



## Endoscopic Spinal Surgery in High Level Athletes: Report of 2 Cases

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### Abstract

Herniated discs are a common pathology in the general population and even more so in elite athletes. Although they have less low back pain and sciatica than the general population, they have more injuries due to overuse since adolescence and often undergo discectomy when conservative treatment fails. Multiple factors need to be examined in this particular patient population. This is due to several influencing factors such as a high percentage of muscle mass, a low percentage of fat, an early possibility of rehabilitation, the degree of postoperative pain, and the search for the shortest possible duration of surgery. With the open or microscopic technique, the average return time is about 5 months. With the advent of percutaneous techniques and their advancement, especially endoscopy, this average time has been reduced to 2.5 months in football players according to reports and case series. This indicates that endoscopy, in addition to its benefits in the general population, is more effective in athletes because of the special needs of these athletes. In this article, we report a series of cases of football players who underwent endoscopic discectomy and achieved good results and an early return to competition level.

**Keywords:** Endoscopic Spine Surgery; Athletes; Disc Herniation; Discectomy; Sports

### Introduction

Physical activity and sports are considered beneficial for spinal health; however, excessive spinal loading in athletes in some sports is associated with degenerative diseases [1,2], probably due to the

heavy loading of the intervertebral discs and intervertebral groups in some sports. For this reason, athletes in some sports are more susceptible to developing disc herniation (DH), as these loads place them at high risk for degenerative disc disease [1,3].

In professional athletes, DH often leads to a deterioration in performance that may result in a long absence for conservative treatment [4], which negatively affects the athlete's activity time and may even lead to premature retirement [5,6]. Generally, treatment consists of 6 to 8 weeks of conservative management before surgical intervention is considered, provided there is no significant neurologic impairment or progressive deficit [7,8]. Because the conservative treatment period is quite long, athletes often undergo surgical treatment to allow an early return to sport. However, some works have shown that there is no difference between operated and non-operated athletes in terms of career length [9,10]. Clinical outcomes after DH in the general population are excellent, with satisfaction rates of about 90% and return to work of 75%, in addition to return to normal daily activities [9,11,12]. In athletes, the vast majority succeed in returning to sports after discectomy, and this rate varies from 79.6% to 90.4% (mean of 83%), according to a recently published meta-analysis [8].

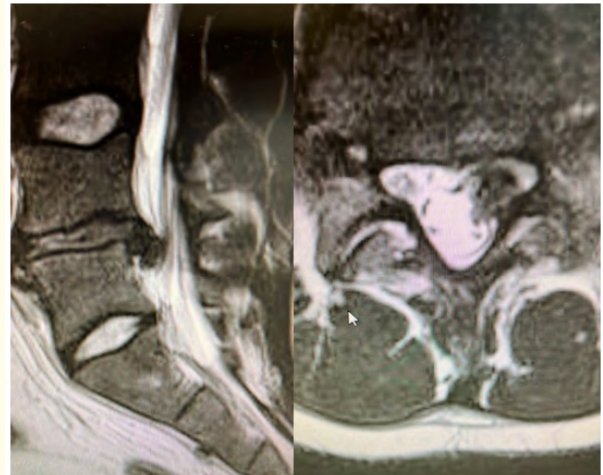
This particular patient list argues for minimally invasive procedures with the least amount of soft tissue injury possible, allowing for early rehabilitation and increasing the chances of returning to sports as soon as possible and minimizing loss of performance, position, and/or even contracts with clubs. In this context, minimally invasive procedures such as endoscopic spine surgery (ESS) are gaining importance because the posterior musculature is not damaged, which facilitates recovery and return to sports [1]. Therefore, this article presents a series of cases of athletes who underwent ESS and were able to return to sports early.

## Description of the cases

### Case 1

Male patient, 31 years old, professional football goalkeeper. He had chronic low back pain with episodes of aggravation depending on training load, but with left sciatic pain for 6 months with progressive aggravation. Magnetic resonance imaging (MRI) diagnosed a lumbar disc herniation (LDH) L4-L5 with extrusion to the left and inferior migration (Figure 1). Conservative treatment with medication, physical therapy and strengthening, rest, acupuncture, and foraminal blockade was initiated but failed to improve. After the failure of the aforementioned treatment and worsening of pain, withdrawal from sports, and limitation of daily

activities, percutaneous endoscopic surgery (PELD) transforaminal L4-L5 left was decided. The patient progressed in the postoperative period and started physical therapy in the first week. After 14 days, he started exercises and light sports training, and after 21 days, he started traditional goalie training. With a good evolution of the condition, 1 month after the procedure, the athlete returned to sports at a competitive level in a professional championship.

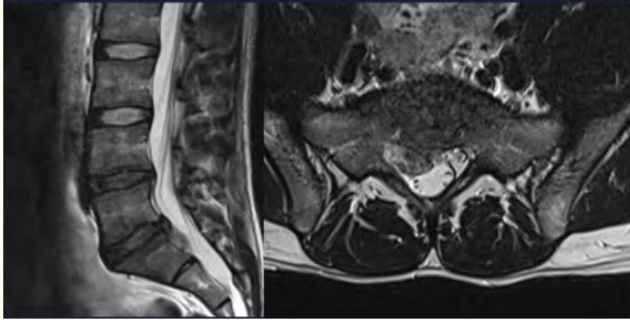


**Figure 1:** MRI showing left extrude LDH l4-l5 with lower migration.

### Case 2

Male patient, 33 years old, professional soccer goalkeeper. He presented with chronic mild low back pain with a sciatic pain crisis in the right lumbar region, with an index of 2/10 on the visual analog pain scale (VAS) to the sole of the foot, strength deficit in the triceps and peroneals (S1). MRI showed right DH at L5-S1 level (Figure 2). After failure of conservative treatment to restore strength (medication, physical therapy, strengthening, withdrawal from games, and reduction of training load), he underwent interlaminar PELD L5-S1.

In the postoperative period, the patient had no pain and began light jogging 10 days after surgery. On day 17 after surgery, he started light goalie-specific training, after 21 days he started more intense training involving takedowns, and on day 24 he started full training with no restrictions. After one month, he still had limitations in the right lower extremity, with smaller heels on that side. After intensive work to compensate for lower limb function, the patient returned to competitive sports within 10 weeks.



**Figure 2:** MRI showing right DH at L5-S1 level.

## Discussion

Soccer is the most popular sport in the world, with millions of players around the world, and studies show a 2% to 14% rate of spinal injuries that can occur in childhood or adolescence [13-15]. According to Pfirrmann, *et al.* the number of games played and the early age at which the sport is started can be significant factors in the occurrence of spinal injuries, as the position of the player can influence the type of injury, with goalkeepers having the highest rates of low back pain [13].

Athletes have greater muscle development, which allows for greater strength, but this leads to a higher susceptibility to injury. The goalkeeper position places high biomechanical demands, such as sudden changes in velocity, trunk rotation, flexion, and extension, and these repetitive loads affect spinal stability [16]. The high stresses from intense training since childhood and adolescence may promote the occurrence of spinal pathologies at an early stage [13-15] and predispose to more severe disk degeneration and acute low back pain than the general population [17,18]. Baranto, *et al.* demonstrated this in their studies, in which they followed athletes for 15 years and found no significant worsening of spinal changes on MRI that were already present at baseline and concluded that they occurred during adolescence [19].

The prevalence rate of low back pain in certain sports ranges from 1% to 30% [20]. This pain appears to be more related to acute conditions due to exercise stress and less related to chronic conditions than in the general population [15]. The higher prevalence of pain and injury may be related to a higher rate of degenerative disk disease (DDD) in athletes, as shown by

Hellstrom, *et al.* who found a prevalence of 75% DDD in athletes versus 31% in the general population [21], which was later confirmed by another study and seems to be directly related to the high prevalence of LDH of over 58% [15].

In some sports, such as rowing, basketball, gymnastics, diving, field hockey, American soccer, baseball, and rugby, more stress is placed on the athlete's spine, resulting in a higher prevalence of injuries because more extending, bending, and twisting movements are performed. In contrast, such injuries do not usually occur in swimmers [1,22,23].

The effectiveness of treatment in the general population is usually measured by questionnaires such as the Oswestry Disability Index (ODI), the Quality-of-Life Questionnaire (SF-36), and VAS. However, in athletes, such questionnaires are less meaningful because they generally relate to early return to sport and performance [24]. Important data are: Return to sport, performance level, number of games played, seasons played, and sport-specific statistics [5,9,22,24-26].

Nair, *et al.* conducted a systematic review in which they analyzed 450 elite athletes in the United States. These athletes underwent microdiscectomy between 1967 and 2010 in the 4 major sports leagues and among Olympians. Return to sport ranged from 75% to 100% and averaged between 2.8 and 8.7 months [6]. This high rate may be the result of better physical preparation of athletes compared with the nonathletic population. Watkins studied 60 Olympic athletes who underwent microdiscectomy and found that it took an average of 5.2 months to return to their previous athletic level (with 88% of athletes returning to their previous level of performance) [27], whereas Earhart, *et al.* reported an average of 8.7 months for the same surgical technique [25]. Another literature review found similar results for return to sport under conservative treatment or microdiscectomy: overall, 78.9% returned to previous performance levels under conservative treatment an average of 4.7 months after treatment initiation, and 85.1% returned to sport after microdiscectomy 5.2 to 5.8 months after surgery [28]. A meta-analysis found a similar rate of return to sport in athletes who underwent surgery or conservative treatment. However, because these were not minimally invasive procedures, the time to return to sport varied from 5.2 to 8.7

months [26]. Sedrak, *et al.* recently published a meta-analysis that reached very similar conclusions. In this work, it was found that after microdiscectomy, the average time to return to sport was 5.19 months. In athletes treated conservatively, the time to return to sport was slightly shorter, averaging 4.11 months, with a high rate of athletes recovering after microdiscectomy (83%) [8]. Another meta-analysis by Overley, *et al.* found an average return to sport of 83.5% after microdiscectomy, and again there was no difference from athletes who underwent conservative treatment [29].

In athletes, PELD has been studied since the 1990s, when two research groups found a return to sport at preinjury levels of 76.9% to 86.7% in an average of 7 to 7.5 weeks [30,31]. However, the athletes in the former study [30] were not professionals. In the same study, non-athletes had a return to sport of 58% with an average duration of 9 weeks. For microdiscectomy, the rate was 54%, with an average return time of 17 weeks. In addition, the author reports that 73% of athletes had some limitation [30,31]. In a recent systematic review, Sivakanthan found 5 articles with 33 athletes who underwent endoscopy and found that 88% of athletes were able to return to their previous athletic level within 3 months after surgery. Because it is a minimally invasive and effective procedure that allows an early return to sports, PELD is often indicated in athletes for whom surgery is indicated for LDH [32].

Yamaya, *et al.* first investigated the effect of return to sport in elite adolescent athletes who underwent PELD and found an early return to sport of 94.4% after an average of 7 weeks [33]. An important factor to evaluate in this particular population is that they seek an extremely early return due to the limited time available during high school to demonstrate their skills and performance, especially in countries where the quality of the athlete at this stage is important to continue in college and professional competitive sports. Another interesting finding of the study is that 38% of the adolescents had worsening disk degeneration during follow-up [33].

Nakamae and coworkers analyzed the evolution of elite athletes who underwent PELD at the L4-L5 levels under sedation. ninety-five percent of them returned to levels similar to those before pathology after an average of 9.2 weeks. In addition, improvement of pure low back pain was noted in athletes by endoscopy, performing

thermal annuloplasty, which may be related to the reduction of intradiscal pressure, which tends to be higher in athletes [34], and a reduction of this pressure may be useful in discogenic pain [35]. This is because an influencing factor in low back pain is annular rupture and leakage of nucleus pulposus contents, leading to an inflammatory response (cytokines, TNF, interleukins) and consequently low back pain. Reduction of intradiscal pressure may contribute to reduced extravasation and local inflammatory process [36,37].

Kapetanakis, *et al.* performed the first prospective study of percutaneous transforaminal endoscopic lumbar discectomy (PTELD) in elite athletes with LDH. All 55 cases were treated by the same surgeon and followed up for 2 years, evaluating VAS and SF-36. In addition to disk removal, foraminoplasty was performed. In the postoperative period, all underwent the same rehabilitation protocol. For all parameters assessed, there was significant improvement in the first 6 weeks, which stabilized during the follow-up period of up to 2 years [38], similar to what was found in another study [34]. The average time to return to sport in these studies was 6.7 weeks, with 100% of athletes regaining their pre-pathology level or performance [34,38].

The amount of disk removed and the levels operated on may also be a factor to consider in postoperative follow-up. One study concluded that the group in which an average of 1 gram of disk was removed had better postoperative outcomes than the group in which an average of 3.4 grams was removed [39]. Another point to be clarified is that resumption of sports seems to be more possible with 1-level discectomy compared with 2-level discectomy [23].

In summary, for endoscopic spine surgery, only case reports and series can be found in the literature, and clinical studies are not yet available. In two case series specifically involving soccer players, the average time to return to professional sports was 2.5 months [32,40], confirming the results of the cases presented and representing a much shorter time compared to microdiscectomy.

### Rehabilitation and return to sport

Rehabilitation is extremely important for the adequate and early recovery sought by athletes. Rest or restriction of postoperative activities have been shown to be inefficient in returning to sports and reducing complications or recurrences [41].

There is no clear consensus or definitive recommendation on the type of postoperative rehabilitation for the lumbar spine [32,42], but adherence to preoperative treatment ensures a better recovery [42,43]. However, there are few literature reports on this topic, with variations in methods of postoperative rehabilitation, and even fewer in athletes undergoing endoscopic discectomy [44]. In a nonrandomized prospective study of nonathletes undergoing single-level microdiscectomy, Gencay-Can, *et al.* showed that starting aerobic rehabilitation within 1 month of surgery produced better results than home exercise alone [45].

Another prospective, randomized study compared rehabilitation interventions in patients undergoing single-level discectomy and found no differences between trunk-specific rehabilitation and general rehabilitation. The authors questioned whether adequate recovery after lumbar discectomy is something “natural,” as specific rehabilitation has not been shown to be more effective in the general population [46]. Sudhaus and coworkers showed that fear of exercise in the postoperative period leads to a higher rate of postoperative pain. It is possible that a high rate of return to sport can be partially explained by the fact that early rehabilitation of athletes prevents the occurrence of limitation-related pain through early mobilization and rehabilitation [47]. On the other hand, other studies concluded that trunk strengthening leads to improved outcomes after discectomy [48,49].

A meta-analysis published in 2014 showed that rehabilitation exercises started between 4 and 6 weeks after surgery improve pain and postoperative dysfunction, but there is little consensus among the protocols used [50]. It is well known that lumbar paravertebral musculature is of great value for postoperative quality of life [51,52]. Loss of function of the lumbar multifidus leads to a worse prognosis and carries the risk of “failed back syndrome” [53]. Patients diagnosed with LDH often present with lower limb pelvic muscle dysfunction and gait changes [54,55], and one study confirmed this by demonstrating improvement in gait after surgery [42].

Bouchet, *et al.* found a lower rate of postoperative pain in patients with proportionally larger muscle area, in contrast to a higher rate of pain in patients with more fat in the multifidus and psoas muscles. This could also be related to the fact that athletes

who tend to have greater lean mass are more likely to return to sport [56]. A walking and early rehabilitation protocol was also implemented for athletes who underwent PELD testing. They were encouraged to walk around on the same day as surgery, in addition to physical therapy for the hip. They also began core strengthening and stretching exercises after one week, and started running and body balance training three weeks after surgery. One week later, they started flexibility training, and 6 weeks after surgery, most of them were allowed to return to sports depending on their recovery. As mentioned earlier, the average return to sports was 9.2 weeks. The authors report that athletes received sports rehabilitation in the postoperative period and began trunk stabilization training (muscle coordination, isometric control, and establishment of a neutral trunk position) after 1 week, with the possibility of returning to sports after 6 weeks [34]. However, the authors do not describe the other features of the rehabilitation program. In this regard, a different protocol was established, which states that athletes rest for the first two weeks, then begin progressive core activities and other exercises, and after 10-12 weeks begin heavy training, with a return to sport possible within up to 12 weeks [32].

## Conclusion

Spinal endoscopy is gradually being used in athletes, with results showing an early return to sport. This technique has been shown to be comparable to open spine surgery in improving low back pain and sciatica, but advantages such as minimal tissue damage, early rehabilitation, and the possibility of a quick return to training and sports.

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