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Retrograde Ejaculation after Anterior Lumbar Fusion Resolved with a Plant-Based Diet: Case Report and Discussion

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ABSTRACT

This is an unusual report of a 33-year-old male with retrograde ejaculation as a complication of stand-alone L5-S1 anterior lumbar spinal fusion. This case is discussed in detail, with particular interest directed toward fertility issues and their implications. A plant-based diet was suggested as a treatment option due to the diet's blood viscosity reduction properties. The patient initially noticed improvement after two months of starting the diet, with complete resolution of his retrograde ejaculation six months after beginning a plant-based diet. He successfully fathered a child a few years afterward.

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Introduction

The anterior approach to the lumbar spine has gained popularity among surgeons due to its advantages over other methods of access. It is associated with minimal blood loss, minimal manipulation of neural elements, and preserves posterior ligaments and paraspinal musculature if used as a stand-alone procedure [1]. Surgeons find the approach appealing for its ability to restore intervertebral height, lumbar lordosis, and sagittal balance by virtue of a relatively large cage. However, the anatomy encountered poses unique access-related complications. One such complication that may arise in male patients is retrograde ejaculation [RE], a condition that inhibits proper ejaculation of semen and can result in reduced fertility.

This case report aims to describe retrograde ejaculation as a complication of an anterior lumbar interbody fusion at the L5-S1 level, and the near-complete resolution of this complication potentially attributed to a plant-based diet.

Case Presentation

A 33-year-old-male presented with progressive worsening of lumbar pain over three years. He complained of sharp pain and paresthesia radiating down the posterolateral aspect of his legs bilaterally, worsened upon sitting or moving for prolonged periods.

MRI of the lumbar spine [Figure 1] showed severe central canal stenosis and foraminal stenosis at L5-S1, and XR of the lumbar spine [Figure 2] showed severe multilevel spondylosis with grade 1 vs. grade 2 spondylolisthesis at L5-S1, supporting his symptoms.

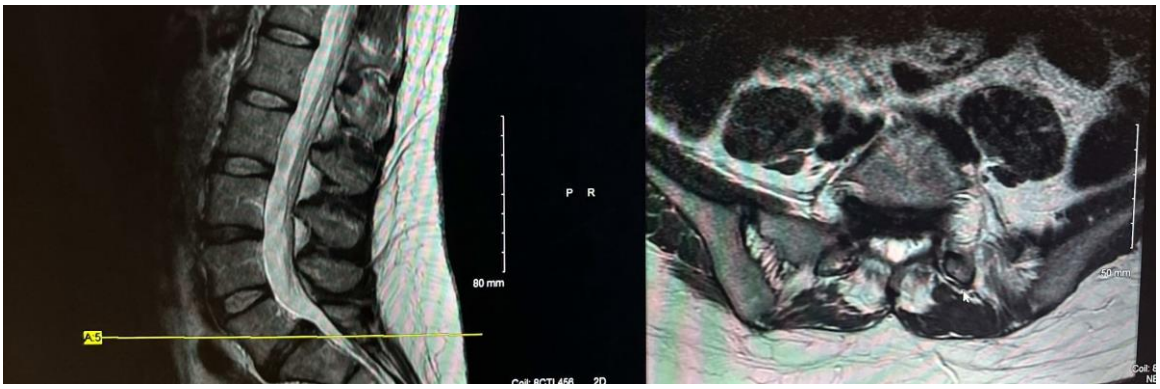

Figure 1: Pre-operative MRI of the Lumbar Spine at the L5-S1 level, demonstrating severe central canal stenosis and foraminal stenosis.

Figure 2: Pre-operative XR of the Lumbar Spine, demonstrating severe multilevel spondylosis, as well as grade 1 vs. grade 2 spondylolisthesis at L5-S1.

The patient's pathology and symptoms made him a good candidate for a stand-alone L5-S1 anterior discectomy and interbody fusion, after all non-operative treatments such as physical therapy, epidural steroid injections, and medication modifications were exhausted.

The anterior lumbar interbody fusion [ALIF] surgery involved a transverse midline incision in the lower abdomen, followed by mobilization and retraction of the rectus abdominis muscle and division of the posterior rectus sheath. The L5–S1 disc was approached in the bifurcation of the iliac vessels, and the median sacral vessels were ligated using suture and/or bipolar diathermy. A discectomy was performed and a large hyperlordotic cage with BMP was impacted into position. Instrumentation into the L5 and S1 vertebral bodies was checked with C-arm imaging prior to tightening. No complications occurred and blood loss was approximately 25mL. The patient was evaluated postoperatively and found to have full strength in his legs with minimal pain. He was able to urinate without difficulty, tolerated a clear liquid diet, and was discharged the same day.

However, at the two-week postoperative visit, the patient reported an inability to ejaculate. After urological consultation, he was prescribed Imipramine and Pseudoephedrine, which increase the sympathetic tone of the bladder. Despite this treatment, ejaculation did not improve after six months of use.

After failing this combination of medications, the patient underwent Testicular Sperm Extraction to retrieve viable sperm and was encouraged to follow a plant-based diet, known to improve endothelial function due to an increase in nitric oxide bioactivity found in foods such as spinach, lettuce, carrots, and beets [2]. Within two months, he endorsed a dramatic increase in the volume of ejaculate.

Discussion

Anterior lumbar spine surgery is a popular choice among surgeons due to its biomechanical advantages over other approaches. However, several complications are associated with anterior lumbar surgery, with vascular injury being the most devastating. With regards to RE, the incidence of this complication in males from anterior lumbosacral spinal surgery has ranged from 0.42-5.9% [3]. Despite the complication rate decreasing due to the advent of the retroperitoneal approach, some surgeons are still hesitant to perform this procedure on men of child-siring age.

The standard ejaculatory procedure is dependent upon the anatomical and functional integrity of the internal urethral sphincter, urinary bladder neck, and posterior urethra. This process occurs in two steps: emission and expulsion. Emission occurs when seminal fluid is deposited into the posterior urethra upon arousal. Subsequently, expulsion begins with the contraction of the internal urethral sphincter, which closes the urinary bladder neck and prevents the semen from reverting into the bladder as a result. The seminal fluid is then ejected through the urethra to the exterior of the body [4].

The inferior hypogastric plexus, emerging from the lumbosacral junction, supplies sympathetic innervation to the urinary bladder, urethra, and corpora cavernosa [Figure 3]. This innervation is essential for the function of the ejaculatory duct and the seminal vesicle, which ultimately reach the proximal urethra and the prostate [5]. Thus, any disruption to the integrity of the inferior hypogastric plexus may inhibit the contractility of the internal urethral sphincter, resulting in a failure to close the bladder neck and an increased likelihood of RE into the bladder, which offers the path of least resistance [Figure 4]. The role of the hypogastric plexus in emission has been demonstrated clinically by the loss of emission after non-nerve sparing para-aortic lymph node dissection for testicular cancer [6], and induction of emission in paraplegic men through

electrical stimulation of the hypogastric plexus [7]. Interference with the pelvic nerves can occur due to their small size, the depth and

narrowness of the pelvis, and the presence of fibrous and fat tissue surrounding the sacro-recto-genito-pubic plate [8].

The inferior hypogastric plexus is located retroperitoneally on either side of the rectum, lateral and posterior to the seminal vesicle [9]. It receives neuronal input from the hypogastric and pelvic nerves in addition to the caudal paravertebral sympathetic chain [10]. The nerve terminals of the sympathetic neurons, which play the predominant role in the ejaculation process, secrete primarily norepinephrine, although other neurotransmitters such as acetylcholine and nonadrenergic/noncholinergic also play important roles [11].

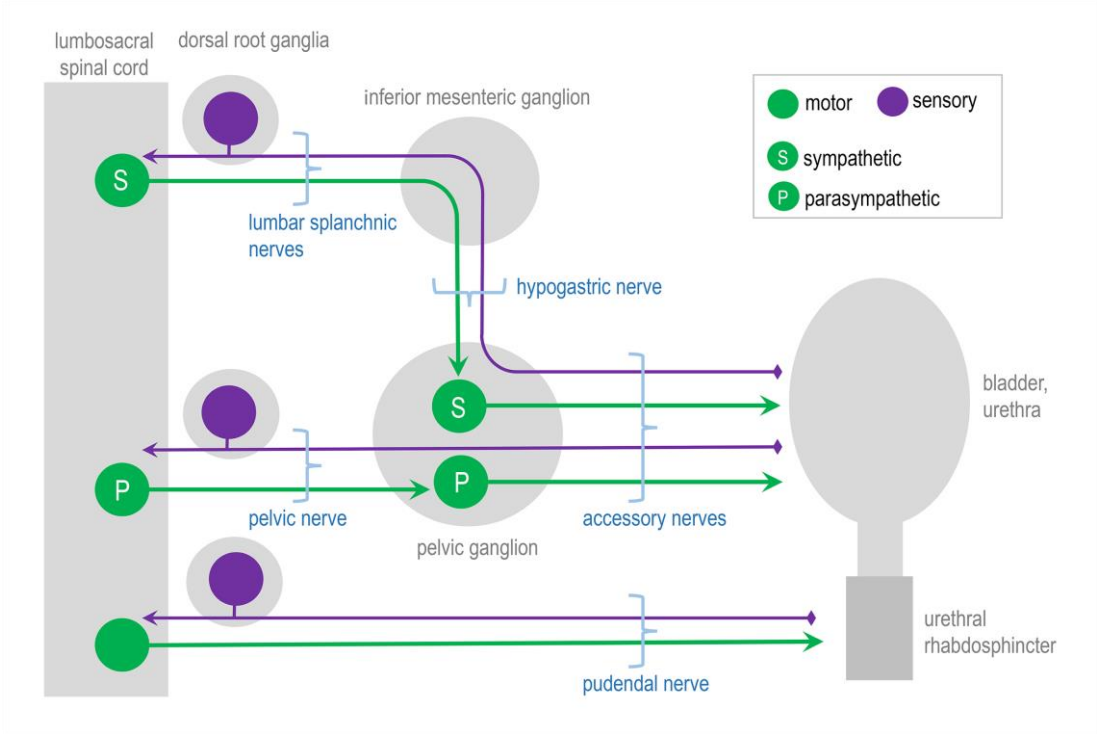

Figure 3: The hypogastric plexus emerges from the lumbosacral junction to supply sympathetic innervation to the urinary bladder, urethra, and corpora cavernosa.

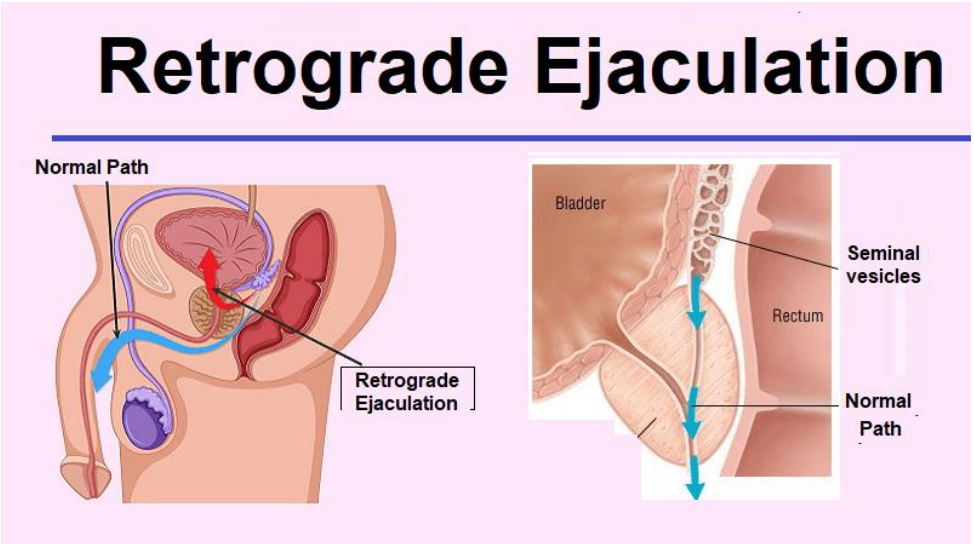

Figure 4: The juxtaposition of antegrade vs. retrograde ejaculation. While internal urethral sphincter contraction results in bladder wall closure and subsequent antegrade ejaculation [normal path], failure of the internal urethral sphincter to contract leaves the bladder wall open. This favors retrograde ejaculation into the bladder as the path of least resistance.

In this unique case study, we report a complete resolution of RE without the need for any surgical intervention or medication usage. Although other factors, including time and observation, may have played a role in the improvement of RE, the rapid improvement in symptoms following the initiation of a plant-based diet is notable. While RE is often thought to be a rare but often permanent complication of anterior spine fusion, particularly at the L5-S1 level, in practice, most spine surgeons choose to avoid anterior surgery at this level, especially if the patient is considering fathering children. Additionally, many surgeons recommend banking sperm if anterior surgery is considered. Although many surgeons opt for an all-posterior approach for young males, the amount of discectomy, restoration of disc height, endplate preparation, annular release, graft size, and restoration of lordosis is typically limited with posterior-only access[12, 13, 1]. Furthermore, ALIF surgery has historically recorded high fusion rates [14], provides indirect decompression [15], and the option of percutaneous screw fixation posteriorly improves fusion rates to near 100% [16].

The incidence of complications associated with intraperitoneal structures has decreased with the advent of the retroperitoneal approach, which offers direct visibility and a shorter learning curve compared to the transperitoneal approach. However, the retroperitoneal approach still poses unique risks such as damage to major vasculature or the hypogastric plexus, with resultant RE and infertility.

Pharmacologic treatment for the correction of RE is based either on increasing the sympathetic tone of the bladder, or on decreasing parasympathetic activity, and is conducted with alpha-agonistic or anticholinergic and antihistaminic drugs, mostly with Imipramine. Temporary oral intake of Imipramine is an effective and safe treatment to re-establish antegrade ejaculation in patients with retrograde ejaculation following retroperitoneal surgery [17].

The benefits of nutritional supplements, minerals, and plant extracts in disease prevention have become widely recognized, and commercial health claims being made are subject to regulation in most countries. From the mechanistic perspective, these substances replenish the body's deficiencies and restore normal function. The field of nutrigenomics, which explores the role of antioxidants and metabolic compounds in neuroprotection, has gained traction since the 1990s. Neuroprotective agents are now widely acknowledged to be beneficial not only for promoting optimal bodily function but also for mitigating free radicals and neuroinflammation processes that underlie many neurodegenerative conditions, such as Parkinson's disease and Alzheimer's disease [18].

Research has shown that just two hours after eating a heavy animal-based meal, arteries can constrict by 40%, essentially causing a "traffic jam". The calorie-matched plant-based meal allowed them to open freely for quick, easy transit [19]. The nitrates found in plant-based foods like spinach, lettuce, carrots, and beets signal blood vessels to dilate [20].

Efficient blood flow optimizes performance, with blood helping oxygen and vital nutrients reach the cells in our muscles, brain, and the rest of our body, while also eliminating waste [21].

Animal products contain a wide range of pro-inflammatory compounds and molecules, including bacterial endotoxins, trimethylamine N-oxide [TMAO], nitrosamines, heterocyclic amines [HCAs], N-Glycolylneuraminic acid, and polycyclic aromatic hydrocarbons [22-26]. On the contrary, plants are packed with high doses of anti-inflammatory compounds, including thousands of powerful antioxidants. There is a stark contrast between these two classes of food, with plant-based foods having on average 64 times the antioxidant content of animal foods [27]. This helps explain why switching to a plant-based diet has been shown to reduce measures of inflammation by 29 percent in just three weeks [28].

Although RE has traditionally been thought of as

an access-related complication, since the patient's retrograde ejaculation was not responsive to conventional treatments that increase the sympathetic tone of the bladder such as imipramine and Pseudoephedrine, it is possible that the solution lay upstream at the hypogastric plexus. Previous literature has shown that RE incidence has also been shown to increase due to the neuroinflammatory effects of recombinant human bone morphogenic protein-2 [rhBMP-2] on the plexus during anterior lumbar surgery [29], thus attenuating the nerves within the hypogastric plexus. Therefore, we can postulate that the high dosages of anti-inflammatory compounds within the patient's plant-based diet reduced the inflammation of this area, thus abolishing the attenuation of the nerves and restoring normal sexual function.

Another study demonstrated that a nitric oxide [NO] synthase inhibitor, L-NG-nitro-arginine

[L-NNA], inhibited the release of catecholamines caused by hypogastric sympathetic nerve stimulation [30]. This effect was reversed by the administration of L-arginine, an amino acid that aids in the synthesis of NO [31]. Therefore, we can reason that a plant-based diet, rich in nitric oxide, would facilitate sympathetic nerve stimulation accordingly.

This case report presents an alternative treatment option that should be considered for male patients with post-operative RE. While a single case report cannot provide conclusive evidence of the benefits of a plant-based diet, it does offer these patients an alternative and provides an avenue for further research. The benefits of a plant-based diet remain largely unexplored and warrant further investigation.

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