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Return to Sport of Male Judokas who have Various Surgical Treatments of Lumbar Disk Herniation

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Abstract

Lower back pain is one of the most common sources of pain in professional athletes. Regarding flexion pain in athletes, lumbar disk herniation is the most common disorder. The limited evidence on the effectiveness of surgical treatment does not allow conclusions to be drawn about the relative effectiveness of various surgery treatments for facilitating a rapid return to sport. The present paper aimed to search for objective data on the period return to sport of elite male judokas with various surgical treatment modalities of lumbar disk herniation. Participants: elite male judokas (n=8). All athletes had complaints of lower back pain. All judokas were recommended surgery: removal of lumbar disk herniation (L5-S1). Two methods of surgical treatment were used: Group 1 (n=4): total resection of the intervertebral disc and installation of the functional endoprosthesis and Group 2 (n=4): spinal fusion. Athletes' pain level using Visual Analogue Scale (VAS) and Russian Oswestry Disability Index (RODI) was assessed for 3, 6, and 9 months after surgery. Athletes' personal diary data to estimate the period return to sport was used. Group 1 VAS and RODI indicators were significantly ($p<0.01$) lower 6 and 9 months after surgery. The daily training time of Group 1 was significantly ($p<0.01$) longer in 6 and 9 months after surgery. A special judo performance test (60 Ippon-seoi-nage) showed a significant ($p<0.01$) advantage of Group 1 9 months after surgery. Research shows that Group 1 judokas returned to sport after 6-9 months, and Group 2 judokas after more than 9 months.

Keywords: *lower back pain, lumbar disk herniation, elite athletes, judo, rehabilitation, return to sport*

Introduction

Lower back pain (LBP) is one of the most common medical presentations in the human population. It is a common source of pain in athletes, leading to significant time missed and disability (Petering & Webb, 2011). Research has revealed that lumbar motion that induces specific pain would be a clue to the exact diagnosis. For the flexion pain of athletes, lumbar disk herniated (LDH) nucleus pulposus is the most common disorder (Sairyo & Nagamachi, 2016). Researchers note that the prevalence of LBP in professional athletes across a variety of time frames and sports is not known (Farahbakhsh et al., 2018). Reviews show that the lifetime prevalence of LBP in wrestlers is not high compared to other sports, specifically rowing and cross-country skiing (Trompeter, Fett, & Platen, 2017).

Triki, Koubaa, Masmoudi, Fellmann, and Tabka (2015) indicate that judo was identified as a high-risk sport for causing LBP. Judo is an acyclic and high-intensity intermittent Olympic sport, which requires complex technical and tactical skills and puts high physiological, neuromuscular and power demands on athletes (Kons, Da Silva, Fischer, & Detanico, 2018). As elite judokas have to perform a great number of actions during

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each match, the physical performance of a single match is high (Eken, Özkol, & Varol, 2020). The most recent changes in competition rules demand higher standards of judokas' distinct physical fitness level: high-speed and muscle-strength level (Osipov, Kudryavtsev, Iermakov, & Jagiello, 2018). Judo training involves multiple repetitions of rapid movements, short maximal muscle contractions, usually with heavy external loads, and frequent training bouts with a partner. This type of training is associated with a significantly increased risk of injuries and overloads of the lumbar spine (Ahmetov et al., 2017). Vertebral disc prolapses were the most severe injuries concerning time loss and sporting performance reduction in judo (Akoto et al., 2018). Sakai, Sairyo, Suzue, Kosaka, and Yasui (2010) indicate that Japanese judo athletes were prone to suffer lumbar spondylolysis, at an incidence of about 20%.

Spondylolysis and spondylosis is a common cause of LBP in professional athletes. It remains unclear whether professional athletes with spondylolysis who undergo surgical repair are able to return to sports as effectively or faster than if they had conservative treatment (Scheepers, Streak Gomersall, & Munn, 2015). Reiman, Sylvain, Loudon, & Goode (2016) indicate that comparing surgical versus conservative treatment found no significant difference between athletes regarding return to sport. Surgical interventions have been recommended for athletes who have had persistent LBP for more than six months with no relief from rest and bracing (Lawrence, Elser, & Stromberg, 2016). It is known that the recovery period of athletes after some surgical interventions (lumbar discectomy) ranged from 2 to 8 months (Nair, Kahlenberg, and Hsu, 2015).

Yamaguchi and Hsu (2019) indicate that more robust and objective research on operative and non-operative treatment modalities for elite athletes with LBP and LDH are needed. Experts' point out two operative treatment modalities athletes with LDH: spinal fusion (Fusion) and total resection of the lumbar disk (TDR) with the installation of the functional endoprosthesis (Botov, Shnyakin, Osipov, & Zhavner, 2018). Scheepers et al. (2015) indicate that the limited evidence on the effectiveness of surgical treatment versus conservative treatment for spondylolysis in professional athletes does not allow any conclusions to be drawn about the relative effectiveness of surgery versus conservative treatment for facilitating a rapid return to sport or a high level of post-injury sporting level/performance. Further research is required to compare conservative therapy to surgical therapy and to compare the various surgical techniques to each other (Tawfik, Phan, Mobbs, & Rao, 2020).

Unfortunately, the literature review does not provide robust and complete data on effective treatment modalities providing a quick return to sport of elite judokas with spondylolysis, spondylosis, and LDH. The purpose of the research is to search for objective data on the period return to sport of elite male judokas with LDH various surgical treatment modalities.

Methods

The elite male athletes (n=8) practising judo for 9–12 years. The average age of judokas was 25.22±2.49 year. All judokas had complaints of LBP and lower limb pain. All judokas went to the clinic complaining of continuing and increasing LBP and lower limbs pain after non-effective conservative therapy lasting from 4 to 8 weeks. All athletes were diagnosed with dorsopathy with painful radicular syndrome of the disc herniation and a decrease in the height of the L5-S1 disc. All judokas were recommended surgical intervention: LDH removal (L5-S1). All athletes gave voluntary informed consent to participate in research. The research was approved by the local ethics expert committee of the Institute of Physical Culture, Sports and Tourism (Siberian Federal University) and local ethics expert committee of the Voyno-Yasenetsky Krasnoyarsk State Medical University.

The research was conducted in the neurosurgical department of the regional clinical hospital (Krasnoyarsk), Voyno-Yasenetsky Krasnoyarsk State Medical University and Sports wrestling, academy named D.G. Mindiashvili (Krasnoyarsk). The overall research period was four years (2015–2018). All judokas underwent surgery: LDH removal (L5-S1) during 2015-2017. Participants were divided into two groups. Group 1 (n=4) underwent surgical intervention with total resection of the intervertebral disc at the level of the lumbar spine (TDR) with decompression of the dural sac and the subsequent installation of the functional endoprosthesis (M6-L Artificial Lumbar Disc). Group 2 (n=4) underwent surgical intervention with spinal fusion (Fusion) with transpedicular screws after LDH removal (L5-S1). The overall rehabilitation period for athletes was three months after surgery. All athletes used daily physical exercise sets (30 minutes per day) and electro-neuromyostimulation in the lower back (20–30 minutes per day). The daily physical rehabilitation course included a light weight-training programme, avoiding exercises that inappropriately load the lumbar spine. Phase I (5–7 days after surgery): warm-up (10 min); extension the knee while lying supine with the spine in a neutral position and the hip flexed to a 90° angle (2 sets of 20–30 reps); abdominal bracing (25–30 reps); hip flexors stretching (20–30 reps). Phase II (2 weeks after surgery): warm-up (10 min); hip hinge drill (2 sets of 20–30 reps); superman (2 sets of 20–30 reps); wall squats and sit to stand (30–40 reps); half lunges (30–40 reps). Phase III (4 weeks after surgery): warm-up (10 min); bridging and heel lifts (2 sets of 20–30 reps); lateral pulls with light weights (3.5–5.5 kg; 3 sets of 20–30 reps); hip hinge drill (3 sets of 20–30 reps); seated upright rowing machine (2–3 min). The electro-neuromyostimulation course consisted of electroneuromyostimulation to the area of low back muscles tow times a day (each session took 10–15 minutes). The neuromuscular stimulation device "Mercury" (Russia) was used during the athletes' rehabilitation. Electro-neuromyostimulation characteristics of device: pulse frequency 50 Hz, pulse duration 350 μs, synchronous waveform. All judokas began sport training after a rehabilitation period.

To assess participants' pain syndrome magnitude, the Visual Analogue Scale (VAS) was used. Assessment of participants' quality of life to the Russian Oswestry Disability Index (RODI) was carried. The magnetic resonance tomographies (MRI) of the lumbar spine were also performed in the research period: after surgery, as well as three, six, and nine months in the research period. Athletes' personal diary data to estimate the period of return to sport were used. The personal special fitness performance level of judokas using a special test (60 Ippon-seoi-nage; throws two partners in rapid succession) was determined.

Statistical programme SPSS17 was used for statistical processing and analysis of the research results. The Pearson test ($\chi 2$) and Mann-Whitney U-test to compare the research results were used.

Results

No significant differences in VAS and RODI indicators between athletes groups before surgery were found. MRI data of all judokas did not reveal the appearance of new pathologies during the research period. Significant differences in VAS and RODI athletes' indicators in the rehabilitation period (3 months after surgery) were not found. Significant differences in VAS and RODI indicators of judokas groups were found six months after surgery. Group 1 VAS and RODI indicators were significantly ($p<0.01$) lower. A similar trend in a later research period (9 months after surgery) was revealed. The VAS and RODI indicators of Group 1 were significantly ($p<0.01$) different from the indicators of group 2.

Training time indicators (minutes per day) for judokas of both groups did not have significant differences after the end of the rehabilitation period (3 months after surgery). In the next research period (6 months after surgery), significant differences in the indicators of daily training time were revealed. It was found that the daily training time of Group 1 was significantly ($p<0.01$) longer than that of Group 2. A similar trend in the next research period (9 months after surgery) was revealed. Group 1 judokas had almost 18.85±1.07 minutes more daily training time.

The performance of both athletes groups in performing a special test (60 Ippon-seoi-nage) did not differ significantly three and six months after surgery. A special test revealed a significant ($p<0.01$) advantage of Group 1 judokas nine months after surgical intervention. The positive dynamics of testing, reducing execution time in both athlete groups during the period of the research, was revealed. Complete data of the research are presented in Table 1.

Table 1. The overall data of the research

	Research period			
Athletes (n=8)	**Before surgery**	**3 months**	**6 months**	**9 months**
		VAS		
Group 1 (TDR)	8.47±2.34	4.69±2.18	3.43±1.54*	2.73±1.19*
Group 2 (Fusion)	8.51±2.41	4.83±2.27	5.26±1.12	4.87±1.46
		RODI		
Group 1 (TDR)	56.22±7.46	18.76±4.39	10.34±3.07*	6.42±2.15*
Group 2 (Fusion)	58.18±6.73	19.52±5.21	13.58±4.25	10.79±3.46
		Daily training time (minutes per day)		
Group 1 (TDR)	-	47.09±11.42	119.46±14.15*	174.24±17.32*
Group 2 (Fusion)	-	45.51±9.34	104.33±18.41	155.39±16.25
		60 Ippon-seoi-nage (minutes)		
Group 1 (TDR)	-	2.45±0.21	2.29±0.26	2.11±0.09*
Group 2 (Fusion)	-	2.47±0.15	2.32±0.22	2.29±0.15

Legend: * (reliability of results differences) – $p<0.01$.

Discussion

There is a lack of useful data on the prevalence and mechanism of LBP in some popular sports. Researchers need to recruit a large sample population of the athletes for the standard and acceptable definitions for LBP treatment (Farahbakhsh et al., 2018). However, experts note that carrying out such studies is associated with significant difficulties. Botov et al. (2018) point out that surgery (TDR) is estimated to cost the equivalent of USD 6,000-7,000 and surgery (Fusion) is estimated at USD 2,000-3,000 in the Russian Federation. Lack of money has a significant impact on the number of cases of certain surgical treatments for athletes. Difficulties finding similar participants of the research also exist. It took us about four years to select eight similar male judokas and conduct a complete research study. It should be recognized that the conduct of such studies will face the problem of recruiting a sufficient number of similar participants.

Nair et al. (2015) point out that the recovery period after lumbar discectomy ranged from two to eight months. Our research shows that the full recovery period of judokas lasts nine months and more. The recovery period for athletes was found to be related to the surgical treatment modality. Group 1 (TDR) show higher recovery indicators nine months after surgical treatment. Not all judokas forced themselves to return to competition. Perhaps a longer recovery period for athletes is associated with medical advice.

Akoto et al. (2018) indicate that about 30% of judokas with vertebral disk injuries after return to sport had strongly reduced of sporting performance or stopped judo. Studies of the Russian male judokas' superior performance fitness level show that the average time for completion of the special test (60 Ippon-seoi-nage) is about 2.15–2.20 minutes (Osipov et al., 2018). It was revealed that Group 1 athletes exceeded this indicator nine months after surgical intervention. Judokas (Fusion) showed lower indicators on the special performance test (60 Ippon-seoi-nage) nine months after surgery. These results allow us to conclude that the end of the rehabilitation period and full return to sport occurred with the Group 1 athletes (TDR).

The scientific literature provides some data on the number of athletes who successfully returned to sport after surgical treatment (TDR or Fusion). Botov et al. (2018) indicate that the higher percentage of athletes' number successfully returned to sport after TDR. Athletes (Fusion) had pain complaints and sport performance problems. Some athletes (Fusion) were not able to successfully return to sports and ended their sports career. Experts believe that the increased LBP during training loads in athletes (Fusion) is associated with an increased load

on the intervertebral discs and degenerative changes (the appearance of lumbar disc protrusions and degenerative changes in facet joints) at adjacent levels of the spine. Experts attribute the lack of significant LBP in athletes (TDR) to quality endoprosthesis. The presence of an endoprosthesis can significantly reduce the load on adjacent intervertebral discs (Botov et al., 2018). However, most of the athletes studied were not involved in martial arts. Our research revealed a similar tendency for higher back pain syndromes among judokas in six and nine months after surgery (Fusion). The daily training time for athletes (Fusion) was also significantly ($p<0.01$) lower than that of athletes (TDR). However, complaints of severe back pain and the inability to continue sport training were not received. Possibly a longer research period and a greater number of participants are required to obtain robust and objective data.

More objective and robust research on alternative treatment modalities is needed for athletes with LBP and LDH (Yamaguchi & Hsu, 2019). The limited evidence on the effectiveness of surgical treatment does not allow any conclusions to be drawn about the relative effectiveness of surgery for facilitating a rapid return to sport or athletes' performance level post-treatment (Scheepers et al., 2015). The objective data on the recovery period duration and return to sport of judokas after various LDH removal surgical treatments are presented in our study. We found that Group 1 (TDR) showed much better recovery rates, as reflected in VAS, RODI, and daily training time, six months after surgery. A similar trend nine months after surgery was determined. The small number of participants does not allow making a general conclusion about a higher level of effectiveness of surgical treatment (TDR) of male judokas with LDH. However, it was found that male judokas (TDR) have fewer pain symptoms and have more daily training time in practice during the period of returning to sport in comparison judokas (Fusion).

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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