral ligaments has been described in the nineteenth century [23]. Sympathetic fibers originating from T10 to L1 spinal roots run through the superior hypogastric plexus which is at the level of the aortic bifurcation in the presacral space. Nerve fibers from the superior hypogastric plexus split into two hypogastric nerves that course along the internal iliac vessels on each side and connect to the inferior hypogastric plexus.

The parasympathetic innervation derives from S1 to S4 via the pelvic splanchnic nerves and travels through the lateral pelvic wall to join the inferior hypogastric plexus and form the Frankenhauser ganglia lateral to the cervix. The inferior hypogastric plexus consists of three areas: the vesical plexus, the uterovaginal plexus, and the middle rectal plexus.

The uterovaginal plexus receives sympathetic fibers from T10 to L1 and parasympathetic fibers from S1 to S4 and lies on the medial side of the uterine vessels, lateral to the attachment of uterosacral ligaments (**Figure 2**). Therefore, division of the uterosacral ligaments may interrupt many sensory fibers that carry painful stimuli of the cervix and uterine corpus.

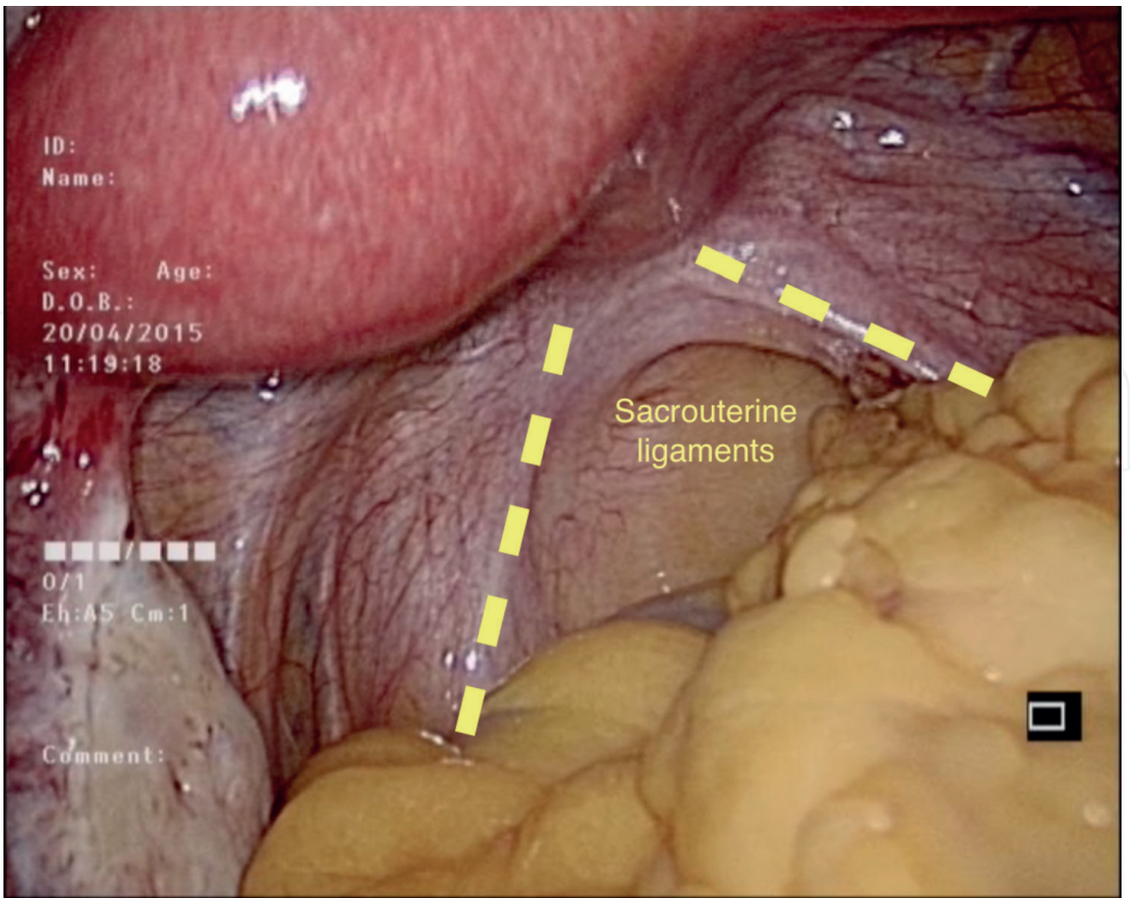

Figure 2.
The uterosacral ligaments located on the inferoposterior part of the uterus contain the nerve fibers of the inferior hypogastric plexus.

The technique of uterosacral nerve ablation was first described by Ruggi in 1899 [24]. Later, Doyle evolved the technique proposed by Ruggi [5]. Doyle suggested that the transection of the cervical division of the Frankenhauser uterovaginal plexus lying in, around, and under the terminal 2.5 cm of the uterosacral ligaments permitted sensory denervation of the cervix and uterine fundus and the proximal parts of the uterine tubes. Transection of the nerve fibers did not result in autonomic imbalance because both sympathetic and parasympathetic pathways were interrupted and the rectal and bladder functions were not affected. In Doyle's series, dysmenorrhea was relieved in 69 of 73 cases (94.5%). Relief was partial in six cases (8.2%), and there were four failures (5.5%) [5].

Uterosacral nerve ablation may be performed through abdominal, vaginal, or laparoscopic routes. Laparoscopic route is called laparoscopic uterosacral nerve ablation (LUNA). There are huge variations in the technique of LUNA without clear evidence on which technique is superior to the other [25]. It has been suggested that division of the uterosacral ligaments approximately 1.5 cm distal to the cervix should interrupt many sensory nerve fibers of the cervix and uterine corpus, and Doyle suggested that this was possible even through the vaginal route [5]. However, anatomical studies showed that the majority of uterosacral nerve fibers were found at a distance of 6.5–33 mm and at a depth of 3–5 mm distal to the attachment site of the uterosacral ligaments to the cervix [26]. There are widespread variations in the technique performed, including the route of surgery, the site of nerve ablation, and the method used for nerve ablation such as laser, electrodiathermy, scissors cutting, or harmonic scalpel [27].

Uterine nerve ablation is performed under general anesthesia. At the beginning of the procedure, attention should be given to the course of the ureters and the

neighboring vessels in order to prevent inadvertent damage. A uterine manipulator may aid in the visualization of the uterosacral ligaments by permitting anteflexion of the uterus. First, incision is made on the medial aspect of the ligament at its insertion to the uterus, and the second incision is made lateral to the uterosacral ligament and medial to the ureter. The ligament may be grasped with a forceps and stretched toward the lateral pelvic wall to aid in the ablation process. One or both of the ligaments may be transected. Full or partial transection of the ligaments may be done bilaterally with laser or electrodiathermy, according to the surgeons' preference. Laser usage may result in less thermal damage to the neighboring structures. The posterior part of the cervix between the insertions of the uterosacral ligaments may be ablated to interrupt the sensory fibers that cross to the contralateral uterosacral ligament. A small portion of the ligament may be transected and examined histologically to confirm the presence of the nerves fibers in the specimen [28].

Uterine nerve ablation may be classified as a safe operation with few complications reported in the literature; the complications such as constipation, postoperative bleeding, and urinary urgency were more common with presacral neurectomy when compared with LUNA [29]. Potential adverse events that may be observed after uterosacral nerve ablation include vascular, bowel or ureteric injury, bleeding, the need for conversion to open surgery, and pelvic organ prolapse.

Latthe et al. evaluated the variations in the indications and surgical technique of LUNA among the members of the UK Royal College of Obstetrics and Gynecologists and European Society of Gynecological Endoscopy [30]. The most common indication for LUNA was chronic pelvic pain (68%) followed by dysmenorrhea (66%), endometriosis (60%), and dyspareunia (39%). The authors stated that the European group was more likely to perform LUNA (62 versus 21%), and the technique differed between the two groups. The European group completely transected the uterosacral ligaments (56 versus 36%) and at a distance of more than 2 cm from its cervical insertion (50 versus 21%) when compared to the UK group. The authors concluded that there was variation in the LUNA technique in Europe according to operator experience. In addition to variations in the technique and indications, gynecologists' opinions regarding surgery for CPP may differ. Latthe et al. evaluated the gynecologists' beliefs about the effectiveness of laparoscopic uterosacral nerve ablation using a structured survey [31]. Twenty-five gynecologists responded to the questionnaire; none stated that LUNA would increase pain, while two gynecologists stated that the intervention would worsen the pain. However, most of the respondents believed that LUNA would have a small beneficial effect on pain.

There are studies evaluating the efficacy of uterosacral nerve ablation in the treatment of primary or secondary dysmenorrhea, CPP related to endometriosis, and dyspareunia. Feste reported significant improvement in the symptoms of primary dysmenorrhea or dysmenorrhea associated with endometriosis in 71% of the patients who underwent uterosacral nerve ablation [32]. Donnez et al. reported complete relief in 50% and mild to moderate relief in 41% of the patients [33]. Davis reported significant improvement in dysmenorrhea and dyspareunia in 92 and 94% of the patients with endometriosis who underwent uterine nerve ablation and vaporization of endometriosis, respectively [34]. Yen et al., in their randomized study, evaluated the effect of LUNA on secondary dysmenorrhea associated with myoma and concluded that LUNA had a beneficial effect on alleviating pain related to dysmenorrhea [35]. Lichten and Bombard in their randomized, prospective, double-blind study of the effect of LUNA on treatment-resistant dysmenorrhea showed complete relief in almost half of the patients 1 year after surgery [36].

Johnson et al., in their randomized study included 123 patients with chronic pelvic pain. There was significant reduction in dysmenorrhea, but there was no benefit in nonmenstrual chronic pelvic pain in patients with or without endometriosis [37].

No improvement was observed on dyspareunia and dysmenorrhea. Vercellini et al., in their randomized study on the effect of LUNA on endometriosis-related dysmenorrhea, showed no reduction in the frequency and severity of dysmenorrhea [38]. LUNA had no additional effect on health-related quality of life, psychiatric profile, and sexual satisfaction. Shawki, in his randomized controlled trial, evaluated the efficacy and satisfaction related to LUNA in patients suffering from CPP associated with either no or mild endometriosis [39]. The authors found no significant difference between the groups that underwent diagnostic laparoscopy and LUNA and diagnostic laparoscopy only in the treatment of primary and secondary dysmenorrhea, but there was a significant difference regarding dyspareunia. Daniels et al., in their randomized controlled trial, showed that there was no significant difference regarding pain scores and quality of life between the LUNA group and no LUNA in the treatment of CPP [40].

There is only one randomized trial comparing the effect of presacral neurectomy and LUNA. Chen et al. compared the effect of presacral neurectomy and LUNA on primary dysmenorrhea [41]. Laparoscopic presacral neurectomy was more effective than LUNA in the long-term follow-up. In a systematic review of nine randomized trials on the surgical interruption of the pelvic nerve pathways, five trials investigated the effect of LUNA, two trials laparoscopic presacral neurectomy, and two trials open presacral neurectomy [42]. For the treatment of primary dysmenorrhea, LUNA had a small beneficial effect when compared to control group. There was no significant difference between LUNA and presacral neurectomy in the treatment of dysmenorrhea in the short-term follow-up; however, laparoscopic presacral neurectomy was more effective than LUNA in the long term. LUNA was not found effective in the treatment of secondary dysmenorrhea.

Therefore, although initial case series have shown promising results, both prospective and randomized controlled studies have shown that LUNA had no significant effect in the cure of CPP, but it may have a beneficial effect in some patients with pelvic pain and primary dysmenorrhea. The European Society of Human Reproduction and Embryology (ESHRE) guideline on management of women with endometriosis has suggested that clinicians should not perform LUNA as an additional procedure to conservative surgery to reduce endometriosis-associated pain and presacral neurectomy was effective as an additional procedure to conservative surgery to reduce endometriosis-associated midline pain with significant potential complications [43].

4. Conclusions

Pelvic denervation procedures such as presacral neurectomy and uterosacral nerve ablation have been evaluated in the treatment of chronic pelvic pain with or without endometriosis with varying results. Recent randomized trials regarding uterosacral nerve ablation have shown no significant benefit of uterosacral nerve ablation. Presacral neurectomy may be used as an adjunct in the treatment of CPP with or without endometriosis; however, the surgery may not have the desired effect due to variations in the anatomy. In addition, the beneficial effect may diminish over time due to regeneration of the nerve fibers.

Author details

Funda Gungor Ugurlucan* and Cenk Yasa
Division of Urogynecology, Department of Obstetrics and Gynecology,
Istanbul Faculty of Medicine, Istanbul University, Istanbul, Turkey

*Address all correspondence to: fgungor@yahoo.com

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