

Development of Korean Academy of Medical Sciences Guideline Rating the Physical Impairment; Kidney, Bladder, Urethra, Male and Female Reproductive Systems (Preliminary Report)

For the evaluation of the kidney impairment, serum creatinine concentrations or glomerular filtration rates are mainly used, and the conditions of solitary or transplanted kidney and chronic dialysis are also taken into the considerations. Some symptoms and signs of the chronic renal disability in spite of adequate treatment add one additional grade. For evaluating bladder and urethral impairment, the criteria include voiding symptoms and signs. The patients with urinary diversions have impairment grades depending on the alteration of upper urinary tract function. For penile impairment, the degrees are evaluated using the international index of erectile function, nocturnal penile tumescence and color doppler ultrasonography. For evaluating impairment of other male reproductive organs, functional and anatomical changes of these organs, analysis of the semen or hormones and the state of solitary testis are used as the criteria. For evaluating impairment of female reproductive organs, pregnancy potential, requirement of continuous treatment and the ability of sexual intercourse are used. Also, degree of impairment is modified according to the ages in evaluating female reproductive systems. We have tried to make this evaluation system objective, scientific, and convenient, but still find it leaving much to be desired.

Key Words : Evaluation; Disability; Physical Impairment; Urogenital System

Ji Hyeong Yu¹, Sang Hyun Kim²,
Seung Hwan Sohn³, Kyung Hoon Paik⁴,
Jeong Zoo Lee⁵, Jang Hwan Kim⁶,
Jong Kwan Park⁷, Ki-Sung Ryu⁸,
Jong Kwan Jun⁹, Yong Kyoan Cho¹⁰,
and Jae Yong Chung¹

Departments of Urology¹ and Internal Medicine², Sanggye Paik Hospital, Inje University College of Medicine, Seoul; Department of Internal Medicine³, Dr. Sohn's Hemodialysis Center, Seoul; Department of Pediatrics⁴, Samsung Medical Center, Sungkyunkwan University College of Medicine, Seoul; Department of Urology⁵, Pusan National University Hospital, Pusan National University College of Medicine, Busan; Department of Urology⁶, Urological Science Institute, Yonsei University College of Medicine, Seoul; Department of Urology⁷, Chonbuk National University Hospital, Chonbuk National University College of Medicine, Jeonju; Department of Obstetrics & Gynecology⁸, St. Mary's Hospital, the Catholic University of Korea, College of Medicine, Seoul; Department of Obstetrics & Gynecology⁹, Seoul National University Hospital, Seoul National University College of Medicine, Seoul; Department of Obstetrics & Gynecology¹⁰, Sanggye Paik Hospital, Inje University College of Medicine, Seoul, Korea

Received : 12 April 2009
Accepted : 4 May 2009

Address for correspondence

Jae Yong Chung, M.D.
Department of Urology, Inje University College of
Medicine, 761-7 Sanggye 7-dong, Nowon-gu, Seoul
139-707, Korea
Tel : +82.2-950-1137, Fax : +82.2-950-1954
E-mail : chung90@paik.ac.kr

INTRODUCTION

Although we have used several systems for the evaluation and the compensation of the physical impairment patients in Korea, none of them is considered to be good enough to meet the high standard of requirement of the courts, the medical community and workers' compensation authorities (1-3). Furthermore as these are from other countries, they could not reflect the condition of Korean people (4).

In the urinary and reproductive systems of current Korean welfare act for the disabled, only the patients with hemodial-

ysis or peritoneal dialysis due to chronic renal failure and the patients with transplanted kidney and the patients with urinary diversions are acknowledged as the disabled (3). A lot of patients could not get compensations because the law doesn't cover them. Besides, the compensation of the disability requires different forms of medical certificate for each standard with further inconvenience.

In the United States of America, there is a scientific guideline to the evaluation of permanent impairment, established by American Medical Association (AMA) (2). Also, new version of AMA guideline was published in 2007 (5).

Therefore, it is about the time we had a new evaluation system which is not only scientific and useful, but appropriate to the culture and condition of Korean people as well.

The purpose of this report is to describe the resolved criteria of Korean Academy of Medical Sciences (KAMS) committee on a permanent impairment in urinary and reproductive systems, in assessing the severity and in determining the impact of the impairment on the ability to perform daily activities. But this is a preliminary report. A lot of part can be revised through future studies.

MATERIALS AND METHODS

In March 2007, KAMS planned a project for new evaluation of permanent impairment for Korean. It organized 11 committees for each organ and asked them to make new systems on the evaluation of the permanent impairment (6). The committee of genitourinary system consisted of ten physicians who were recommended by Korean Association of Internal Medicine, Korean Urological Association and Korean Society of Obstetrics and Gynecology.

Through two workshops, the members of the committee were informed of the background, purpose, basic concept and rating methods of impairment rating guideline. The evaluation systems for the permanent impairment of European

Union, the United States or some countries in Asia (7) were also reviewed.

Especially, the AMA Guideline 5th edition (4) on the evaluation of permanent impairment made a good reference. Also, 6th edition of the AMA Guideline (5) is published in 2007. Nevertheless, we tried to make our own one which would accommodate the culture of Korean people.

An impairment is considered permanent when it has reached Maximal Medical Improvement (MMI); the impairment is nearly well stabilized and it is unlikely to change in the next year with or without medical treatment. Furthermore, the evaluation for the permanent impairment should be done when a patient reaches MMI. (5)

This evaluation guides for genitourinary system consist of four parts; upper urinary tract (kidney), lower urinary tract (bladder & urethra), male reproductive systems including prostate, and female reproductive systems.

RESULTS

Guideline for evaluation of upper urinary tract impairment (Table 1)

Kidney plays important roles in excretion of metabolic waste, acid-base balance, control of blood pressure (BP), and

Table 1. Guideline for evaluation of upper urinary tract system impairment

Grade of impairment	Amount of disability		
	Body impairment	Organ impairment	Description
1	90%	85-100%	Serum Cr \geq 10 mg/dL or GFR <15 mL/min In child, serum Cr \geq 4 times of normal Cr value of patient's age or GFR <15 mL/min/1.73 m ² Patient with 2nd grade and persistent symptoms and signs* of chronic renal disorder in spite of adequate treatment Chronic dialysis patient more than 3 months
2	50%	70-85%	Serum Cr: 7-10 mg/dL or GFR: 15-30 mL/min In child, serum Cr 3-4 times of normal Cr value of patient's age or GFR of 15-30 mL/min/1.73 m ² Patient with 3rd grade and persistent symptoms and signs* of chronic renal disorder which needs continuous observation or treatment
3	30%	55-70%	Serum Cr: 4-7 mg/dL or GFR: 30-45 mL/min In child, serum Cr 2-3 times of normal Cr value of patient's age or GFR of 30-45 mL/min/1.73 m ² Patient with 4th degree of disability and persistent symptoms and signs* of chronic renal disorder which needs continuous observation or treatment Renal transplant patient
4	10%	40-55%	Serum Cr: 2-4 mg/dL or GFR: 45-60 mL/min In child, serum Cr 1.5-2 times of normal Cr value of patient's age or GFR of 45-60 mL/min/1.73 m ² Unilaterally functioning kidney

*, Symptoms and signs of chronic renal disability.

1) Uremic pericarditis (more than moderate degree on echocardiography, etc); 2) Bleeding tendency; 3) Uremic neuropathy (confusion, disorientation, seizure, peripheral neuropathy, etc); 4) Uremic gastroenteritis (nausea, vomiting, uremic fetor, etc); 5) Uremic pruritus; 6) Renal anemia (Hemoglobin \leq 10 gm/dL); 7) Malnutrition (Serum albumin <3.0 gm/dL); 8) Severe hypertension (Diastolic blood pressure \geq 105 mmHg, Diastolic pressure in child \geq 95 percentile of normal diastolic blood pressure of same age); 9) Electrolyte and Acid-base imbalance.

Cr, creatinine; Ccr, Creatinine clearance rate; GFR, glomerular filtration rate.

erythropoietin production. Serum creatinine (Cr) and creatinine clearance rate (Ccr) account for renal function and are useful to measure upper urinary tract function. Renal impairment is evaluated by medical nephrologist and pediatric nephrologist.

Symptoms and signs

Symptoms and signs of upper urinary tract impairment are given in Table 1.

Laboratory findings

Either Serum Cr or Glomerular Filtration Rate (GFR) is used. Based on optimal results, GFR evaluation method is assessed by medical and pediatric nephrologists.

Disorder grade (Table 1)

Disorder is graded by renal function test, kidney transplantation, dialysis etc.

In case of different results between serum Cr and GFR, the poorer renal function is selected.

Impairment grade is assessed in MMI because of the possibility of disease progression or improvement.

Hemodialysis longer than 3 months due to chronic renal failure (CRF) is recognized as first grade, and kidney transplantation is recognized as third grade. According to the function of transplanted kidney, it can be recognized as more severe grade.

Patients on hemodialysis reach MMI at 3 months after the start of the treatment. Patient with kidney transplantation reaches MMI in 6 months after the surgery. On condition that there is no rejection symptom and a physician decides that the kidney function becomes stabilized. When a patient gets kidney transplantation after hemodialysis, MMI is reached at 3 month after the beginning of the dialysis and the impairment rating should be done in 6 months after the operation.

When children are evaluated, disability rate is added by 10%.

Guideline for evaluation of lower urinary tract impairment (Table 2)

Lower urinary tract impairment is evaluated by urologists.

Guideline for lower urinary tract impairment evaluation

The bladder is a urine reservoir that is voluntarily controllable. Normally it permits several hours of urinary retention. Pathologic conditions within or outside the urinary system may induce bladder dysfunction.

In women, the urethra is a urinary passage and has a voluntary sphincter, but no circular smooth muscle sphincter. In men, the urethra has a voluntary sphincter and propulsive muscles, and is a passage for urine and seminal ejaculations.

Symptoms and signs

Urinary frequency, dysuria, urinary incontinence, urine retention, hematuria, pyuria, passage of urinary calculi, suprapubic mass, diminished urinary stream, extraneous or ectopic urinary openings, periurethral masses, etc.

Disorder grade

Grade of lower urinary tract impairment would be determined according to Table 2.

Impairment grade is assessed in fixed or stable impairment without disease progression or improvement.

The findings of urodynamic study are not considered in lower urinary tract impairment evaluation.

Guideline for evaluation of male reproductive organ impairment

The male reproductive organs include the penis, scrotum, testicles, epididymis, spermatic cords, prostate, and seminal vesicles. The percentages would be increased by 50% for men younger than 40 yr, and decreased by 50% for men older than 65 yr.

The impairment of male reproductive organ impairment is evaluated by urologists.

Guideline for evaluation of penile impairment (Table 3)

The penis has the sexual functions of erection and ejaculation. Urinary function of the penis is discussed before. When evaluating the impairment of penis, consider impairment of both sexual and urinary functions. Impairment of sexual function would be determined according to Table 4. To determine impairment of the whole person, this estimate would be combined with the appropriate percentage for estimated urinary function impairment. This classification also may be used to estimate penile implant impairment.

Symptoms and signs

Erection and sensation abnormalities of the penis, partial or complete loss of the penis, etc.

Disorder grade

Objective techniques useful in evaluating penis function include, but are not limited to, penile tumescence studies, doppler ultrasound penile blood flow evaluations, dynamic cavernosometry, cavernosography and angiography. (8)

Disorder is graded by the degree of vaginal penetration, erection, ejaculation and orgasm using international index of erectile function (IIEF) questionnaire, nocturnal penile tumescence (NPTM) and color doppler ultrasonography (CDU).

Guideline for evaluation of scrotum impairment (Table 4)

The scrotum covers, protects, and provides a suitable environment for the testicles.

Table 2. Guideline for evaluation of lower urinary tract system impairment

Grade of impairment	Amount of disability		Description
	Body impairment	Organ impairment	
1	30-39%	81-100%	<p>Impaired bladder reflex activity with loss of voluntary control on micturition resulting in the use permanent urinary diversion (e.g. nephrostomy, ileal conduit, vesicostomy, suprapubic cystostomy or clean intermittent catheterization)</p> <p>or</p> <p>Urethral dysfunction causing intermittent or continuous urine dribbling and loss of voluntary urinary control resulting in the use permanent urinary diversion (e.g. suprapubic cystostomy or clean intermittent catheterization)</p> <p>or</p> <p>Urethral dysfunction or change of lower urinary tract system resulting in the use permanent bilateral percutaneous nephrostomy</p> <p>and</p> <p>Alteration in normal upper urinary tract function is seen directly/indirectly resulting from changes in either bladder or urethral function</p>
2	20-29%	51-80%	<p>Impaired bladder reflex activity with loss of voluntary control on micturition resulting in the use permanent urinary diversion (e.g. nephrostomy, ileal conduit, vesicostomy, suprapubic cystostomy or clean intermittent catheterization)</p> <p>or</p> <p>Urethral dysfunction causing intermittent or continuous urine dribbling and loss of voluntary urinary control resulting in the use permanent urinary diversion (e.g. suprapubic cystostomy or clean intermittent catheterization)</p> <p>or</p> <p>Residual urethral blockage of over 75% upon cystoscopy, urethroscopy or performance of a voiding cystourethrogram resulting in the use permanent urinary diversion (e.g. suprapubic cystostomy or clean intermittent catheterization) despite of operation or any other treatments</p> <p>or</p> <p>Urethral dysfunction or change of lower urinary tract system resulting in the use permanent unilateral percutaneous nephrostomy</p> <p>and</p> <p>Upper urinary tract function is not affected by the bladder disorder</p>
3	10-19%	31-50%	<p>Symptoms and signs of bladder disease that require continuous treatment Normal bladder function is not seen without treatment</p> <p>or</p> <p>Urethral dysfunction causing intermittent or continuous urine dribbling and loss of voluntary urinary control that require continuous treatment but not the use permanent urinary diversion (e.g. suprapubic cystostomy or clean intermittent catheterization)</p> <p>or</p> <p>Residual urethral blockage of over 50 to 75% upon cystoscopy, urethroscopy or performance of a voiding cystourethrogram resulting in the use continuous urethral dilation</p> <p>and</p> <p>Upper urinary tract function is not affected by the bladder disorder</p>
4	1-5%	0-30%	<p>Recurrent symptoms and signs of bladder disease that require intermittent treatment Normal bladder function is seen during recurrent episodes</p> <p>or</p> <p>Urethral dysfunction causing intermittent or continuous urine dribbling and loss of voluntary urinary control that require intermittent treatment but not the use permanent urinary diversion (e.g. suprapubic cystostomy or clean intermittent catheterization)</p> <p>or</p> <p>Residual urethral blockage of 25 to 50% upon cystoscopy, urethroscopy or performance of a voiding cystourethrogram resulting in the use irregular intermittent urethral dilation</p> <p>and</p> <p>Upper urinary tract function is not affected by the bladder disorder</p>

The functional or structural impairment mentioned above should be directly related to the cause which is claimed for.
All description criteria must be met for each category of impairment grade.

Table 3. Guideline for evaluation of penile impairment

Grade of impairment	Amount of disability		
	Body impairment	Organ impairment	Description
1	20-25%	41-60%	Vaginal insertion is impossible. Degree is severe category in IIEF questionnaire, NPTM, vasoactive agents induced CDU
2	14-19%	21-40%	Vaginal insertion is possible, however there is severe difficulty in normal erection, ejaculation and orgasm Degree is over moderate category in IIEF questionnaire, NPTM, vasoactive agents induced CDU
3	8-13%	0-20%	Vaginal insertion is possible, however there is a little difficulty in normal erection, ejaculation and orgasm Degree is mild category in IIEF questionnaire, NPTM, vasoactive agents induced CDU

Increase the percentages by 50% for men younger than 40 yr old, and decrease the percentages by 50% for men older than 65 yr old. IIEF, International Index of Erectile Function; NPTM, nocturnal penile tumescence; CDU, Color Doppler ultrasonography.

Table 4. Guideline for evaluation of scrotal impairment

Grade of impairment	Amount of disability		
	Body impairment	Organ impairment	Description
1	11-15%	41-60%	Scrotum is entirely lost (over 90%)
2	5-7%	21-40%	Scrotum is almost lost (60-89%), the testicular function is normal, however, one testicle was moved to outside of the scrotum or removed to preserve testicular function
3	1-3%	0-20%	Testicular function is normal, however, location of the testicle is a little changed due to the scrotum lost (30-59%)

Increase the percentages by 50% for men younger than 40 yr old, and decrease the percentages by 50% for men older than 65 yr old.

Table 5. Guideline for evaluation of testis, epididymis and spermatic cord impairment

Grade of impairment	Amount of disability		
	Body impairment	Organ impairment	Description
1	13%	41-60%	Anatomical change of the testis, epididymis or spermatic cord The signs and symptoms by disease of related organ remain, but continuous treatment is needed No Function of semen or hormones
2	7-12%	21-40%	Anatomical change of the testis, epididymis or spermatic cord The signs and symptoms by diseases of related organ were remained, but continuous treatment is needed Analysis of semen or hormones is in abnormal range
3	1-6%	0-20%	Anatomical change of the testis, epididymis or spermatic cord The signs and symptoms by disease of related organ remain, but continuous treatment is not needed Analysis of semen or hormones is in normal range Solitary testicle

Increase the percentages by 50% for men younger than 40 yr old, and decrease the percentages by 50% for men older than 65 yr old.

Symptoms and signs

Pain or enlargement of scrotum, testicular immobility, inappropriate testicle location, testicular masses, etc.

Disorder grade

Objective techniques useful in evaluating scrotum function include, but are not limited to, observation, palpation, testicular examination, and scrotal ultrasound. (9)

Disorder is graded by scrotal pain or discomfort, architectural alteration of scrotum, the state of testicular function and the location of testicle.

Guideline for evaluation of testis, epididymis and spermatic cord impairment (Table 5)

The testicles produce spermatozoa and synthesize male steroid hormones. The epididymis and spermatic cords trans-

Table 6. Guideline for evaluation of prostate and seminal vesicle impairment

Grade of impairment	Amount of disability		Description
	Body impairment	Organ impairment	
1	15%	41-60%	Sexual dysfunction or urinary incontinence by radical prostatectomy to treat prostatic cancer
2	7-14%	21-40%	Abnormal function and anatomical change of prostate and seminal vesicle Symptoms and signs related with prostate and seminal vesicle are severe and frequent Continuous treatment is needed
3	1-6%	0-20%	Abnormal function and anatomical change of prostate and seminal vesicle is remaining, however, continuous treatment is not needed

Increase the percentages by 50% for men younger than 40 yr old, and decrease the percentages by 50% for men older than 65 yr old.

Table 7. Guideline for evaluation of ovarian impairment

Grade of impairment	Amount of disability		Description
	Body impairment		
1	26-35% pregnancy rate 0%		Loss of bilateral ovarian function before menopause e.g.) Bilateral oophorectomy, ovarian failure due to infection, radiotherapy, chemotherapy, and premature menopause
2	16-25% pregnancy rate 40%		Symptoms and signs of ovulation disorder needs constant treatment But, no abnormal findings in laparoscopy and hysterosalpingogram
3	0-15% pregnancy rate 50-100%		e.g.) Polycystic ovarian syndrome A patient has signs of ovarian disorder or deformation and does not need constant treatment or A patient has one ovary which has normal function e.g.) Unilateral or bilateral ovarian cystectomy, Unilateral oophorectomy

The degree of impairment is modified according to age.

port the spermatozoa.

Symptoms and signs

Local or referred pain, tenderness and change in size, contour, position, and texture, testicular hormones and seminal fluid abnormalities, size and textural changes, testicular, epididymal, and spermatic cord function disturbances, etc.

Disorder grade

Objective techniques useful in evaluating testicular, epididymal, and spermatic cord function include, but are not limited to, vasography, ultrasound, spermatic arteriography and venography, biopsy, semen analysis, and clomiphene stimulation test, gonadotropin releasing hormone (GnRH) stimulation test, and human chorionic gonadotropin stimulation test (9).

Disorder is graded by testicular symptoms or signs, architectural alteration of testis, epididymis or spermatic cord, the need of continuous treatment, analysis of semen or hormone.

The solitary testicle is recognized as third grade.

Guideline for evaluation of prostate and seminal vesicle impairment (Table 6)

The prostate and seminal vesicles provide the appropriate nutrition, environment, and transport for spermatozoa and

semen. Impairments associated with urinary functions of the parts of the urethra involved with the prostate are discussed in the lower urinary tract system.

Symptoms and signs

Local or referred pain, tenderness, oligospermia, hemospermia, urinary tract abnormalities, etc.

Disorder grade

Objective techniques useful in evaluating prostate and seminal vesicle function include, but are not limited to, urography, endoscopy, prostatic ultrasonography, vasography, biopsy, prostate secretion examination, magnetic resonance imaging (MRI), and hormone excretion pattern analysis (10).

Disorder is graded by the function of prostate and seminal vesicle, symptoms or signs related to prostate and seminal vesicle disease and the need of continuous treatment.

Sexual dysfunction or urinary incontinence by radical prostatectomy to treat prostatic cancer is recognized as first grade.

Guideline for evaluation of female reproductive organ impairment

The female reproductive organs include the vulva, vagina, cervix, uterus, fallopian tubes, and ovaries. Impairment of

Table 8. Guideline for evaluation of uterine tube impairment

Grade of impairment	Amount of disability	
	Body impairment	Description
1	26-35% pregnancy rate 0%	Bilateral tubal agenesis or loss of bilateral tubes before menopause, not restorable by operation e.g.) tubal agenesis in Mullerian agenesis, bilateral salpingectomy due to tubal pregnancy
2	26-35% pregnancy rate 30%	Bilateral tubal occlusion or loss of bilateral tubes before menopause Restorable by operation e.g.) Bilateral tubal obstruction due to infection, bilateral tubal occlusion following tubal ligation
3	16-25% pregnancy rate 50%	A patient has signs of tubal deformation and needs constant treatment But, tube(s) is (are) patent in laparoscopy and hysterosalpingogram e.g.) tubal adhesion, hydrosalpinx
4	0-15% pregnancy rate 50-100%	A patient has signs of tubal deformation and does not need constant treatment or A patient has one tube which has normal function before menopause e.g.) Unilateral salpingectomy due to tubal pregnancy After chemotherapy in tubal pregnancy treatment

The degree of impairment is modified according to age.

Table 9. Degree of impairment modification according to age

Age (yr)	Delivery	Sexual function
20-34	100%	100%
35-44	60%	80%
45-50	20%	70%
Above 51	0%	50%

female reproductive organs is strongly influenced by ovarian function which changes with aging. Physiologic changes, before and after menopause, are very important when evaluating and estimating female reproductive organ impairment.

Guideline for evaluation of fallopian tube and ovary impairment
(Table 7, 8)

The Fallopian tubes transport ova, and spermatozoa. The ovaries develop and release ova and secrete sex and reproductive hormones.

Symptoms and signs

Vaginal bleeding or discharge, fallopian tube stenosis or obstruction, abnormal morphologic characteristics, pelvic masses or neoplasia, absent, infrequent, or abnormal ovulation, abnormal hormone secretion, menstrual dysfunction, etc.

Disorder grade

Objective techniques useful in evaluating fallopian tube and ovarian function include, but are not limited to, cervical and vaginal cytologic smears, pelvic roentgenography, hysterosalpingography, ovarian biopsy, blood and urine hormonal assays, ultrasonogram, computed tomography, magnetic resonance imaging, laparoscopy, and basal body temperature studies.

Disorder is graded by symptoms or signs related to vulva

Table 10. Guideline for evaluation of uterine impairment

Grade of impairment	Amount of disability		
	Body impairment	Organ impairment	Description
1	20%	46-100%	The impairment of pregnancy potential is 46 to 100%
2	9-17%	31-45%	The impairment of pregnancy potential is 31 to 45%
3	1-7%	15-30%	The impairment of pregnancy potential is 15 to 30%
4	0%	-15%	The impairment of pregnancy potential is less than 15%

The degree of impairment is modified according to age.

or vaginal disease, the need of continuous treatment, the possibility of delivery or sexual intercourse.

The degree of impairment is modified according to age (Table 9).

Guideline for evaluation of uterus and cervix impairment (Table 10)

The most important function of uterus is to maintain pregnancy. Impairment of uterine corpus and cervix may have an effect on the maintenance of pregnancy. Because maternal age is also an important factor for pregnancy, it is strongly recommended to consider in assessing uterine function. In this part, we excluded fertility disadvantage related to ovarian function which is shown by menstrual dysfunction. Uterine impairment is confined to organ impairment rate. Diagnostic tools for assessing uterine impairment are listed in Table 11.

We calculated final uterine impairment by multiplying the rate of age-related uterine impairment and the rate of disease-related uterine impairment (Table 12).

Symptoms and signs

Women with uterine impairment do not show specific symptoms and signs. Most of them visit a hospital due to menstrual dysfunction and infertility. The others are women who experienced hysterectomy because of uterine myoma or cancer.

Disorder grade (Table 10)

Disorder is graded by percentage of pregnancy potential.

Disorder is graded by percentage of pregnancy potential.

If women have more than one morbid conditions of uterus, the sum of the rate of disease-related uterine impairment is considered as her total impairment rate. When it exceeds 100%, 100% is considered as her total diseases-related uterine impairment rate. The only exception is a case of hysterectomy. In this case, 100% impairment is assigned regardless of women's age.

If the degree of uterine impairment is changed (for example, in cases of hysterectomy, septostomy, or adhesiolysis), it should be reassessed.

Guideline for evaluation of female external genitalia impairment (Table 13, 14)

The vulva has cutaneous, sexual, and urinary functions. Urinary function is discussed in the urinary system. The vagina

has a sexual function and also serves as a birth passageway. The clitoris is an erectile organ that has an important role in sexual functioning.

Symptoms and signs

Sensation alteration or loss, lubrication loss, partial or complete absence of vulva and vagina, vulvovaginitis, vulvitis, vaginitis cicatrization, ulceration, stenosis, atrophy or hypertrophy, neoplasia or dysplasia, difficulties with sexual intercourse, urination, or vaginal delivery, underlying perineal structure support defect, etc.

Disorder grade

Vulvar and vaginal impairment evaluation is divided into two guides in terms of delivery or sexual function.

Table 12. The rate of age (year)-related loss of pregnancy potential and disease-related loss of pregnancy potential

The rate of age (year)-related loss of pregnancy potential	
Age of 20 to 34:	0%
Age of 35 to 39:	20%
Age of 40 to 44:	30%
Age of 45 to 49:	50%
Age of more than 50:	100%
The rate of disease-related loss of pregnancy potential	
Uterine anomaly	
Didelphys:	20%
Unicornuate uterus:	30%
Bicornuate uterus:	20%
Septate uterus:	30%
Arcuate uterus:	20%
Incompetent internal os of cervix:	50%
Uterine synechiae	
Mild:	20%
Moderate:	40%
Severe:	80%
Uterine myoma or adenomyosis (at least one of more than 5 cm myoma in diameter):	10%
Uterine polyp:	20%
Hysterectomy, total or subtotal:	100%

Table 11. Diagnostic tools for assessing uterine impairment

Diseases	Diagnostic methods
Congenital anomaly	Hysteroscopy (or hysterosalpingography) and laparoscopy
Incompetent internal os of cervix	History*
Uterine synechiae	Hysteroscopy or hysterosalpingography
Myoma	Ultrasonography, CT, or MRI
Adenomyosis	Ultrasonography, CT, or MRI
Polyp	Hysteroscopy
Hysterectomy	Reviews of medical records

*, Women experienced at least one pregnancy loss which was related to painless cervical dilatation during the 2nd or 3rd trimester of pregnancy.

Table 13. Guideline for evaluation of vulva and vagina impairment in terms of delivery

Grade of impairment	Amount of disability		Description
	Body impairment	Organ impairment	
1	20%	100%	Vulvar or vaginal disease or deformity symptoms and signs require continuous treatment and vaginal delivery not possible if premenopausal
2	9-17%	60%	Vulvar or vaginal disease or deformity symptoms and signs require continuous treatment and limited potential for vaginal delivery if premenopausal
3	1-7%	30%	The impairment of pregnancy potential is less than 15%

The degree of impairment is modified according to age.

Disorder is graded by symptoms or signs related to vulvar or vaginal disease, the need of continuous treatment, the possibility of delivery or sexual intercourse.

The degree of impairment is modified according to age (Table 9).

DISCUSSION

In the United States, the American Medical Association's Guides (4) to the evaluations of permanent impairment have been developed and are the most commonly used source for assessing and rating an individual's permanent impairment. Even though we referred the AMA's guideline 5th edition (4) as a model, we also tried to make our own which would fit more for Korean people.

Needless to say, the ideal evaluation of impairment should depend entirely on objective findings of the patients. However, the reality is different. We just try to use more objective tools in the evaluation. And physicians could determine the rating in a comprehensive way using subjective and objective findings. We are afraid that the determination of the rating would be somewhat different depending on physicians, especially in patients with voiding dysfunction and sexual dysfunction.

Evaluation of upper urinary tract system impairment

Originally, the first Korean version of the Guideline to the Evaluation of Permanent Renal Impairment (11) was based on the guideline similar to that published by American Medical Association (4). The revised second Korean version of the Guideline to the Evaluation of Permanent Renal Impairment offers several following features.

First, we simplified grading instructions to promote consistent scoring of impairment ratings and to minimize the bias among physicians. In the previous edition, grading system was complex and complicated.

We unify these three groups (Table 15) into one group (Table 1) with deleting relatively mild symptoms and signs, such as edema, hematuria or proteinuria and renal osteodystrophy. We also clarified the definition of symptoms and signs, such as "renal anemia" as hemoglobin ≤ 10 gm/dL and "severe hypertension" as diastolic blood pressure ≥ 110 mmHg (12).

We changed methods for measuring renal function to Ccr and serum Cr level from blood urea nitrogen (BUN), Ccr and serum Cr level in the previous version. Serum Cr is the most widely used marker for GFR (13). BUN is affected by state of hydration, catabolism and liver disease. Ccr is a more accurate measure, however, there are many clinical settings where a Ccr is not available, and decisions concerning drug dosing must be based on the serum Cr. A formula that accounts for age-related decreases in GFR, body weight, and sex and allows an estimate of Ccr in men has been described by Cockcroft-Gault (12):

Table 15. Symptom and signs of chronic renal disability in the previous guideline

Group I: severe symptoms and signs	
Uremic pericarditis (more than moderate degree on echocardiography)	
Bleeding tendency	
Uremic central nervous system abnormality (confusion, disorientation, seizure)	
Group II: moderate symptoms and signs	
Uremic peripheral neuropathy	
Uremic gastroenteritis	
Fluid and Electrolyte imbalance	
Renal osteodystrophy on radiologic examination	
Renal anemia	
Metabolic acidosis	
Severe hypertension	
Uremic pruritus	
Group III: mild symptoms and signs	
Persistent hypertension or edema	
Persistent microscopic hematuria or proteinuria	

Table 14. Guideline for evaluation of vulva and vagina impairment in terms of sexual function

Grade of impairment	Amount of disability		Description
	Body impairment	Organ impairment	
1	20%	100%	Vulvar or vaginal disease or deformity symptoms and signs require continuous treatment and Sexual intercourse not possible
2	9-17%	60%	Vulvar or vaginal disease or deformity symptoms and signs require continuous treatment and Sexual intercourse possible only with some degree of difficulty
3	1-7%	30%	Vulvar or vaginal disease or deformity symptoms and signs do not require continuous treatment and Sexual intercourse possible

The degree of impairment is modified according to age.

Table 16. Grading of renal dysfunction in the previous guideline

Methods	Unit	Mild	Moderate	Severe
Ccr	mL/min	20 ≤ Ccr < 50	10 ≤ Ccr < 20	Ccr < 10
Scr	mg/dL	4 ≤ Scr < 7	7 ≤ Scr < 10	10 ≤ Scr
BUN	mg/dL	20 ≤ BUN < 50	70 ≤ BUN < 100	100 ≤ BUN

Ccr, Creatinine clearance; Scr, Serum creatinin; BUN, Blood urea nitrogen.

$$\text{Creatinine clearance (mL/min)} = \frac{(140 - \text{age in year}) \times \text{lean body weight (kg)}}{\text{plasma creatinine (mg/dL)} \times 72} (\times 0.85 \text{ in women})$$

In children, creatinine clearance can be estimated by Schwartz formula (14):

$$\text{Creatinine clearance (mL/min/1.73 m}^2\text{)} = \kappa \times \text{height (cm)} / \text{serum creatinine (mg/dL)}$$

(κ : 0.55 for children and adolescent females, 0.7 for adolescent males)

We simplified grading instructions for physicians to judge grade by either renal dysfunction or symptoms and signs, but not by both of them.

Second, we extended three grades (Table 16, 17) into four grades (Table 1) to accommodate diversity of renal impairment. We place chronic dialysis patients into the first grade and renal transplant patients into the third grade.

Third, we added new guideline for pediatric patients with permanent renal impairment, because normal serum Cr and Ccr are different according to age or body surface area of pediatric patients. We also added criteria of severe hypertension in pediatric patients in "Symptom and Signs of Chronic Renal Disability" (Diastolic pressure in child ≥ 95 percentile of normal diastolic blood pressure of same age).

Evaluation of lower urinary tract system impairment

We developed a system with special attention paid to the following points.

First, impairment grades for bladder and urethral dysfunction is incorporated. This is based on the fact that not all impairments of the lower urinary tract could be objectively demonstrated. The sole use of strict objective criteria with numerical values has a high possibility of masking actual impairments as normal findings or vice versa. An appropriate combination of both objective and subjective results is incorporated in deciding the final impairment grade to better reflect the actual degree of impairment.

Second, changes to the upper urinary tract and use of urinary diversions are incorporated in the decision of an impairment grade.

Third, a number of causes of artifact in cystometry must be recognized. There are technical issues such as pressure measurement artifacts (the presence of air bubbles, kinked tubing, incorrect placement, migration of the pressure catheters)

Table 17. Degree of renal disability in the previous guideline

1st degree:	One or more symptom and signs in Table 15 group I and One or more severe renal dysfunction in Table 16
2nd degree:	Two or more symptom and signs in Table 15 group II and One or more moderate renal dysfunction in Table 16
3rd degree:	One or more symptom and signs in Table 15 group III and One or more mild renal dysfunction in Table 16

and infusion rate artifacts (especially in neurogenic bladder) and patient-related issues, including lack of cooperation, outlet incompetence, and vesicoureteral reflux. If the bladder outlet is incompetent, urine may leak around the filling catheter and a low bladder compliance may not be diagnosed because the bladder is never adequately filled (spinal dysraphism, severe intrinsic sphincter deficiency [ISD] in an older woman, etc) (15). In this scenario, cystometry may not be the main role in rating permanent impairment of lower urinary tract system. So the findings of urodynamic study are not considered in lower urinary tract impairment evaluation.

Evaluation of male reproductive system impairment

It is difficult to exactly evaluate the ratio of impairment of organ function induced by trauma or disease, because all dysfunctions are not exposed to outside of the body. The impact of erectile dysfunction would be greatly different depending on age, marital status and occupation, etc. Erectile dysfunction is less important in old ages than in young ages. For example, the penis is not vital organ and is not needed at work, but erectile function in young patients who are sexually active is very important. Therefore, in the guideline, we added the 50% of the score expected in patients under 40 yr old, whereas we subtracted the 50% of the score expected in patients over 65 yr old. We hope that the evaluation of the genital organ impairment should be reevaluated in the future, since the living standard of Korean people is getting better.

In the guideline of impairment of genital organ function, some symptoms and signs are quantitatively evaluated by medical instruments, laboratory examinations or questionnaires, however, others would not be quantitatively evaluated by the same tools. Therefore, doctor's bias may distort the evaluation. In opposite view, some symptoms and signs are subjectively made by patients. Nevertheless, doctors can not deny patient's symptoms such as erectile dysfunction or orgasmic dysfunction.

Evaluation of female reproductive system impairment

We revised the female reproductive system with special attention paid on the following points. First, impairment of female reproductive system function is influenced by age, especially women in child-bearing age. Therefore, we consider

physiologic differences between premenopausal and postmenopausal women when evaluating and estimating female reproductive organ impairment.

Second, we tried to describe pregnancy rate according to ovarian or uterine diseases.

Third, we tried to express appropriate diagnostic tools to evaluate uterine impairment.

Fourth, we showed the rate of age-related loss of pregnancy potential and the rate of disease-related loss of pregnancy potential in terms of uterine impairment. Unlike AMA Guideline, therefore, we evaluated uterine impairment according to pregnancy potential. Fifth, we tried to divide the vulvar and vaginal impairment, into delivery and sexual function.

In conclusion, we tried our best to make this evaluation system objective, scientific, and convenient as much as possible. Nevertheless, we still find it to be revised much more. We hope that this would help many patients with impairment as well as doctors who evaluate them in the future.

REFERENCES

1. McBride ED. *Disability evaluation and principles of treatment of compensable injuries, 6th ed.* Philadelphia: JB Lippincott Co, 1963.
2. Gunnar A, Linda C, American Medical Association. *Guides to the Evaluation of Permanent Impairment, 5th ed.* New York: American Medical Association; 2000; 143-71.
3. Ministry of Health and Welfare. *Guidance for the disability grading, 2003.*
4. Li Z, Kang SH, Lee SD. *Review of Korean Disability Evaluation Systems and Suggestions for the Improvement Direction.* *Korean J Leg Med* 2007; 31: 16-30.
5. American Medical Association. *Guides to the evaluation of permanent impairment, 6th ed.* New York: American Medical Association; 2007: 129-58.
6. Lee KS. *Assessment of physical impairment and disability evaluation: problem of present system and design for better system.* *J Korean Neurosurg Soc* 1994; 23: 276-82.
7. Ministry of Health, Labor and Welfare in Japan. *Outline of the Systems and Basic Statistics in Annual Reports on Health and Welfare 1998-1999 Social Security and National Life from white paper and reports. Volume 2-II, 2007* (www-admin@mhlw.go.jp).
8. Rosen RC, Hatzichristou D, Broderick G, et al. *Clinical evaluation and symptom scales: Sexual dysfunction assessment in men.* In: Lue TF, Basson R, Rosen R, et al ed. *Sexual Medicine: Sexual Dysfunctions in Men and Women, Paris: Health Publications; 2004; 173-220.*
9. Baker LA, Sigman D, Mathews RI, Benson J, Docimo SG. *An analysis of clinical outcomes using color Doppler testicular ultrasound for testicular torsion.* *Pediatrics* 2000; 105: 604-7.
10. Carter SS, Shinohara K, Lipshultz LI. *Transrectal ultrasonography in disorders of the seminal vesicles and ejaculatory ducts.* *Urol Clin North Am* 1989; 16: 773-90.
11. Korean Medical Association. *Guides to the Evaluation of Permanent Impairment, 1st ed.* Seoul: Korean Medical Association; 2005.
12. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, Jones DW, Materson BJ, Oparil S, Wright JT Jr, Roccella EJ; Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. National Heart, Lung, and Blood Institute. National High Blood Pressure Education Program Coordinating Committee. *Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure.* *Hypertension* 2003; 42: 1206-52.
13. Denker BM, Brenner BM. *Azotemia and urinary abnormalities.* In: *Harrison's Principles of Internal Medicine.* Kasper DL, Braunwald E, Fauci AS, Hauser SL, Longo DL, Jameson JL, eds. 16th ed. New York: McGraw-Hill; 2005.
14. Schwartz GJ, Haycock GB, Edelmann CM Jr, Spitzer A. *A simple estimate of glomerular filtration rate in children derived from body length and plasma creatinine.* *Pediatrics* 1976; 58: 259-63.
15. Andrew C, Peterson MD, George D, Webster MD. *Urodynamic and Videourodynamic Evaluation of Voiding Dysfunction.* In: Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA, editors. *Campbell-Walsh urology, 9th ed.* Philadelphia: Saunders; 2007; 1986-2010.