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The Michel Benoist and Robert Mulholland yearly European Spine Journal Review

A survey of the “medical” articles in the European Spine Journal, 2004

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Introduction

The editors of the European Spine Journal invited Robert Mulholland and me to comment on the papers published during 2004 in the European Spine Journal. I was asked to review the “medical” articles; that is to say, the category of articles which primarily interest non-surgical specialists, such as neurologists, rheumatologists, radiologists specialists in physical, sports or rehabilitation medicine, as well as basic scientists, and prevention or methodology specialists. At the same time, the term “medical” may also describe “the art of medicine in general”, meaning that the non-surgical papers may also be of interest to surgeons.

Over 100 articles and reviews were published in the European Spine Journal in 2004. The majority of the papers are surgically oriented and include technical

innovation or notes, spine surgery techniques, as well as results of surgically treated series. However, a substantial part of the articles are medically oriented, and are the subject of this review.

The difficulty was to choose papers of this category to be reviewed. By definition, all papers published in the European Spine Journal have been criticised and evaluated by competent reviewers before publication. All of them are of excellent quality. Therefore the choice of the articles to be further reviewed was not because these were deemed to be the best, but rather because in addition to their excellence they could contribute to bringing new information, provoking an active discussion and furthering research. The purpose of this presentation is to cast a critical look at this series of articles, which I have grouped under various headings when possible.

Basics

Very few biological basic papers were published in the Journal in 2004. Two, however, appeared in the December issue.

The article by Bibby and Urban [4] is particularly interesting as it summarizes all the factors regulating the biology of the discal cell responsible for the production of the matrix proteins, as well as of the proteases and their inhibitors. These factors include influence of genes, mechanical constraints, cytokines, and growth factors. The importance of an adequate nutrient supply to the cell is emphasised here. The study demonstrates that cell viability decreases if the medium is acidic with low glucose and oxygen concentrations. In the clinical setting, the authors evoke the factors limiting the blood supply to the disc, such as smoking, atherosclerosis of the lumbar arteries, or loss of permeability of the endplate—all factors contributing to disc degeneration.

Basic studies of the biology of the discal cell are of utmost importance. They clearly indicate that degeneration of the disc is related to the inability of the cells to produce a normal matrix. Moreover, the rationale of the ongoing experimental studies on discal regeneration is based on administration of therapeutic molecules delivered to the cells with an expected ensuing augmentation of the production of matrix proteins. Biological therapy of discal degeneration is still in infancy but is an exciting field of future research.

Arai et al. [1] have assessed on dogs the nucleus pulposus-induced effects on nerve root function and shown that Indomethacin could block these effects. Since the original paper by Olmarker et al. [13], showing that simple application of autologous nucleus pulposus on nerve roots of pigs induces reduction of conduction velocity and nerve fiber degeneration, subsequent studies have confirmed that inflammatory mechanisms are involved in the functional and histologic changes of the nerve roots. It has also been shown that the biological effect of nucleus pulposus was related to the disc cell population. Moreover, experimental studies have indicated that nucleus pulposus could also cause pain sensation probably involving cytokines, and more precisely TNF alpha.

The present study is another demonstration of the relevance of inflammatory mechanisms in the physiopathology of nerve root injury and sciatica. As in previous studies, disc incision induced a reduction in nerve root and dorsal ganglion blood flow as well as in nerve root function measured by nerve conduction velocity. As formulated in the conclusion, this well performed experimental paper calls for continued research in the inflammatory reaction, how it is initiated, and what differentiates it from its resorption in the spinal canal.

Whiplash-associated disorders

Most patients with acute whiplash recover within a few weeks to a few months with an appropriate treatment. However, pain and disability may persist after 1 or 2 years in 15–40% of patients. Most data in the literature indicate that the late whiplash syndrome is a combination of organic lesions created by a severe injury and of secondary psychological factors. Four interesting papers have been published on this topic.

In the August issue, Seferiadis et al. [17] published a systematic review of treatment interventions in whiplash-associated disorders. They analysed the evidence-basis of the commonly used treatments both in acute and chronic phase. The literature search of this paper and the selection for the quality assessment of studies are appropriate. Quality assessment of studies is based on three validated scales. Best synthesis evidence is conducted according to the rating system utilized by the Cochrane Collaboration Back Group. Twenty-six RCTs are analyzed and scored. According to this scientific support, the authors recommend early physical activity in acute WAD, zygoapophyseal radiofrequency neurotomy, cognitive intervention, physical therapy, and exercises in chronic WAD.

In the same issue of the Journal, Pettersson et al. [14] have tested the temperament and character of whiplash patients in the acute phase and 2 years later. Data are compared with an age- and gender-matched control group. Results of this study indicate that, according to the Temperament and Character Inventory utilised for testing, whiplash patients do not differ in personality traits from normal controls, and are normally developed in character. Moreover, a small proportion of the 40 whiplash patients studied had persisting symptoms, without any changes on the personality testing. The conclusion of this study was that chronic whiplash-associated disorder is not related to pre-existing personality traits. This is in keeping with previous studies indicating that psychological factors are a secondary phenomenon and reactive to the injury.

Another useful article related to whiplash injury was published in the November issue. This paper by Lancaster et al. [9] compares three different outcome measures in 277 whiplash patients examined for medico-legal reporting. The three scoring systems were: (1) the neck disability index (NDI) derived from the Oswestry low-back pain disability questionnaire, (2) a general health questionnaire (GHQ), self-administered to detect psychiatric disorders; (3) the Gargan and Bannister classification questionnaire (GBG), which is based on the severity of symptoms. Interestingly, there was a significant association between the two physical outcomes (NDI and GBG) and also between the two physical questionnaires and the psychological outcome scale. The

authors review the various accepted classification systems of non-specific degenerative neck pain, as well as of whiplash-associated disorders. Considering the overlap existing between assessment systems, even those concentrating on physical or psychological symptoms, the authors propose a simple self-administered questionnaire concentrating on physical symptoms and their effect on psychological status, work and leisure activities.

An article from Finland by Miettinen et al. [11] reported on the impact of whiplash injury in the long term. A total of 144 injured individuals were recruited from traffic accidents in Finland in 1998. Relevant personal and medical data were sent by the insurance company after consent by the injured persons. This mode of recruitment obviously introduced a bias, as only a small proportion of all neck injuries in Finland in the same year could be studied. However the majority of those responding (79%) could be evaluated prospectively and could be assessed at 3-year follow-up. Patients were classified according to the clinical classification of whiplash-associated disorders of the Quebec Task Force, most of them belonging to group 1 or 2. Three years after the whiplash accident, 11.8% of the injured subjects reported persisting symptoms, mainly neck pain, and considered that the injury deteriorated their health, compared with before the accident. At 3-year follow-up, there was a significant correlation between the severity of the injury according to the whiplash-associated disorder classification and the perceived change in health. The results of this study are in keeping with those of previous studies, demonstrating that in the long term a varied proportion of injured individuals are on prolonged sick leave and still use health services.

Taken together, these four papers complete our knowledge in whiplash-associated disorders. Firstly, the Finnish paper confirms that only a minority of patients are disabled by chronic pain. Secondly, based on scientific evidence, the authors of the review article recommend radio-frequency neurotomy of the zygoapophyseal joints, which can provide complete relief of pain in well-selected patients on the condition of an accurate technique. These results indicate that persisting neck pain after whiplash injury may be related to organic lesions induced by the severity of the initial injury, as suggested by the Finnish paper.

The article by Pettersson et al. [14] reinforces the already well-demonstrated notion that psychological disorders frequently observed in chronic whiplash are secondary to the injury, as it often happens in chronic pain disorders. This is in keeping with the therapeutic recommendations of the systematic review: early physical activity and mobilization in the acute phase, and physical therapy with cognitive intervention in chronic patients as well, as an early legal settlement.

Prevention

The article by Cardon and Balague [6], published in the December issue, is an interesting literature-update search in the scientific published literature of relevant intervention studies for low-back pain prevention in school children. Moreover, a search for modifiable risk factors for low-back pain in individuals under 18 years and not seeking treatment was included. Interestingly, the search was performed under the auspices of the European Commission within the scope of "Cost Action B13", focusing on the development of European guidelines for diagnosis, treatment and prevention of low-back pain. This is a good example of a European collaboration programme, establishing networks of researchers across Europe. The authors correctly anticipated the probable lack of scientific evidence in the papers published in this domain and consequently conducted an open-based literature search rather than a classical systematic review. A total of 49 relevant studies were included in this review. Five of them are intervention studies; 44 concern risk factors. An overview of each study includes type of article, description of intervention, specific outcomes and main conclusions. In the five intervention educational studies, large differences between the programmes make comparison difficult. In addition, and for methodological reasons, the studies' conclusions are limited and must be interpreted with caution. Therefore the authors conclude that although promising, the results of these studies cannot be generalised or provide robust guidelines. Analysis of the modifiable risk factors is divided into ten topics: body mass index, mobility and flexibility of muscles and joints, muscular strength, sports participation, physical activity, backpack-related factors, sitting posture and sedentary activity, working during off-school hours, psycho-social factors, smoking, and other factors. As pointed out by the authors of the review, most studies are cross-sectional, and for that reason it is difficult to differentiate etiology from prognostic factors. Results and conclusions are controversial for most risk factors analysed and as a result there is no present evidence that modifying these factors will have a preventive action. However there is one exception: psycho-social factors are, as in the adult population, mainly associated with back pain reports in children.

In their conclusions, the authors of the review formulate a few recommendations: further longitudinal studies are needed to evaluate the effects of preventive programmes in children, taking into account risk factor modification, as well as their preventive action in adulthood; they also emphasize the importance of avoiding medicalisation of back pain in school children.

In the July issue, Prista et al. [16] analysed a cross-sectional survey of children aged 11–16 years, attending the intermediate schools of the Maputo district in

Mozambique. Prevalence of low-back pain was evaluated in 204 children, and studied according to three residence zones: urban, suburban and rural. Other independent variables included age [11–16], sex, usual activity, time spent watching TV, and time spent walking to and from school. For statistical analysis, children were considered to have low-back pain if, in a validated self-questionnaire translated into Portuguese, they reported having had several episodes of low-back pain which interfered with their usual activities. Several episodes of low-back pain during the previous year were reported by 13.5% of the 204 children. Among the statistically analysed variables, living in the urban centre, compared with the peripheral regions, was associated with an increased prevalence of low-back pain; age 13–14 and walking more than 30 min to and from school every day were also associated with back pain. Although cross-sectional, this study generates the hypothesis that socio-cultural and environmental factors may modulate prevalence of low-back pain. Children living in the urban centre were less active than the subjects living in the rural region, who spend more time in physical activities and heavy tasks. It is suggested by the authors that in the urban centre access to medicine, legal and insurance systems similar to factors found in Western industrialised countries lead to an increase of reported back pain. This is one more good example of the importance of psycho-social and environmental factors in the development of low-back pain. Results of this study are important to take account in prevention of low-back pain in school children.

Imaging

In the July issue, Fagan et al. [7] reported an elegantly performed imaging study designed to determine the radiological features enabling the differentiation in the face of an os odontoideum between a traumatic or congenital etiology. X-ray and CT examinations were performed in 18 cases of os odontoideum. Only one subject had a history of trauma. Measurements on CT included the arch/peg ratio to be used as an indicator of anterior arch hypertrophy. The jigsaw sign was defined as an abnormality of the atlanto-dens joint thickness and configuration. A narrowed cartilage space and ankylosed or inter-digitating joint space defined the jigsaw sign. Control data were obtained from 75 patients who underwent CT of the sinuses. A significant arch/peg ratio was disclosed and a positive jigsaw sign was detected in 75% of the 18 cases studied. Association of these two radiological features constitutes specific and sensitive criteria for a congenital abnormality. Data obtained from this study are particularly important to keep in mind when examining subjects after a high-velocity neck trauma.

Five typical cases of conjoined nerve roots are presented by Böttcher et al. [5] in the March issue of the Journal. Clinical presentation of the five patients is described. Only one of them was operated on by decompressive laminectomy; the four other patients were conservatively treated. A review of the literature is performed. Clinical aspects include low-back and radicular pain even without an additional compressive factor, such as stenosis or disc herniation. Pre-operative diagnosis is, therefore, crucial to avoid unnecessary surgical interventions. An interesting discussion concerns the reliable diagnostic methods. The authors recall that CT is now often the first method for evaluation of radicular pain, due to suspected disc herniation, and discuss the imaging CT features enabling the conjoined roots to be differentiated from discal tissue. In their evaluation, the authors state that MRI is the gold standard for diagnosing conjoined lumbo-sacral nerve roots. Coronal T2-weighted image is able to demonstrate the nerve anomalies with a sensitivity equal to that of myelography.

Many studies have shown the importance of early diagnosis in acute spondylolysis. It is assumed that bone scintigraphy is able to detect recent lesions, not yet detectable on plain X-rays. In the October issue of the Journal, Gregory et al. [8] presented a study exploring the value of combining single photon emission computerised tomography (SPECT) and computerised tomography in the investigation of spondylolysis. One hundred and eighteen patients, with low-back pain aged 8–44 years have been studied. SPECT was positive in 80 patients. However spondylolysis was identified on CT in only 53 patients. In the case of a positive SPECT and a negative CT, the authors recommend rest to prevent a stress fracture. The majority of patients without increased activity on SPECT had no morphological changes of the pars, and further investigations are needed to find out the cause of low-back pain. Bone scintigraphy appears to be the most sensitive tool to detect spondylolysis. Based on the data obtained in their study, the authors conclude that SPECT should be the first line investigation for this condition.

Stenosis

In the February issue, Arinzon et al. [2] discuss the outcomes of surgery for lumbar stenosis in diabetic patients. Diabetes is a frequent disease in the elderly and, as the population ages, lumbar spinal stenosis is encountered more and more in individuals over 65 years. Coexistence of the two morbidities is, therefore, not exceptional. In case of failure of conservative treatment, decompressive surgery may be considered. The questions are: (1) does the coexistence of diabetes reduce the rate of success of surgery, and (2) is the risk of complications higher than in a non-diabetic population? Previous studies

have come to different conclusions and answers to these questions remain controversial. For this reason, this well-designed retrospective study is worthwhile, as it presents new and pertinent information. Sixty-two elderly diabetic patients undergoing surgery for lumbar spinal stenosis are reviewed post-operatively at a mean follow-up of 40.3 months. Results of surgery are compared with a sex- and age-matched non-diabetic control group. Pre-operatively, diabetic patients had more pain and more frequent neurogenic claudication than the non-diabetic group. Neurological abnormalities, including motor weakness and numbness, were also more frequent in the diabetic group, as well as nocturnal pain. Outcome assessments were based on visual analogue scales, limitation of walking distance and limitation in performance of the basic activities of daily living. Degree of satisfaction with surgery outcome was assessed, as well as factors associated with the patients' satisfaction rate.

Pain relief was achieved in both groups, but the degree of satisfaction was greater in the non-diabetic group. Diabetic patients had a higher rate of complications. The overall conclusions of the author were: outcomes of decompressive surgery in diabetic individuals depend on the duration of diabetes, insulin treatment, existence of comorbidities and associated diabetic neuropathy.

Medical treatment

In the July issue, Ng and Sell [12] assessed the efficacy of peri-radicular infiltrations for radicular pain in 62 patients with degenerative stenosis, and in 55 patients with lumbar discal herniation. Injections were done under image-intensifier with a rotogram performed before injection of a mixture of 40 mg of methyl-prednisolone and 2 ml of 25% buvicaine. A single injection was performed in each patient. Pertinent outcome measures included Oswestry Disability Index (ODI), Low-back Outcome Score (LBOS) and VAS. Modified Zung Depression Scale and Modified Somatic Perception Questionnaire were also evaluated. All patients were followed up at 3 months. The mean change in VAS was slight: 1.2 in the stenosis group, compared with two in the herniation group. The mean change in ODI was 12% for the herniation group, compared with 5.5% for the stenosis group. In summary, both groups improved, but with a more marked improvement in the herniation patients.

This paper does not provide robust conclusions. However, it is of interest as it brings into discussion many unanswered questions, both in this study and in previous works in the literature. A careful reading of the reviewer's comments is recommended [15]. For example, it has not been demonstrated whether repeat injections would bring better results and if so at what intervals, and whether the volume of fluid injected is sufficient.

When the steroid is injected in the foramen, how far does it go centrally? Conversely, if the steroid is injected epidurally does it reach the foramen? Moreover, and as pointed out by the reviewer, the short-term results of epidural or periradicular steroid injections are not correctly addressed in most papers. This information is particularly important considering the natural evolution of the lumbar disc herniation. Clearly, more controlled studies are needed, including, for example, comparison of epidural versus periradicular injections. In addition to the questions raised above, the exact location of the herniation as well as the site of the stenosis should be more precisely described.

Complications of surgery

In the August issue, Aunoble et al. [3] described two cases of intervertebral disc prosthesis dislocation. Persisting low-back pain caused by discal degeneration and not responding to conservative treatment was treated in both cases by a total disc replacement at the L5-S1 level, using a Prodisc Implant. After an initial functional improvement, patients experienced severe low-back pain. Radiologists detected anterior dislocation of the polyethylene inlay in the first case, and L5-S1 spondylolisthesis with polyethylene inlay dislocation in the second case. Repeat surgery was required and performed in both cases.

Discussion of these case reports and the reviewer's comments [18] are particularly important. Firstly, the authors conclude that the Prodisc was implanted too anteriorly and that the shear forces induced by the anterior position caused the dislocation. The authors suggest that a more comprehensive range of tools and a stronger inlay attachment to the endplate should lower the risk of dislocation. This has already been observed by other authors in three cases. The technical problem should be solved by the manufacturer. Secondly one can only agree with the reviewer's comments; reading them is strongly recommended. If indications of disc prosthesis are not seriously restricted and scientifically controlled, there is certainly a risk of observing such complications more and more frequently. As opposed to the United States, where two controlled studies are now ongoing, there is a trend in Europe to overuse this technique and not always in the hands of experienced spinal surgeons.

Conclusion

There are obviously many more articles likely to interest non-surgical readers of the eight issues of the European Spine Journal in 2004 than there are papers commented upon in this short review. Some of them have been analysed by Robert Mulholland, my surgical

counterpart; others are apt to interest readers in certain sub-specialities, such as researchers involved in anatomy or biomechanics. The excellent anatomical article by Mannion et al. [10], describing a new skin-surface device for measuring curvatures and ranges of motion, is a good example of a paper likely to interest surgeons involved in treating deformities and specialists in physical medicine. The same remarks can be

made about fundamental research work concerning, for example, the cervical spine, muscles, or kinetics of motion segment. However, it must be recognised that publications in 2004 were mechanically and surgically oriented. Conversely, biological research papers were few. It is the wish of this reviewer that more fundamental biological work appears in the European Spine Journal in the future.

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