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Protection of the genitofemoral nerve using endoscopic assistance in minimally invasive lateral lumbar fusion☆,☆☆,☆☆☆

Thomas K. Lee, MD [a,d], Joseph S. Yazdi, MD [a,d,*], Kenneth E. Floro, MD [b], Processo T. Arenos, MD [c], Jessica R. Lee, DO [d]

[a] *Tesson Heights Orthopaedic and Arthroscopic Associates, 12152 Tesson Ferry Rd, Suite 1, Saint Louis, MO 63128, USA*
[b] *12639 Old Tesson Rd., Suite 115, Saint Louis, MO 63128, USA*
[c] *3009 N. Ballas Rd., Suite 129A, Saint Louis, MO 63131, USA*
[d] *SpineMore, LLC, 12152 Tesson Ferry Rd, Suite 2, Saint Louis, MO 63128, USA*

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A B S T R A C T

Postoperative groin and thigh dysesthesias are known potential sequelae of minimally invasive lateral lumbar interbody fusions (LLIF). Injury to the genitofemoral nerve (GFN) may play some role in occurrence of these symptoms. Our goals were to determine a precise, reproducible manner of diagnosing postoperative GFN dysfunction, and to evaluate an endoscopic assisted LLIF as a viable method of identifying and protecting the GFN. We performed a retrospective review of 21 consecutive patients undergoing endoscopic-assisted LLIF at 33 disc levels. CO_2 insufflation was performed through a laterally placed incision. The GFN was visualized over the surface of the psoas muscle and mobilized away from the surgical corridor. The rest of the surgery proceeded as previously described (Ozgur et al., 2006 [18]). The presence of GFN injury was defined as a subjective sense of pain, numbness, or dysesthesias in the GFN territory, or an objective decrease in sensation in the ipsilateral femoral triangle. The patients were followed for an average of 15.1 months (range of 2 to 41 months). The GFN was identified in the surgical corridor in seven cases. In 6 patients, the nerve was easily mobilized. In one patient, intramuscular dissection was required. This patient experienced temporary diminished sensation in the territory of the GFN. Therefore, our rate of transient genitofemoral neuropathy was 4.8%, and there were no cases of permanent nerve damage. This paper further confirms the specific sensory distribution of the femoral branch of the GFN and also provides in vivo evidence that the vulnerably situated GFN can be safely mobilized and avoided using an endoscopic direct look.

1. Introduction

The minimally invasive lateral retroperitoneal approach for lumbar fusion has become very popular over the last few years because of its applicability for a wide range of conditions. These include disc degeneration [12], traumatic instability [21], spondylolisthesis [27], and deformity [3,17]. It is also particularly suitable for the obese and the elderly [19,20]. Initially, most of the literature was concerned with the safety of the femoral nerve as it traverses medial and posterior to the psoas muscle [1,24,27]. In fact, the neuromonitoring systems so far developed are specifically designed to detect the proximity of the surgical corridor in relation to the motor component of the femoral nerve. However, one of the most common complications from this approach is paresthesia or dysesthesia of the thigh [6,12,27]. Unfortunately, there is a paucity of literature in regard to identification and avoidance of those nerves that lead to these complications. Determining the source of neurogenic thigh pain can be challenging because of the number of sensory nerves that pass through the retroperitoneum. These include the mixed motor and sensory nerves such as iliohypogastric, ilioinguinal, femoral, obturator, and genitofemoral (GFN) nerves as well as the purely sensory lateral femoral cutaneous nerve. Another factor that can make this determination difficult is the presence of pre-operative radiculopathy of the thigh caused by upper lumbar nerve irritation. Thus surgery in this area could lead to peripheral neuropathy overlapping residual radiculopathy.

Abbreviations: GFN, genitofemoral nerve; LLIF, lateral lumbar interbody fusion.

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☆☆☆ Given the retrospective nature of this study, an ethical review committee statement was not needed.

* Corresponding author at: 12152 Tesson Ferry Road, St. Louis, MO 63128, USA.
E-mail address: joeyaz21@yahoo.com (J.S. Yazdi).

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Despite some overlap, the pattern of paresthesia can help identify the involved nerve. In this study, we will focus on the GFN and its generally accepted distribution which involves the skin over the femoral triangle, and scrotum or labia, as well as a small area of the proximal medial thigh [7,9,26].

The most common minimally invasive lateral retroperitoneal approach involves serial dilation through the psoas muscle without direct visualization. Typically, the motor component of the femoral nerve is monitored during this process through electrophysiological monitoring [12,18]. Although the GFN carries motor fibers, detecting them requires monitoring the cremaster muscle, which is not routinely performed [11]. Furthermore, the cutaneous nerves cannot be detected with this method. Typically, the site of GFN injury is at the point that it penetrates through the psoas muscle and is lying over it. In fact, it is the only nerve to pierce the psoas muscle ventrolaterally at about the L2–3 disc level. It runs obliquely along the surface of the psoas muscle thus placing it at risk with lateral approaches between the L2–3 and L4–5 disc levels [4, 8]. We describe an endoscopically assisted approach that can visualize and protect the nerve as it traverses over the psoas muscle.

2. Methods

We performed minimally invasive lateral lumbar fusions on 21 consecutive patients employing endoscopic assistance to visualize the retroperitoneal surface of the iliopsoas muscle (Table 1). Standard neuromonitoring was used in every case. The placement of the incision was determined by lateral fluoroscopy to correlate with the desired disc level. A small incision was made. The retroperitoneoscopy was performed using an 11 mm Visiport cannula with a bladeless trocar (Applied Medical, Rancho Santa Margarita, CA) using a 5 mm or 10 mm, 0-degree scope with CO_2 insufflation with a pressure of 15 mm Hg to 30 mm Hg. By gently sweeping the cannula, we made a corridor through the retroperitoneal fat perpendicular to the floor until a 2–3 cm area of the psoas muscle was visualized. No attempt was made to explore any more of the surface of the muscle than necessary. This explains why we only visualized the GFN in seven of our twenty-one patients. This technique provided good initial visualization of the psoas in the targeted area.

The nerves traversing the surface of the psoas muscle were photographed (Fig. 1A) and if needed, mobilized gently by a sweeping motion of the cannula from posterior to anterior (Fig. 1B and Video 1).

Table 1
Patient specific data undergoing surgery.

Patient	Age	Months F/u	Levels fused	Needed GFN mobilization
1	62	29	L3–4, L4–5	
2	64	41	L1–2, L2–3	
3	50	6	L2–3, L3–4	
4	64	24	L1–2, L2–3, L3–4	
5	42	4	L4–5	Yes
6	62	29	L2–3, L3–4	Yes
7	36	27	L4–5	Yes
8	51	30	L4–5	
9	66	3	L3–4	Yes
10	56	12	L3–4	
11	46	9	L4–5	
12	56	23	L4–5	Yes
13	46	2	L4–5	
14	53	21	L3–4, L4–5	[b]
15	51	19	L3–4, L4–5	
16	60	5	L3–4, L4–5	
17	69	4	L4–5	Yes
18	62	4	L2–3, L3–4	Yes[a]
19	34	13	L4–5	
20	71	5	L3–4, L4–5	
21	46	8	L3–4, L4–5	

[a] Required intramuscular dissection for mobilization. See Video 2. GFN distribution dysesthesia lasted 24 h.
[b] Experienced distal iliohypogastric nerve injury.

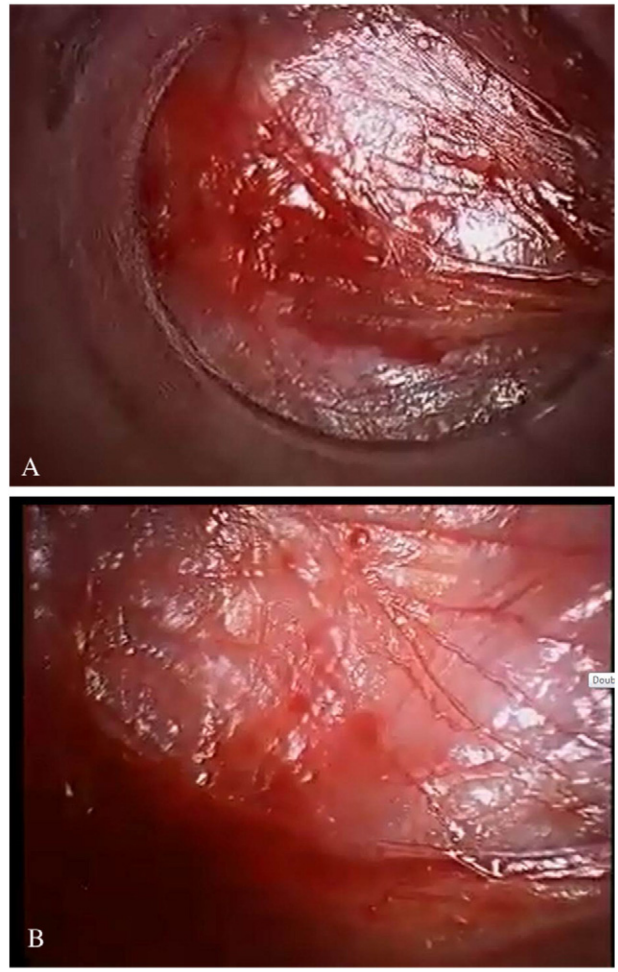

Fig. 1. A. This figure shows an endoscopic view of GFN and accompanying vessels at needed insertion site for the dilator at L2–3. B. This figure shows a higher magnification view of the ventral aspect of psoas muscle after sweeping of the GFN and vessels anteriorly.

In one patient, case #18, we were unable to sweep the nerve away from the L2–3 disc area. Therefore, blunt intramuscular dissection by splitting the muscle and then repositioning of the nerve was accomplished using an endoscopic Kittner sponge through the second portal (Video 2).

In all cases, after exploration of the surface of the psoas muscle via retroperitoneoscopy, the endoscope was removed and the incision was lengthened slightly to accommodate the retractor. The first dilator was placed through the Visiport cannula and then the cannula was removed over the dilator. We then performed the usual monitored serial dilation through the psoas muscle to gain access to the disc. After adequate discectomy, a synthetic cage was packed with fusion material and placed in the disc space. Each patient had subsequent posterior fusion and pedicle screw fixation. All patients underwent a focused neurological examination in the recovery room and on subsequent follow up office visits to assess for new symptoms of pain, numbness, or changes in light-touch sensation in the area usually attributed to the GFN.

3. Results

In our series of twenty one patients, there were two fusions at L1–2, five at L2–3, twelve at L3–4, and fourteen at L4–5, thus resulting in a total of thirty three fused levels (Table 1). The mean age was 55 years with an age range of 34–71 years. GFN was seen over the surface of the psoas muscle at the desired insertion site at eight disc levels in 7 of 21 patients (Fig. 1A). The GFN was observed twice at L2–3 and