Laparoscopic pudendal nerve decompression

The treatment of Chronic Pelvic Pain Syndrome due to Pudendal Nerve Entrapment

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The pudendal nerve originates in the sacral plexus; it derives its fibers from the ventral rami of the second, third, and fourth sacral nerves (S2, S3, S4). It innervates the external genitalia of both sexes, as well as sphincters for the bladder and the rectum.

It passes between the piriformis and coccygeus muscles, and leaves the pelvis through the lower part of the greater sciatic foramen. It crosses the spine of the ischium, and re-enters the pelvis through the lesser sciatic foramen. It accompanies the internal pudendal vessels upward and forward along the lateral wall of the ischiorectal fossa, being contained in a sheath of the obturator fascia termed the pudendal canal. The pudendal nerve gives off the inferior rectal nerves. It soon divides into two terminal branches: the perineal nerve, and the dorsal nerve of the penis or the dorsal nerve of the clitoris.[1]

Pudendal Nerve Entrapment

Pudendal Nerve Entrapment (PNE), also known as "Alcock Canal Syndrome" is an uncommon source of chronic pain, in which the pudendal nerve is entrapped or compressed as it leaves or enters the pelvis in various tunnels created by adjacent muscles, tendons or bony and ligamentous tissues.[2,3]

In this condition the nerve is most commonly compressed:

- In the space between sacrotuberous and sacrospinous ligaments (~70% cases)
- Within the pudendal canal of Alcock (~20% cases)
- While straddling of the falciform process of the sacro-tuberal ligament by the pudendal nerve and its branches
- Anywhere along the course of the pudendal nerve or its branches

The most common causes for pudendal nerve entrapment syndrome include:

- Repeated mechanical injury (e.g. sitting on bicycle seats for prolonged periods over many years or months)
- Trauma to the pelvic area
- Damage to the nerve during surgical procedures in the pelvic or perineal regions
- Compression from lesions or tumours arising in the pelvis
- Any cause for the development of peripheral neuropathy (e.g. diabetes or vasculitis).

Symptoms

The symptoms of PNE syndrome arise from changes in nerve function and structural changes in the nerve that arise from the mechanical effects of compression. These changes give rise to so-called "neuropathic" pain. Therefore, the main symptom of PNE is pain in one or more of the areas innervated by the pudendal nerve or one of its branches. These areas include the rectum, anus, urethra, perineum, and genital area. In women, this includes the clitoris, mons pubis, vulva, lower 1/3 of the vagina, and labia. In men, this includes the penis and scrotum.[4]

Often pain is referred to nearby areas in the pelvis. For example, in male competitive cyclists (who sometimes refer to it as "cyclist's syndrome") can in rare cases develop recurrent numbness of the penis and scrotum after prolonged cycling, or an altered sensation of ejaculation, with disturbance of urination and reduced awareness of defecation.

The symptoms can start suddenly or develop slowly over time. Typically pain gets worse as the day progresses and is worse with sitting. Without treatment, over time there may be a progressive worsening of symptoms starting with a small amount of perineal discomfort that develops into a chronic and constant state of pain that does not decrease even when standing or lying down.[4]

Other possible symptoms:

- Pain after orgasm
- Loss of sensation with difficulty achieving orgasm
- Strange feeling of uncomfortable arousal without sexual desire
- Intolerance to tight pants or elastic bands around the leg.
- Friction and feeling of inflammation along the course of the nerve when walking for too long or running
- Urethral burning with or after urination
- Feeling like the bladder is never empty or feeling the need to urinate even when the bladder is empty
- Urinary frequency
- Pain after bowel movement. Sometimes sufferers also report pain prior to and during the bowel movement
- Painful muscles spasms of the pelvic floor after bowel movement
- Constipation
- Sexual problems. Men complain of a diminution of sensations. Pain after ejaculation is common. For women pain during and after intercourse is often reported
- Scrotum/Testicular pain is possible

Laparoscopic surgical treatment

Surgical treatment of PNE can be performed with different approaches like transgluteal, transperineal and transischiorectal. Pudendal nerve decompression, implied by a limited access to the pelvic nerves and plexuses, can now be overcome with the availability of laparoscopy: the development of video endoscopy and microsurgical instruments enables a unique access to all pelvic nerves and plexuses, providing the necessary visibility with high definition and magnification (15x) of the structures and the possibility to work with appropriate instruments.

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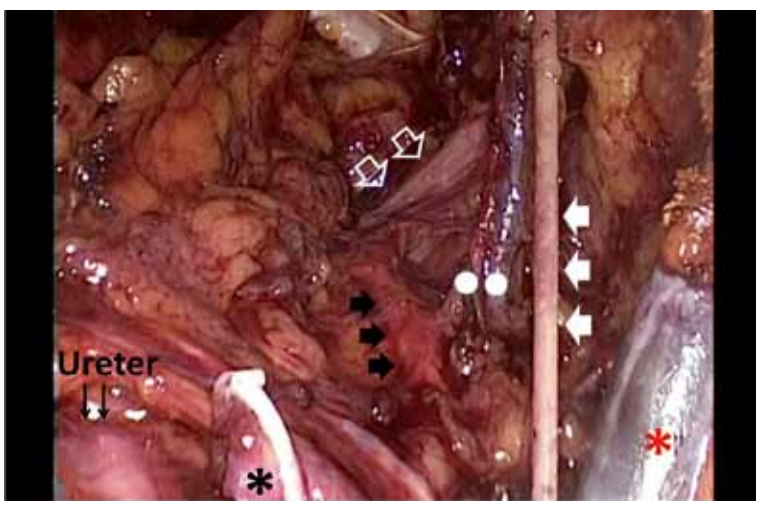


Fig. 1: Black star: Medial umbilical ligament, the first branch of internal iliac artery; Red star: external iliac vein; White-filled dot: Oburator artery and vein; White-filled arrow: Obturator nerve; Black-filled arrow: Internal iliac artery; White-bordered arrow: Sacrospinous ligament

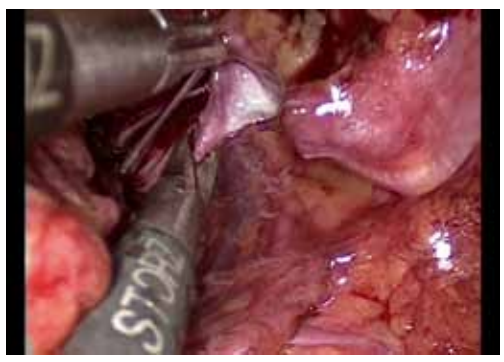
Laparoscopy is the only method which enables us to confirm diagnosis and to treat the patient at the same time. The most frequent etiologies consist of lesions to the nerves, secondary to surgeries by cutting, suturing or coagulation of nerves, compression/ irritation of nerves by scar tissue or enlarged vessels (=vascular entrapment), compression/infiltration of the nerves by pelvic organs (enlarged uterus) or pathologies (cancers, endometriosis).

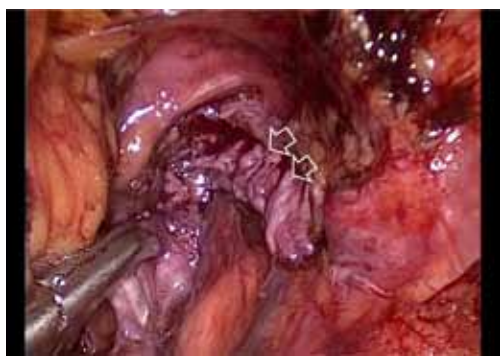
When injuries to the nerves have occurred, laparoscopic exploration not only offers an anatomic and functional exploration of the nerves, but can also result in an effective neurosurgical treatment, using laparoscopic techniques of nerve decompression or reconstruction. Laparoscopy is therefore the essential and logical step in the management of pelvic nerve pathologies that must be indicated as soon as possible, before the nerve damage becomes irreversible and before the process of "pain chronification" begins.

Laparoscopic management for pudendal pain consists of two operative possibilities.[5,6] The first procedure focuses on endopelvic etiologies with elective exploration of the entire sacral plexus, extending from dissection of the endopelvic portion of the sciatic and pudendal nerves to full dissection of the endopelvic sacral nerve roots. The second procedure focuses more on extrapelvic etiologies and it is limited to elective dissection of the pudendal nerve from its emergence from the sacral plexus up to Alcock's canal. The decision to perform the first and/or the second procedure strongly depends on the preoperative history.[6]

Laparoscopic dissection

In our technique of laparoscopic dissection of the pelvic somatic nerve and laparoscopic pudendal nerve decompression (LPnD), we used 5 trocars (13mm optic trocar, placed infraumblical insicion, one 10mm and three 5mm trocars) similar to our uro-oncologic pelvic surgeries. The external iliac vein was identified and the peritoneum was incised between the ureter and external iliac vein. Careful blunt dissection techniques were used to create a peritoneal window medial to the obturator nerve after obturator lymphadenectomy (optional). The medial peritoneal layer was then retracted medially to allow visualisation of the internal iliac vein and arcus tendineus fascia pelvis. (Fig.1) For the better visualisation, partial internal iliac lymph dissection might be required.





Figs 2a, 2b. a: The first cut to the SSL, b: After cutting the SSL

The tendinous arch of the pelvic fascia is incised and retracted medially to fully expose the internal iliac vein. This vessel is then mobilised and traced distally, to the posterior border of the ischiococcygeus muscle. Following these structures distally allows exposure of the sacrospinous ligament (SSL), from an internal perspective. (Fig. 1) Dense and thickening SSL is identified and bluntly dissected from pudendal artery, vein and nerve. Using 5 mm scissors, the sacrospinous ligament is then divided at the opening of Alcock's canal. (Figs. 2a, 2b)

Full exposure of the pudendal nerve begins with exposure of its endopelvic segment, followed by the transsection of the SSL, which permits further dissection of the nerve downward to Alcock's canal.

Age (year)	41.3 ± 10.4 (23-62)
Pre-operative VAS	8.4 ± 0.8 (7-10)
Post-operative 1st month VAS	1.4 ± 1.0 (0-4)
Post-operative 3rd month VAS (*n: 15*)	1.3 ± 1.4 (0-4)
Follow-up (month)	7.4 ± 3.1 (2-13)

Table 1: Our brief results after LPnD using the visual analog scale (VAS)

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The incision can be extended to the upper wall of the Alcock canal and the pudendal nerve can be completely decompressed. (Fig. 3) This allows access to the internal surface of the sacrotuberous ligament, including the falciform portion, which could be subsequently divided, if necessary. The functional integrity of all exposed motor nerves is assessed before and after dissection/decompression of the nerves using intraoperative laparoscopic electrostimulation according to the laparoscopic neural navigation technique as described by Poosover et al.[6,7]

Patients

We operated 18 patients (15 female, 3 male) for chronic pelvic pain. Before and after the first and third months of PnD, we evaluated the patients with the visual analog scale (VAS) to objectify the pain. We observed significant improvement in 12 female and 2 male patients (14/18) with an 80% decrease in VAS. We summarised our findings in Table 1.

Laparoscopic exposure of all pelvic nerves has become feasible, not due to new findings in the pelvic neuroanatomy, but due to the introduction of laparoscopic surgery into the field of deep pelvic surgery. Laparoscopic magnification allows the surgeon a microscopic vision of these very small nerves even in the depth of the pelvis, or in other areas that are difficult to access.

The second important aspect that makes this dissection feasible is the fact that laparoscopy obliges the surgeon to have better knowledge of pelvic anatomy. It also obliges the performing of a gentle dissection with respect for all the structures following anatomic planes. This has enabled us to reduce functional morbidity in patients who underwent laparoscopic radical pelvic surgery by electively sparing the pelvic nerves. It also opens the way for the laparoscopic neuro-functional pelvic surgery.

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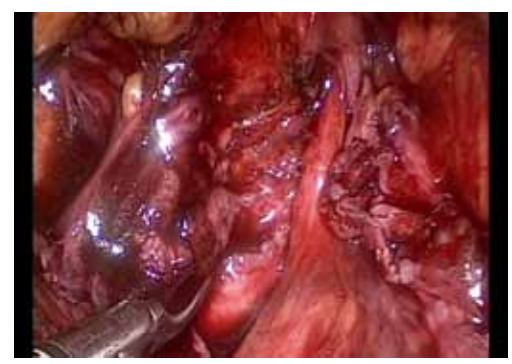

Fig. 3: Completely decompressed right pudendal nerve with dividing SSL and upper border of Alcock canal (inferior aponeurosis of internal obturator muscle)