

Korean Guideline Development for the Evaluation of Permanent Impairment of the Spine: Proposal by the Korean Academy of Medical Sciences Committee

The criteria for the evaluation of spinal impairment are diverse, complex, and have no standardized form. This makes it difficult and somewhat troublesome to accurately evaluate spinal impairment patients. A standardized guideline was studied for the evaluation of spinal impairment, based on the American Medical Association (AMA) Guides and the McBride method. This guideline proposal was developed by specialty medical societies under the Korean Academy of Medical Sciences. In this study, the grades of impairment were assessed by dividing patients into three different categories: spinal cord impairment, spinal injury impairment and spinal disorder impairment. The affected regions of the spine are divided into three: the cervical region, the thoracic region, and the lumbosacral region. The grade of impairment was differentially evaluated according to the affected region. The restricted range of motion was excluded in the evaluation spinal impairment because of low objectivity. Even though the new Korean guideline for the evaluation of spinal impairment has been proposed, it should be continuously supplemented and revised.

Key Words : Korean Guideline; Spine Impairment; AMA Guides; McBride

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INTRODUCTION

In Korea, the diverse criteria are currently used for the evaluation of spinal impairment, therefore, examiners are often faced with a confusion when trying to evaluate patients. Automobile insurance companies and the court system currently perform spinal impairment evaluations according to the McBride method (1), and there is often serious deviation of the grades by this evaluation method. The McBride method is an old evaluation method, and physicians and other medical professionals are keenly aware of its problems, nevertheless, the majority of Korean physicians still use the McBride me-

thod because a newly standardized evaluation method has not been available until now.

The evaluation of spinal impairment is difficult, and it is the most controversial factor in the evaluation of physical impairment. In fact, spinal impairment is not a condition or defect caused by a certain disease, but rather caused by neurological defect or pain. Therefore, the difference among individuals is great, and makes it so hard to obtain its objective evaluation. The criteria that could be used to more objectively evaluate the rating of spinal impairment are, therefore, needed, and a new Korean guideline for the criteria should have been developed based on the McBride method, the American

Medical Association (AMA) Guides (2), and the guideline submitted by each Korean specialty medical society.

MATERIALS AND METHODS

This Korean guideline for the evaluation of spinal impairment is developed under the auspices of the Korean Academy of Medical Sciences, by the committee for evaluation of spinal impairment. The committee members were specialists of neurosurgery, rehabilitation medicine, orthopedics and occupational and environment medicine, who were recommended by the specialty societies.

Optimal time for the evaluation of spinal impairment

The optimal time for the evaluation of spinal impairment is when patients reach maximal medical improvement (MMI). A substantial period of time is required for physical rehabilitation therapy in patients with spinal cord injuries. However, it is difficult to clearly determine a single best time for evaluation because a long recuperation period is not required in cases of simple herniated intervertebral discs, even if surgery had been performed (3). Therefore, it is possible that the optimal time for the evaluation may be even 3 months after sufficient treatment, provided that deterioration or improvement after conservative treatments or surgical treatments is not anticipated. Nevertheless, in cases in which bony fusion was performed or there was an accompanying neurological injury, sufficient bone fusion might be observed or treatment for the rehabilitation of neurological deficits should simultaneously be administered. Therefore, MMI appears to require more than 6 months. The evaluation of patients with spinal disorder should be performed when the symptoms of patients reach a stable state based on the findings at diagnosis, the time when the condition could not be changed regardless of treatment or when patients reached MMI, which should occur at around 6 months.

Classification of the evaluation of spinal impairment

Spinal impairment was evaluated by dividing the spine into three categories: spinal cord impairment, impairment due to traumatic injury of the spinal column, and impairment due to a spinal disorder.

Spinal cord impairment was defined as the impairment caused by spinal injury and cord diseases. The rating of spinal cord impairment was done according to patient's gait, their ability to stand up, upper extremities function, the rating of voiding and defecation dysfunction, and the rating of sexual dysfunction, as well as a combination of the above criteria. The spinal cord impairment category is limited to cases with spinal lesions (including injury) and accompanying spinal injuries in the field of trauma or the field of disease. The criteria for

spinal cord impairment were then applied and combined.

Impairment due to traumatic injury of the spinal column is caused by damage to the spinal column. The rating of neurological deficit is not a category to be considered, and the impairment due to spinal column traumatic injury is evaluated by the injury region in the spinal column. The necessity of surgical treatment was addressed, and the level of impairment was classified according to the rating of compression fracture caused by spinal injury as well as the type of fracture. The content was comprehensively described in each section.

In comparison with impairment caused by spinal column injury, impairment due to a spinal disorder is not caused by direct trauma, but by natural causes such as accumulation of micro-traumas, immunological and aging process mechanisms, unknown causes, etc. These include the lesions of muscles, ligaments, joints, intervertebral discs, nerves, etc. that form the vertebra. In addition, the functional impairment of the spine or structural impairment caused by these lesions is included.

For a case associated with spinal column injury and spinal disorder, a case with a higher grade of impairment was selected from each category and evaluated. In other words, if the evaluation was advantageous for category of spinal disorder, it could be applied to the case of spinal fracture, even if surgery was performed in spine fracture cases or the spine was healed by natural bony union.

Basic tests used for evaluation

To evaluate the grade of impairment, a physical examination is required in addition to a complete medical history, non-medical history, review of patient's records and other information (4, 5). In addition, the grade of impairment and the region of injury should be confirmed by various methods, including a simple radiograph, stress view, computed tomography, bone scan, magnetic resonance imaging and other comprehensive imaging tests (6). Furthermore, impairment due to spinal disorder should be evaluated based on the presence or absence of abnormal findings on electromyography (EMG) and other evoked potential tests of corresponding spinal disorders (7).

The limit of the range of motion is not included in the evaluation of impairment.

Classification of the evaluation region

The area of impairment was divided into the three regions: the cervical area, the thoracic area, and the lumbosacral area, and the rating of impairment was comprehensively classified. The range of the cervical area extends from the first cervical vertebra to the first thoracic vertebra, the thoracic area extends from the second to the 10th thoracic vertebra, and the lumbosacral area extends from the 11th thoracic vertebra to the sacral vertebra.

RESULTS

Evaluation of spinal cord impairment

Impairment of station and gait disorders

Impairment of gait and station function caused patients with spinal cord injuries to experience difficulty in walking. Muscle atrophy associated with nerve root injury or gait disturbance caused by muscle paralysis was not included in this evaluation category, and it might be preferable to perform the evaluation by separately assessing the rating of peripheral nerve impairment.

The individual variation in gait disturbance might be great, therefore, it was important to assess whether the patient was able to walk and stand without assistance. If the patient was unable to walk independently, it was important to assess whether walking was possible with an assistance of another person, a wheelchair, or crutches.

In addition, it was important to assess the rate of gait performance in patients who were able to walk unassisted. When assessing gait disturbance, it was important to assess whether the patient had a limping gait, difficulty going up and down stairways, difficulty walking on flat surfaces, and difficulty walking on severely uneven surfaces (Table 1).

Impairment of upper extremity

Upper extremity impairment was evaluated by assessing the patient's ability to readily use their upper extremities following a spinal cord injury. The criteria used to evaluate the use of the upper extremities were divided down into several categories, however, they could largely be classified into two types: the evaluation of the patient's ability to perform

Table 1. Criteria for rating impairment of station and gait disorders

Class (Grade)	Impairment rating (%)	Description
1	1-14	Walks but difficulty with elevations stairs Walks but difficulty with long (50 meters) distances Cannot run Prominent abnormal walking posture; Limping gait
2	15-29	Cannot walk with inclination Cannot walk with elevation stairs Rises and maintains standing position on chair but cannot on the floor
3	30-49	Rises and maintains standing position with assistance Cannot walk without assistance Rises and maintains standing position on the chair with assistance
4	50-70	Cannot stand without any others help Cannot stand without mechanical supports, and/or assist device Cannot move without wheel chairs

fine tasks and the evaluation of the patient's ability to perform basic tasks for daily living activity. A patient's ability to perform fine tasks was evaluated by assessing whether they had limitations in their ability to write, use chopsticks, fasten a button, transfer a water cup, etc. The ability to perform basic routine tasks was evaluated by assessing whether the patient was able to eat, wash, dress, bathe, etc. These factors could readily be evaluated by examiners without special evaluation tools or test equipment. The impairment of each extremity was calculated and combined in order to assess unilateral and bilateral impairment (Table 2).

Neurologic impairment of bladder

Voiding and defecation problems frequently develop in cases of spinal cord impairment. Both spinal cord impairment and impairment of spinal nerve roots, especially the cauda equina or sacral nerve roots, were observed in patients with spinal impairment, and they could be considered to correspond to cases involving spinal cord injury. However, a more objective application of the evaluation of voiding impairment might be required. Therefore, a uro-dynamic study should be performed in cases in which the degree of voiding impairment was above the grade 2, and cases in which neurogenic bladder findings were confirmed should be evaluated on the basis of more objective results (Table 3).

Table 2. Criteria for rating impairment of upper extremity

Class (Grade)	Impairment rating (%)	Description
1	1-9	Individual can use upper involved extremity but has difficulty for delicate hand activities*
2	10-24	Individual cannot use upper involved extremity for delicate hand activities*
3	25-39	Individual can use upper involved extremity but has difficulty for self-care activities [†]
4	40-55	Individual cannot use upper involved extremity for self-care activities [†]

*, delicate hand activities: writing, using the chopsticks, fastening a button, transferring; [†], self-care activities: eating, washing, bathing, dressing.

Table 3. Criteria for neurologic impairment of bladder

Class (Grade)	Impairment rating (%)	Description
1	1-10	Individual has some degree of voluntary control but is impaired by urgency or intermittent incontinence
2	11-24	Percussion abdomen or press for unination Protective padding for urinary incontinence
3	25-40	Keep the cystostomy or urinary catheter for unination Catherization for unination

Neurologic impairment of defecation

Appropriate methods to objectively evaluate defecation impairment are not currently available, therefore, it is dependent on subject reporting in many cases, resulting in numerous evaluation errors. Voiding and defecation problems simultaneously developed in cases of spinal cord injury. Nonetheless, to determine the level of spinal impairment, the level of defecation impairment, which was difficult to assess, became a criterion of assessment. Therefore, it was decided to adjust the impairment of defecation by including it in the evaluation of the impairment of voiding without separate evaluation.

Neurologic sexual impairment

In the past, sexual impairment was considered to be unrelated to spinal impairment, however it has recently been determined to be closely associated with the grade of impairment, and it has becoming increasingly evaluated in patients with spinal cord impairment. Nevertheless, it was a category that could be substantially subjective, in the evaluation of spinal cord impairment, therefore, and thus it was considered that class should be required in addition to the evaluation and adjustment of urological impairment (Table 4).

Evaluation of impairment due to spinal column injury

Evaluation of the impairment of the compression fracture of the vertebral body

We evaluated the spinal column injury impairment, accord-

Table 4. Criteria for neurologic sexual impairment

Class (Grade)	Impairment Rating (%)	Description
1	1-10	Sexual functioning and reflex are possible, but there is no awareness
2	11-20	No sexual functioning

Table 5. Criteria of rating whole person impairment due to spine fractures; vertebral body

Class (Grade)	Impairment rating (%)			Description
	Cervical	Thoracic	Lumbosacral	
1	5	5	5	<25% compression of one vertebral body
2	12	11	14	25-50% compression of one vertebral body
3	20	17	24	>50% compression of one vertebral body

Two more vertebral compression fractures with separating more than 4 bodies; (ex: C7 fracture and T4 fracture) Combine maximum compression body's impairment and 1/2 impairment in next compression body. Two more vertebral compression fractures with separating less than 4 bodies; add 3% (maximum 6%): ex: C7 fracture and T3 fracture.

ing to the compression rate in the vertebral body (Table 5). For cases with a fracture separated by more than 4 vertebrae (example: fracture of the C7 and T4), the impairment rating should be initially calculated in the area with more severe impairment, and combined with half of the impairment of the remaining lesions (up to maximal 3 areas could be combined). The impairment rating calculated by combining half of the impairment rating in the remaining lesions is smaller than the impairment rating calculated by adding 3%. For cases separated by less than 4 vertebral bodies (example: fracture of C7 and T3), the area with more severe impairment was calculated, and fractures in other areas could be calculated by adding 3% to up to 2 areas, and a maximum of 6% could be added (Table 5).

Evaluation of fracture impairment in areas other than the vertebral body

This section deals with the case with a fracture in the posterior element in areas other than the vertebral body. In cases of neural canal invasion, the degree of impairment was evaluated based on the category of nerve root injury, if the nerve roots were injured. When the nerve roots were not injured, it was evaluated according to the this category (Table 6).

Evaluation of impairment due to spinal disorders

Classification of the grade of impairment due to spinal disorders

The impairment due to spinal disorders was rated into 5 grades. In addition, the impairment within each grade and within established impairment range of each grade was evaluated under the direction of the clinician.

Impairment was rated as grade 0 (0%), grade 1 (mean value 5%, range 1-7%), grade 2 (mean value 10%, range 8-15%), grade 3 (mean value 20%, range 16-25%), and grade 4 (mean value 30%, range 26-35%).

Criteria for the evaluation of impairment due to spinal disorders

The vertebral region was subdivided into the cervical area, the thoracic area, and the lumbosacral area for the evaluation

Table 6. Criteria of rating whole person impairment due to spine fractures; posterior elements

Class (Grade)	Posterior element fracture	Impairment rating (%)			Description
		Cervical	Thoracic	Lumbosacral	
1	I	3	3	3	Without involving spinal canal
	II				With involving spinal canal
	III	3	3	3	With soft tissue injury

More than three fractures; add 3%.
Involved nerve root injury case; peripheral nerve injury part.
Without nerve root injury case; (B. I Part).

Table 7. Criteria of rating whole person impairment due to spine disorders

Class (Grade)	Impairment rating (%)	Disorders
0	0	With no residual symptoms and objective signs.
1	1-7	Unoperated or surgically treated, with residual symptoms and without abnormal findings on electrophysiologic test. Single-level fusion without residual signs or symptoms.
2	8-15	Unoperated or surgically treated, with residual symptoms and with abnormal findings on electrophysiologic test. Single-level fusion with residual signs or symptoms. Two or three level fusion without residual signs or symptoms except limit of motion.
3	16-25	Two or three level fusion with residual signs or symptoms or transitional syndrome. More than four level fusion without residual signs or symptoms except limit of motion.
4	26-35	More than four level fusion with residual signs or symptoms.

of spinal impairment which was caused by spinal disorders (classification of each area was identical to that described above). For cases where fusion was performed in the thoracic vertebral area, the impairment should be evaluated by lowering the patient's score by one grade. Nevertheless, in cases where one-segment fusion was performed in the thoracic area, the impairment rate was evaluated according to the symptoms remaining in the corresponding area. In cases where the impairment included cervical vertebrae, thoracic vertebrae or lumbar vertebral area separately, the grade of impairment should initially be evaluated by calculating the impairment rate in each area and combining the scores. The injury of nerve roots accompanying distance dysfunction in patients with spinal disorder should be substituted by evaluation of the impairment in the peripheral nerve injury area. In spinal disorder, the impairment of patients whose spinal segments were fused naturally by inflammatory or other causes should be evaluated by the same method as that used to treat cases where spinal fusion surgery was performed (Table 7).

DISCUSSION

The evaluation of spinal impairment is very complex, and it is difficult to objectively evaluate. An independent guideline for the evaluation of spinal impairment was initially described. However, many parts require further supplementation and amendment. A better guideline for the evaluation of spinal impairment could be established only through further discussion.

The methods to evaluate the grade of spinal impairment are very specific, and evaluation errors may occasionally occur depending on examiners, because it is difficult to objectively determine the rating of spinal impairment (8). In the past, the evaluation of spinal impairment was done by directly measuring the range of motion in the spine, therefore, there have been wide variations in the evaluation of patients with spinal impairment depending on the attitude of patients and measurement method used by examiners (9). Therefore, the measurement of the range of motion was excluded from the McBride method, and spinal impairment was classified according to disease instead. In the AMA Guides, spinal impairment was initially assessed by measuring the range of motion in the spine, however, the method has been improved, and it is now assessed by using a combination of the Diagnosis Related Estimates (DRE) and Range Of Motion (ROM) methods (10, 11). The DRE method is performed on the basis of patient diagnosis, but not the range of motion. Such problems were clearly realized during the preparation of the present guidelines for the evaluation of spinal impairment, and whether or not to include the range of motion in the evaluation criteria became a matter of controversy. Nonetheless, the measurement of the restriction of movement by evaluating patients seriously lacks objectivity, therefore, the limitation of the level of range of movement was not considered as a criterion in the evaluation of impairment (11). However, if more objective measurement methods are developed in the future, such a criterion may also be considered.

In the AMA Guides, which is similar to the method used to evaluate impairment in other organs, the grade of impairment is evaluated as an impairment rate, but not by the level of impairment. The grade of spinal impairment is evaluated by either DRE method or ROM method. The DRE method is applied to patients with obvious injury; those whole causality can not be assessed or in those who do not show the characteristic of impairment well. The ROM method is used only in cases in which the DRE method could not be applied. According to the 5th edition of the AMA Guides, the DRE method classifies each of the three spinal areas, including the cervical, thoracic, and lumbar vertebrae, according to the 5 categories of the DRE (2). The ROM method assesses impairment according to patient diagnosis, which is evaluated based on whether surgery was performed, the presence or absence of residual symptoms, and the restriction of range of motion in the spine. However, the measurement of ROM by the AMA Guides is considered to have several problems, each edition shows a different measurement method and the measurement tools change nearly every day (11, 12). Therefore, the DRE method has been the recommended method for evaluating impairment whenever possible.

In McBride's method of spinal impairment evaluation, the impairment rate in many cases is evaluated at a rating somewhat higher than the AMA Guides (1). The McBride method is an old method that takes the loss of labor capacity into con-

sideration. It has the advantage of including both temporary and permanent impairment, and it is important that the range of movement is not considered. However, the method was revised in 1963 and remains as it was, and it is a method that is rarely used today in other countries. However, in Korea, the McBride method is still widely used in association with automobile insurance laws or in the determination of compensation by the court system, therefore, the criteria of McBride's method for the evaluation of impairment have to be reconsidered.

In the table on the grade of physical impairment used by the industrial hazard compensation insurance enforcement agency, spinal impairment is classified as either deformity impairment or functional impairment. Furthermore, the conditions, methods, and application grade for the evaluation of functional impairment caused by intervertebral disc herniation are defined separately.

The problems associated with the evaluation of industrial hazard spinal impairment are that it is classified based on the spinal fixation level and that it is restricted to the fixation of the first and second compartment. Therefore, it is difficult to objectively evaluate spinal impairment. These evaluation criteria were established when spinal fusion surgery was not common, therefore, they are associated with a number of errors considering the fact that the level of impairment of spinal fusion surgery is very high. Thus, the grade of impairment has frequently been overestimated. Nonetheless, spinal fusion surgery became generalized, and is performed in cases of spinal stenosis or spinal instability that require fusion surgery. Therefore, the AMA Guides and other criteria for the evaluation of impairment in fusion cases have been considered not to have great significance for assessing the grade of impairment. Consequently, the evaluation criteria of industrial hazards contain many categories that require further supplementation (13).

Many parts of the guideline for the evaluation of spinal cord impairment in the present study are identical to those of the AMA Guides, nevertheless, it was slightly modified to suit to the Korean situation. First, regarding gait disturbance, the grade of impairment in the lower extremities in Korea, tends to be more severe than that in the upper extremities, and thus the level of gait disturbance is evaluated to a greater extent. The evaluation of voiding and defecation dysfunction is different from the rating of bladder dysfunction determined by the urologists, and the rating of defecation dysfunction is not satisfactory in some areas. Therefore, the evaluation method is limited to the impairment of voiding function, and the guidelines for evaluation of voiding impairment need to be adjusted to fit the evaluation criteria proposed by other fields. In addition, cases involving the dysfunction of the peripheral nerves and spinal nerve roots may present as the impairment of gait or the ability to stand up. These impairments may differ among patients, therefore, additional criteria for the evaluation of impairment are needed in the future.

In the evaluation of upper extremity impairment, the dominant upper extremity and non-dominant upper extremity are

not distinguished from one another and are separately evaluated in the AMA Guides. However, the dominant upper extremity is not distinct, and the use of the dominant upper extremity has recently become unclear, therefore, its definite basis must be shown.

The grade of dyspnea is evaluated in the AMA Guides. Since a substantial grade of impairment would already be shown in cases of spinal injury caused by dyspnea, a separate evaluation seems to be not necessary. Therefore, the evaluation of dyspnea was excluded from our evaluation method, because it does not have a great influence on the increase in the rate of impairment.

For the evaluation of the impairment caused by spinal column injury, the criteria used to measure the level of spinal compression fracture are not clearly described, and the evaluation of spinal instability has not yet been established. Therefore, the criteria for the evaluation of spinal instability need to be studied further. In addition, the assessment of cases showing neurological impairment symptoms accompanying fracture is not clear.

When evaluating spinal impairment caused by spinal disorders, it is difficult to distinguish between the grade of impairment in cases of surgical treatment and non-surgical treatment. The restriction of the range of motion is also difficult to evaluate, because it is not easy to objectively measure. In the present evaluation of impairment, the assessment of the restriction of range of motion was not considered, and it was classified according to whether surgical treatments were performed and also to the level of surgery range.

The rate of residual neurological symptoms should also be mentioned. The rate is simply described as residual symptoms, and more clear assessment criteria on the issue should be determined in the future. In addition, by describing the evaluation level according to fusion level, the rate of impairment in some cases is increased according to fusion, possibly resulting in excessive surgery. Therefore, a revision of these criteria may be required in the future. In cases of natural fusion due to degenerative findings, the level of impairment may increase with age, therefore, further discussion on the issue is required.

Distinct lesions in the nerve roots were separately evaluated for peripheral nerve impairment. However, the level of nerve root impairment and peripheral nerve root impairment are clearly different. Therefore, the grade of impairment may show wide variation depending on the examiner. Thus, further criteria for the evaluation of nerve root impairment may be needed.

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