The Michel Benoist and Robert Mulholland Yearly European Spine Journal Review: a survey of the “medical” articles in the European Spine Journal, 2013

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of peripheral sensitization, which can cause persistent low-back pain of peripheral origin. Second, the most important psychosocial factors involved in chronicity have been identified, and questionnaires have been developed, which aim at detecting these factors for initial stratified treatment. Third and importantly, brain imaging techniques such as functional MRIs have revealed interesting insights into morphological and functional changes in chronic pain conditions. Readers will find in this review papers reflecting these advances. Finally, I have included in my review a few “surgical” papers, which bring important information to medical specialists.

Introduction

In the 2013 volume of the *European Spine Journal* there are fewer so-called “medical” papers than usual, contrasting with the abundance of clinical and research articles devoted to scoliosis and deformities. However, I have found a few important studies which, in line with other recent publications, have improved our knowledge of “non-specific low-back pain”, which until recently was a rather ill-defined concept. Progress has been made in the clarification of the neural mechanisms leading to chronicity, thus restricting the field of “absence of specificity” of common low-back pain. First, recent research on the significance of modic changes has clarified the neural mechanisms of peripheral sensitization in low-back pain. Active, fast-progressing modic 1 discopathy is the clinical scenario

Surgical interventions for low-back disorders

The systematic review by Jacobs et al. [15] published in September aims to evaluate the scientific evidence of the efficacy of four surgical interventions: disc herniation, spondylolisthesis, stenosis and degenerative disc disease. The originality of this fine piece of work is that the search for evidence is based on reviewing published systematic reviews. It is now recognized that systematic reviews and meta-analyses are the best source of evidence. However, as emphasized by the authors, the quality of these reviews varies and results may be biased. The authors of the present review followed stringent selection criteria. The risk of bias was carefully assessed, using the amstar tool, which is presented in a separate table. Thirteen reviews are included of which nine were of high quality. Results, which could be provided by the review, are summarized as follows: for the treatment of spinal stenosis, intervertebral process devices showed more favorable results than conservative care; for degenerative spondylolisthesis, fusion showed more favorable results than decompression, and fusion rate

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avored instrumented over non-instrumented fusion. The authors conclude that although the quality of the reviews was acceptable, the quality of the studies included was poor. The authors make useful recommendations for future research.

Outcome of spine surgery and psychological factors

Two papers analyzing the predictive value of psychological factors on the outcome of spine surgery were published in the December issue.

The article by Havakeshian and Mannion [12] investigates the predictive value of cognitive and behavioral factors, more precisely catastrophising and fear-avoidance beliefs, on the 12-month outcome of decompressive surgery for spinal stenosis or disc herniation. A second objective of the study was to examine the evolution of psychological factors before and at 12 months after surgery. Questionnaires were sent to 148 participants. The various questionnaires inquired about the following variables: social-demographic and medical history characteristics, LBP-related disability, pain characteristics, psychological disturbances, fear-avoidance beliefs and catastrophising. Twelve months after surgery a global outcome was evaluated and divided into good and poor responses. The main finding of the study was that fear-avoidance beliefs at baseline was the only statistically significant predictive psychological factor. Consequently, the authors suggest that fear-avoidance beliefs should be identified and treated before surgery. The other psychological factors improved at 12 months post-operatively in patients with a good global outcome and worsened in those with a poor outcome. Rather than being a risk factor, they appear to be a consequence of a long-lasting pain relieved after surgery.

The study by McGregor et al. [19] published in the December issue explores patients' expectations compared with satisfaction of outcome in two common spinal interventions: discectomy for disc herniation and decompression for stenosis. Three hundred and eight patients were included in the study. They were randomized in 91 patients to receive post-operative rehabilitation and a booklet; 86 to receive rehabilitation only; 70 to receive the booklet only; and 91 to receive normal care. Outcome measures included a 100-mm VAS to record back and leg pain, and EQ5D to assess overall health state. Specific assessments of expectation and satisfaction are outlined in detail by the authors who recognize, however, that this approach has not been validated. The main finding of this study points to a clear discrepancy of outcome at 6 and 12 months after surgery, with expectations exceeding achievement. However, satisfaction remained high inspite of this discrepancy,

discectomy patients being more satisfied than decompression patients. Patients receiving post-operative rehabilitation had a better level of satisfaction than those receiving usual care. The article provides a comprehensive literature review and discussion of this important psychological aspect.

Surgery versus conservative care for neck pain

The paper by van Middelkoop et al. [20] published in January is a high-quality Cochrane systematic review investigating clinical trials on surgical treatment compared with conservative care in neck pain patients. A former Cochrane review based only on randomized trials had concluded that in the absence of pertinent data no conclusion could be provided on this subject. Owing to the present difficulty to perform randomized controlled trials (RCTs), the authors of the present study also included controlled clinical trials (CCTs). The methodology and the strategy was that outlined by the Cochrane back review group. The GRADE rating was used to assess the quality of evidence. The trials included in this systematic review had to evaluate adults with neck pain with or without radiculopathy or myelopathy, to provide relevant primary outcome measures and to include treatments on both surgical and conservative care. In total, 787 patients are included in nine trials: 3 RCTs and 6 CCTs comparing surgery with conservative care. In spite of a perfect methodology, results of this scientific review presented in detail are disappointing. Briefly, there was only one study with a low risk of bias, showing a low quality of evidence that plasma decompression/nucleoplasty was superior to conservative care. All the other studies were of high risk of bias, leading the authors to conclude that "There is insufficient literature available to draw a firm conclusion on the effectiveness of surgery compared to conservative care in neck pain patients". The paper contains a good discussion with methodological considerations.

Anti-TNF treatment of sciatica

Numerous experimental studies have demonstrated the presence in degenerate disc and herniations of cytokines, which are known mediators of the peripheral inflammatory response. TNF alpha applied locally on cauda equina of pigs induces allodynia and morphologic changes that mimic human radiculopathy [5]. It was then suggested that anti-TNF drugs could be administered to patients with sciatica of discal origin. The initial studies performed with a small number of patients were rather positive, but with some contradictory differences. The paper by Williams

et al. [30] is an excellent systematic review of biological treatments targeting tumor necrosis factor for sciatica. Nine studies, RCTs and non-RCTs, were included in the review: seven compared the anti-TNF agent with placebo and two with alternative interventions. With an excellent methodology, the authors analyzed the outcome on several parameters: global effect, leg-pain intensity, ODI, need for surgery and return to work. The main findings are summarized as follows: meta-analyses found moderate and statistically significant improvements at medium term in global effects, leg-pain intensity and ODI but only when all studies, RCTs and non-RCTs, were included. When non-randomized studies were excluded, results were no longer significant. There was a non-statically significant reduction in the need for surgery. Overall, the authors conclude that there is sufficient evidence to recommend larger RCTs to clarify the present insufficient evidence.

IL1 and IL6 cytokines in discal herniations with sciatica

The study by Andrade et al. [4] published in April is particularly interesting as it examines the role of IL1 and IL6 in sciatica. Briefly, IL1 and IL6 expressions were assessed by qPCR and western blot in biopsies performed during surgery in muscles and discal tissues (AF and NP) in patients operated for discal herniation and in controls (scoliosis). Levels of IL1 and IL6 expression were then correlated with the degree of pre- and post-operative pain levels evaluated in VAS. Results show that compared with controls, discal tissues of LDH patients express proinflammatory cytokines IL1 and IL6. However, the amount of cytokines was not correlated with the leg pain. The paper provides an interesting discussion on the pathophysiology of sciatica.

Paresthesia and weakness in disc-related sciatica

The paper by Grovle et al. [11] included in the November issue deals with the prognosis of paresthesia (tingling and numbness) and weakness compared with that of sciatic pain. This is an observational cohort study comprising 380 patients with sciatica related to a lumbar disc herniation. Patients were prospectively followed for 2 years. During this period, 121 patients underwent surgery. The bothersomeness index was used to evaluate values for paresthesia, weakness and for leg pain. In a previous study, the authors using the same cohort had shown that bothersomeness of weakness was associated with decreased physical functioning and bothersomeness of paresthesia was associated with impaired working, physical functioning and emotional distress. The main finding of the present

study was that paresthesia and weakness improved in accordance to leg pain. However, at 2 years bothersome paresthesia and weakness were still, respectively, reported in 18.2 and 11.5 % of the patients as compared with 16 % of leg pain. Among patients with no leg pain, 6.7 % reported paresthesia and 5.1 % weakness. As paresthesia and weakness clearly affect patients with sciatica, the authors recommend using the bothersomeness index for weakness and paresthesia in addition to the leg pain in the evaluation of sciatica patients.

Long-term clinical outcome of cauda equina syndrome

The review article by Korse et al. [16] published in May is worth reading carefully as this is the first systematic review of the outcome at long-term of the whole spectrum of the functional complications of cauda equina syndrome, including micturition, defecation and sexual functions. An extensive search of the literature provided only 15 studies meeting inclusion criteria. The methodological quality of these studies was assessed using the adjusted version of the checklist of the Dutch Cochrane center. Clinical symptoms at presentation varied according to the studies but showed a high prevalence of micturition and defecation dysfunction. Saddle anesthesia or hypoesthesia was found in 80 % of patients at presentation. Patients had been operated as soon as possible. At a mean minimal follow-up time of 17 months, results were the following: dysfunction of micturition was 42.5 %; defecation and sexual dysfunction were reported in 49 and 44 %, respectively. This high-quality article discloses that the functional disorders of cauda equina syndrome are very frequent at long-term follow-up.

The arm-squeeze test

In the July issue, Gumina et al. [10] describe a new test consisting of squeezing the middle third of the upper arm. The test aims to discriminate the origin of pains localized in the shoulder region. They may originate from shoulder disorders or from nerve root compression in the cervical spine. According to the authors, the anatomic rationale of the test is that in the middle third of the arm the musculocutaneous, radial, ulnar and median nerves are relatively superficial and that squeezing the biceps and triceps areas in the upper arm could elicit a painful reaction. The purpose of the article was to evaluate the diagnostic value of the test. An accurate diagnosis of cervical nerve root compression and of various pathologies of the shoulder joint was established prior to performing the test. A very high number of patients were included in the study.

Positivity of the test was based on a VAS pain scale. The test was positive in 97.6 % of patients with cervical root compression, compared with 3.87, 1.93, 0, 1.81 and 8.33 % of those with rotator cuff tear, capsulitis, acromio-clavicular arthropathy, calcifying tendinitis and arthrosis, respectively. A positive test was obtained in 4 % of healthy control subjects. This test with a high sensitivity and specificity is considered by the authors to be a valuable addition to the already existing differential diagnostic criteria.

Ultrasound-guided cervical periradicular steroid injections

Efficacy of transforaminal steroid injections for inflammatory radiculopathies caused by discal herniation or foraminal stenosis is now admitted. However, these injections are technically challenging and have been associated with rare but serious complications. They need to be guided by an accurate imaging. Currently, fluoroscopy or CT controls are used. The aims of the prospective randomized study by Obernauer et al. [24] published in the November issue was to assess the feasibility and accuracy of a transforaminal approach guided by an ultrasound device. Forty adult patients with middle or lower cervical radiculopathies with appropriate inclusion and exclusion criteria were assigned in two groups, using a computer-generated randomization table. One group underwent an ultrasound-guided procedure, the other a CT-controlled procedure. Both procedures are fully described. Results are particularly interesting. They show that the ultrasound-guided procedure is feasible and as accurate as the CT procedure. In addition, there is a substantial reduction of time and radiation exposure. Also, and very importantly, the use of ultrasound-guided injections minimizes the risk of rare but devastating complications.

Spinal infection

In the December issue, the reader will find a high-quality paper by Duarte and Vaccaro [9] summarizing the state-of-the-art of spinal infection. A management algorithm is provided. This review is based on an appropriate literature, using databases of the US national library and of the National Institutes of Health. The authors first update the epidemiologic data, which is followed by a concise review of the major agents of infection: bacteria, tuberculosis or fungi and parasites. Another chapter discusses the pathophysiology, summarizing the three routes of infection: hematogenous, direct inoculation and spread from contiguous tissues. The main interest of the paper is the proposed

algorithm divided into two clear sections. The first step concerns diagnosis of spinal infection; the second appropriately summarizes the etiological diagnosis and the surgical indications. A substantial part of the paper is an in-depth discussion of conservative and surgical treatments.

Neurological outcome and survival in metastatic spinal cord compression

There is a consensus in the literature that patients with metastatic spinal cord compression should be treated in emergency. The paper by Quraishi et al. [26] in the June issue is particularly informative as it deals with a group of patients with an acute presentation. The objective of the authors is to investigate the best timing of surgery to optimize neurological outcome and survival. One hundred and twenty-one patients with acute presentation were reviewed retrospectively and divided into three groups. Group one patients were operated within 24 h; group two between 24 and 48 h, and group 3 after 48 h. The majority of patients underwent decompression and stabilization surgery. There was no statistical difference between the groups concerning age, gender, revised Takumashi score, level of metastasis and type of tumor. The neurological outcome is studied in detail using the Frankel grade. There was no statistical difference in Frankel grade improvement between group one and two (within 48 h). However, when neurological outcome considered the totality of patients, those operated within 48 h (groups one and two) had a significantly better Frankel grade improvement than those operated after 48 h (group three). There was no difference of survival between the groups (median survival 6 months, mean 21 months).

Modic changes

Two important articles from the Danish group of Albert et al. [1, 2] concern the significance of modic 1 changes in etiology and therapy of chronic low-back pain. Both papers appeared in the April issue of the journal.

In the first article, the authors report that low-grade *Propionic bacterium acnes* bacteria were demonstrated in the discal tissues of a subgroup of LBP patients developing modic 1 changes following surgery for disc herniation [1]. Endplates and subchondral changes were observed at the operated level. Surgery was performed with stringent antiseptic sterile precautions. Detection, culturing and identification of bacteria were performed using adequate protocols. Therefore, a direct per-operative contamination is highly improbable. As *Propionic acnes* is a commensal frequently found in the skin and oral cavity, a

hematogenous route of infection under anaerobic conditions is the preferred mechanism supported by the authors. Sixty-one patients were included in this study. Positive anaerobic cultures of *Propionic acnes* bacteria were disclosed in 43 % of the total. New modic 1 changes developed in 80 % of patients with positive cultures. In contrast, only 44 % of the patients with negative cultures developed modic 1 changes. Active fast-progressing modic 1 discopathy is usually considered to be of mechanical origin. Because of their findings, the authors conclude that in a subgroup of modic 1 low-back pain patients, inflammation could be of microbial origin. Their findings confirm the results of previous studies discussed in the article.

The second paper by Albert et al. [2] deals with the results of an antibiotic treatment in chronic LBP patients with modic type 1 changes occurring after a previous disc herniation. This is a double-blind randomized clinical controlled trial comparing patients treated with an antibiotic (Amoxicillin-clavulanate) for 100 days with a control group treated with a placebo. The two groups were similar at baseline. One hundred and forty-four patients were evaluated after 1 year. The primary outcome measures were lumbar pain and Roland Morris Questionnaire. Results are interesting. The antibiotic group improved in all outcome measures with a statistical significance when compared with the placebo group. The findings of these two papers have led to numerous discussions in the spinal community and many comments in the lay media. I strongly recommend reading the pertinent comments on these papers in the editorial by O'Dowd and Casey [25] who advise further research. In their opinion, at the present time antibiotherapy should only be considered for patients with LBP of at least 6 months' duration, failure of conservative care, symptomatic disc herniation within the previous year and modic type 1 changes at the same level as the disc herniation. The authors of both studies agree with these proposals [3].

Disc endplate imaging

I wish to call the readers' attention to the paper by Moon et al. [21] in the August issue. The authors describe an MRI FLASH pulse sequence able to visualize the morphology and quantify the thickness of the endplate. The study is based on MR Imaging of human cadaveric lumbar segments performed on a 7T MRI scanner with sequence parameters defined by the authors to optimize image contrast between the endplate and the nucleus. A histological study was performed, confirming that the FLASH sequence accurately detected the endplate. In addition, an *in vivo* study was performed in six volunteers, which established the feasibility of the procedure in clinical application.

Brain structural alterations in chronic low-back pain

In the past few years brain functional MRIs have revealed new insights into the morphological and functional changes in chronic pain conditions. In the September issue of the journal, Ivo et al. [14] reported the findings of brain magnetic resonance imaging performed in 14 chronic low-back patients and in controls. Results of the present study are in keeping with the conclusions of previous studies. The total grey matter volume was significantly reduced when compared with controls. Differences were observed according to the brain regions: alterations were found in clusters having a major role in pain modulation and control: thalamus, dorsolateral prefrontal and middle cingulate cortex. Causes and mechanisms of this brain architecture reorganization are still unclear. Psychometric measures performed in the LBP group of patients revealed high depression and anxiety scores, as measured by the Beck depression inventory and the Beck anxiety inventory.

Vertebroplasty

Three interesting articles concerning vertebroplasty were published in the July issue. The paper by Thaler et al. [28] describes a new procedure based on the principles of kyphoplasty and vascular stenting (VBS). The metallic expandable cobalt–chromium stent remains in the cavity created and does not have to be removed. This demanding technique, which is described in detail, aims to prevent the loss of reduction after deflation of the balloon and to reduce the frequency of cement leakage. In their paper the authors compare the results of 27 patients treated with VBS to a group of 29 patients treated with conventional vertebroplasty. Results with a follow-up of only 3 months showed a significantly lower leakage in the VBS group. All cement extravasations were asymptomatic in both groups. Further randomized studies comparing VBS and balloon kyphoplasty assessing effectiveness and cost-effectiveness of this new procedure are clearly needed.

The paper by Nakamae et al. [22], which also appears in the July issue deals with osteoporotic vertebral compression fractures (OVCF) with an intervertebral cleft (IVC) and delayed neurologic deficit (DND). The aim of this study was to clarify the mechanisms of delayed neurologic deficit and evaluate the efficacy of percutaneous vertebroplasty in OVCF with IVC associated with DND. The authors have prospectively followed 244 patients treated by vertebroplasty for OVCF with an IVC. Thirty patients had developed a delayed neurologic deficit and 244 did not. After vertebroplasty 25 of 30 cases with vertebral compression fractures with a cleft and neurologic deficit achieved a clinically meaningful improvement. There was

no change in local kyphotic angle or the percentage of spinal canal compromise. However, patients with a favorable clinical improvement also showed important improvements in intravertebral instability, considered by the authors as the dominant cause of delayed neurologic deficit. The authors conclude that patients with less instability and severe canal compromise should be candidates for reconstructive surgery. However, for those with predominant instability as the cause of DND, injection of PMMA into the IVC with the assistance of a cavitygram could be considered.

The paper by Lin et al. [18], also in the July issue, deals with the difficult problem of osteonecrosis (ON) after vertebral fractures. The purpose of this study was to clarify the radiological diagnostic criteria of vertebral ON, also called Kummel's Disease by the authors. Twenty patients with low-energy injuries, unstable vertebral compression fractures, compromised vertebral canal and failure of conservative treatment were studied retrospectively. All patients underwent preoperatively a radiological evaluation comprising plain radiographs, including dynamic views and MRI. The radiological findings were compared with the histomorphological analysis performed on the specimens retrieved from corpectomy. The purpose of the histopathologic study was to search in the specimens for histological signs of osteonecrosis, defined by the presence of necrotic bone fragments surrounded by a fibrous stroma. Radiologically, all patients had a cleft but the authors distinguish two varieties of clefts: the vacuum phenomenon identified on the radiograph as a gas containing radiolucent shadow, and the fluid containing cleft with a signal intensity on sagittal T2-weighted images. The power of the fluid sign in diagnosing vertebral osteonecrosis, responsible for instability, was better than that of the vacuum phenomenon. There is an interesting discussion concerning Kummel's Disease and the significance of the clefts.

Interspinous spacers

The use of interspinous spacers in the treatment of neurogenic claudication in lumbar spinal stenosis is still a subject of controversy. In the September issue the reader will find an interesting article by Beyer et al. [8] reporting their experience with the aperiuous device. Forty-five patients with neurogenic claudication due to lumbar spinal stenosis were included in this non-randomized observational study. Patients were divided in two groups: group one underwent spacer implantation ($n = 12$) and group two ($n = 33$) an open decompressive surgery. Five patients in group one required implant removal after 1 year because of absence of efficacy. In the six remaining patients, results on back and leg pain as well as on quality of life were poor.

Decompressive surgery yielded superior results at the 24-month follow-up. However, walking distance improved for both groups. The small number of patients is an obvious limitation of this study, which is nevertheless informative, as the discussion is a comprehensive narrative review of interspinous decompressive devices. The overall conclusions and recommendations of the authors are, "Until better data is forthcoming, we recommend interspinous spacer implantation only within randomized controlled trials for the collection of reliable data and conclusions for the spine surgeon".

In the March Supplement there is an interesting article by Hobart et al. [13] concerning indications of interspinous spacers for lumbar foraminal stenosis. The authors point out that foraminal stenosis is a separate entity distinct from lateral recess stenosis for which most of the spacers' clinical trials have been performed with more or less disappointing results. It has been shown that X-Stop implants induce a significant increase of foraminal area on MRI studies. The authors report the encouraging results of a study involving a small number of patients with this uncommon indication. They strongly recommend further large-scale clinical trials of X-Stop with this indication.

Denosumab: a potential treatment option for aneurysmal bone cysts

In the June issue of the journal, Lange et al. [17] report the treatment by denosumab of two patients with cervical spine aneurysmal bone cysts (ABC). Two young boys had undergone a wide surgical resection of a C5 ABC, rapidly followed by recurrent pain and neurological deficit with progression of the tumor on MRI. Because of the vascularization pattern of both tumors on angiography, an effective arterial embolization could not be performed. Denosumab was then discussed as a possible treatment option because of the immunohistochemical similarity of ABC with giant cell tumors (GCT). In both tumors, the giant cells are positive for markers of true osteoclasts. A previous study by Thomas et al. [29] had reported satisfactory results in GCTs treated by denosumab. Denosumab is a human monoclonal antibody to the receptor activator of nuclear factor-kappa B ligand (RANKL) that blocks its binding to RANK, thus inhibiting development and activity of osteoclasts. In spite of scientific evidence, denosumab treatment was successful. Both patients recovered from pain and neurological symptoms. After 4 months both MRIs showed tumor regression. A longer follow-up is evidently necessary. This reviewer hopes very much that the authors will keep the readership of the Journal informed of the forthcoming evolution.

In a Letter to the Editor published in the October issue, H. Namazi [23] introduces a complementary route by which denosumab can heal bone cysts. “Denosumab [...] also increases osteoblasto-genesis via inhibition of DKK1, which is antagonist of WNT/beta-catenin pathway”. As reported by Namazi, this important mechanism should also be kept in mind for denosumab treatment of bone cyst.

CT morphology of the normal adult coccyx

Coccydynia is a relatively frequent syndrome of the coccygeal region. The abnormal instability found in inter-coccygeal and sacro-coccygeal joints, most often of traumatic origin, is considered to be the main cause of the painful syndrome, sometimes related to local bone or soft tissue pathology. Interpreting local abnormalities requires an appropriate knowledge of the normality. There is a paucity of data on this subject. The paper by Woon et al. [31] in the April issue aims to investigate normal adult sacro-coccygeal morphology. The study is based on analyzing retrospectively 112 adult CT scans of normal adult coccyx. Numerous qualitative and quantitative parameters are evaluated and correlated versus gender, age and BMI. Results are analyzed in detail and can serve as a reference when dealing with pathology.

Leg length inequality and altered spinal posture

The paper by Betsch et al. [6] published in June reports on using rasterstereography to determine the amount of leg length inequality that alters spinal posture. In a previous study [7] the authors simulated various differences up to 15 mm. They detected changes of the pelvic position but were unable to find any significant changes in the spinal posture. In the present study, the authors examined 100 healthy volunteers (53 females, 47 males) with a mean age of 34. Subjects were placed standing on a simulation platform, the height of which was accurately controlled by the device. For length inequality over 20 mm, additional precisely measured wooden blocks were placed under the foot. Spinal posture and pelvic position were measured with the rasterstereography system described in the article. The main finding of the paper was that an inequality of more than 20 mm was necessary to observe postural changes in the spine on healthy test subjects. Changes were found only in frontal and not in sagittal parameters. There was only a tendency to decrease the kyphotic angle. Males and females reacted in the same way as to leg length inequality. This is an interesting paper with clinical relevance.

Pain from donor site after anterior cervical fusion with bone graft

The paper by Skeppholm et al. [27] published in the January issue deals with the local pain and complications following harvesting bone graft from the iliac crest after anterior cervical fusion. This is a randomized prospective study comparing two different methods of reconstruction after anterior-cervical surgery. One group (BG group, $n = 45$) was operated using bone graft from the iliac crest; the other group (NBG group, $n = 62$) underwent a total disc replacement. All patients were evaluated preoperatively and postoperatively at 4 weeks, 3 and 12 months. Pain at donor site was evaluated with a VAS, and HRQOL with EQ-5D. In the BG group, 15 of the 45 patients had a VAS pain scoring of 40 mm or more at 4 weeks and only 5 of them at 3 months and 1 year. On the VAS levels, a statistically significant difference was found at all times of follow-up in the BG group as compared with the non-BG group. However, a significant pain was observed in the BG group only within the first 3 months after surgery. Moreover, no significant difference in EQ-5D was found between the two groups, indicating that harvesting a bone graft has a limited effect on quality of life. Two patients in the BG group had a superficial wound infection and five had a sensory disturbance in the area of the donor site. The conclusion of the authors is that the pain at donor site does not seem to affect the quality of life at 4 weeks postoperatively and onward.

Conflict of interest None.

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