

Appropriateness Ratings in Cataract Surgery

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This study aimed to evaluate the appropriateness of cataract surgery and identify the characteristics of patients and surgeons, clinical and functional outcomes, and surgical methods associated with appropriate cataract surgery. For this purpose, Korean cases of cataract surgery were rated as either 'necessity', 'appropriate', 'uncertain' or 'inappropriate', based on RAND/UCLA Ratings.

For this assessment, the cases of 222 patients who underwent cataract surgery, on either one or both eyes, were studied. The surgeries were performed by 20 ophthalmologists practicing at one of fourteen medical institutions (university hospitals and general hospitals). Patients were interviewed and clinical data collected. The Doctors were questioned with self-entered questionnaire forms. The medical records were also examined to gain an understanding of the surgical process.

The ratings were as follows: 30.6% (68 patients) of surgeries belonged to the bracket "necessity", 46.4% (103 patients) to "appropriate", 15.3% (34 patients) to "uncertain" and 7.7% (17 patients) to "inappropriate". In this study, "necessity" and "appropriate" were defined as "appropriate" (77.0%, 171 patients), and "uncertain" and "inappropriate" as "inappropriate" (23.0%, 51 patients). The low preoperative Snellen visual acuity and visual function, advanced age and male patients were associated with appropriate surgery.

It is concluded that appropriate surgery was related to the clinical and functional outcomes (visual acuity and visual function) and patient characteristics (age and male).

Key Words: Appropriateness ratings, cataract

INTRODUCTION

Increasing attention is being paid to the rate

differences in population-based use of medical and surgical procedures.¹⁻⁶ Since the clinical characteristics of patients may contribute to variations in use rates, a methodology for assessing the appropriateness of the indication for the use of a procedure is necessary.⁷ The concepts of 'being appropriate' and 'providing necessary care' are fundamental to the creation of an efficient and equitable health-care delivery system. The evidence of inappropriate overuse and underuse of procedures has been documented in health systems characterized by utilization review or the pressure of requiring a second opinion. Health systems should function in such a way that inappropriate care is progressively reduced. The ability to determine and identify which forms of care are overuse or underuse is essential to this function. To this end the RAND/UCLA Appropriateness Method (RAM) was developed by RAND Corporation and UCLA (University of California, Los Angeles) in the 1980s. The appropriateness criteria developed in early RAND studies were used as a tool to retrospectively measure performance.⁸ In order to detect overuse, the criteria were applied to representative samples of patients that had received the procedure, and the proportion of procedure performed for inappropriate reasons determined.

The appropriateness criteria are now used prospectively as the basis for developing different clinical decision aids. The method (RAM) has been applied to certain conditions and procedures in many countries, including Canada, Israel, Italy, the Netherlands, Spain, Sweden, Switzerland and the United Kingdom, and its use continues to expand into other countries, particularly in

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Western Europe.^{9,10}

Cataract surgery is one of the most frequently performed procedures in Korea; 146,889 cases of surgery were performed at a cost of 141 billion Won in 2002.¹¹ In the United States, the number of cases has increased significantly in recent years.^{12,13}

Cataract surgery was selected as one of four procedures that were evaluated as a part of the Clinical Appropriateness Initiative; the evaluation was undertaken by RAND, the Academic Medical Center Consortium (AMCC) and the American Medical Association (AMA).⁷ An expert panel in RAND, after having read a literature review summarizing the risks and benefits of the procedure in the United States, made explicit decisions about the appropriateness of various indications for extracapsular cataract extraction, including phacoemulsification and insertion of an intraocular lens.¹⁴ The appropriateness methods dealt with the deficiencies of outcome data by asking experts to provide an assessment of the surgery's appropriateness after they had reviewed the available information. It recognized that physicians had a wealth of knowledge, education and experience that enabled them to make sound judgments about the validity of the outcome data, as well as when data was absent. It also recognized that for a great many clinical situations consensus actually existed.

The strength of the "appropriateness method" was that it evaluated all the available outcome information, was efficient and comprehensive, and that the recommendations were applicable at the time they were rendered. The weakness of the method was that it was limited by the available outcome data and that group judgments were subjective.¹⁵ Because of the latter, rigorous methods must be used to structure the formation and frame of any judgment.

The appropriate ratings of surgery were classified from 1 (Inappropriateness) to 9 (Appropriateness) based on the decisions of the expert panel by the variables: visual acuity, visual function, surgery of one or both eye and complications with an eye. The importance and trend of the variables, which were not informed, needed to be defined and objectively predicted by the physician before surgery. The factors associated

with appropriate surgery are the important patient characteristics relevant to assessing the outcomes of cataract surgery and that may be of benefit to the physician and patient in the decision making with regard to the need for cataract surgery.

In this study, using the cataract appropriateness ratings developed by RAND/UCLA in 1993,¹⁵ 222 cataract surgery patients, at fourteen participating institutions in Korea, were evaluated. The purposes of this study were: 1) to rate cataract surgery as "necessity", "appropriate", "uncertain" or "inappropriate", based on the RAND/UCLA Ratings, and 2) to identify the factors associated with "appropriate" cataract surgery. The factors were the patient and surgeon characteristics (age, gender, marital status and education, and years of practice and the annual volume of surgery, respectively), the clinical and functional outcomes (visual acuity, visual function and symptoms) with vision, satisfactions with vision, overall care and health status and surgical methods (extracapsular cataract extraction, phacoemulsification), etc.

MATERIALS AND METHODS

Subjects

222 patients that had undergone cataract surgery for either one or both eyes were studied. The surgery was performed by one of 20 ophthalmologists from the fourteen practicing institutions (university hospitals and general hospitals), between March and June 1997. Patients who had previously undergone cataract surgery were excluded from the study. Data were collected from 389 patients, with 167 not fitting any of the indications in the cataract appropriate ratings of the RAND/UCLA; the critical data of these 167 patients, such as visual acuity, were not documented; so these patients could not be assessed for appropriateness by the indications.

Patients that had undergone surgery were interviewed, and their clinical data collected. The Doctors were questioned with self-entered questionnaire forms. The patient medical records were examined to gain an understanding of the surgical

process. The patients enrolled in this project were informed of the requirement to undergo a 30-40 minute interview prior to their cataract surgery.

Table 1. presents a comparison of the general and clinical characteristics, and surgeon characteristics between the study (n=222, 57.1%) and excluded

Table 1. Comparison of the Preoperative Characteristics Between the Study (n=222) and Excluded Patients (n=167)

Variables	Study Patients	Excluded Patients	p value (χ^2 - test/t- test)
Age, yrs mean \pm SD*	62.41 \pm 12.94	63.26 \pm 13.93	0.541
Gender			
Male	105 (47.30)	74 (44.31)	0.630
Female	117 (52.70)	93 (55.69)	
Education, yrs			
\leq 6	43 (23.50)	41 (31.30)	0.200
7-12	69 (37.70)	50 (38.17)	
\geq 13	71 (38.80)	40 (30.53)	
Marital Status			
Married	152 (70.70)	96 (65.31)	0.332
Others [†]	63 (29.30)	51 (34.69)	
Operated Eye VA [‡] median(range)	20/80(20/20-HM [¶])	20/125(20/20-HM)	0.333
VF-14 [§] mean \pm SD	65.71 \pm 24.77	66.52 \pm 26.20	0.757
Symptom Score mean \pm SD	5.29 \pm 3.65	5.31 \pm 4.01	0.967
Satisfaction with Vision mean \pm SD	26.73 \pm 23.62	27.57 \pm 25.08	0.738
Satisfaction with Overall Care mean \pm SD	55.88 \pm 18.87	56.13 \pm 18.48	0.897
Subjective Health Status mean \pm SD	42.69 \pm 24.96	38.46 \pm 23.99	0.101
Relative Health Status mean \pm SD	61.12 \pm 23.26	56.41 \pm 25.16	0.065
Other Ocular Disease			
Yes	37 (16.67)	26 (21.67)	0.321
No	185 (83.33)	94 (78.33)	
Surgical Method			
ECCE	23 (11.62)	14 (11.97)	1.000
Phacoemulsification	175 (88.38)	103 (88.03)	
Operated Eye Side			
One	97 (44.09)	93 (56.36)	0.023
Both	123 (55.91)	72 (43.64)	
Years of Practice, yrs			
\leq 10	38 (17.12)	20 (11.98)	0.206
$>$ 10	184 (82.88)	147 (88.02)	
Annual Volume of Surgery, cases			
\leq 200	55 (24.77)	25 (14.97)	0.025
$>$ 200	167 (75.23)	142 (85.03)	

*Standard Deviation; [†]including Separated and Unmarried; [‡]Visual Acuity; [§]Visual Function-14; ^{||}Extracapsular cataract extraction; [¶]only detect Hand Motion(VA 20/2000).

patients (n=167, 42.9%). The surgery to one or both eyes and the surgeon's annual volume of surgery showed statistically significant differences between the two patient groups.

RAND/UCLA appropriateness method (RAM)

In order to evaluate the appropriateness or inappropriateness of performing procedures in a wide variety of specified clinical situations, the Rand Corporation's Health Sciences Program has used a literature analysis and assessment performed by expert panels. The publications were a six-volume series, JRA-01 to JRA-06, each containing literature reviews, indications, appropriateness ratings and necessity ratings for a specific procedure. The companion volumes deal with coronary artery bypass graft, percutaneous transluminal coronary angioplasty, coronary angiography, abdominal aortic aneurysm surgery, carotid endarterectomy and cataract surgery.⁸ For cataract surgery, in 1993, the expert panel, after reading extensive reviews of the literature, rated 2905 indications - equated to clinical scenarios - in which cataract surgery might be performed, and rated them on a scale from 1 to 9 (inappropriate to appropriate).⁸ The JRA-06 (Cataract Surgery: A Literature Review and Ratings of Appropriateness and Cruciality) was published by RAND.¹⁵

In this study, 222 cases of cataract surgery in Korea were abstracted and entered into a computerized study database. Each surgery, which had sufficient data derived from patient data and medical records, was then assigned to a specific indication of the RAND/UCLA cataract appropriateness ratings (JRA-06) using a program that linked the patient data and clinical scenarios. The details of the RAM relating to cataracts are described in the next section.

Indications and appropriateness criteria of cataract RAM (JRA-06)

The indications by the RAND/UCLA criteria consisted of a series of detailed clinical scenarios describing clinical situations that might be encountered in clinical practice. The final list of 2905 clinical situations or "indications" was divided into four chapters: 1) unilateral cataract

without other ocular pathology, 2) bilateral cataracts without other ocular pathology, 3) unilateral cataract with other ocular disease and 4) bilateral cataracts with other ocular disease. Each indication included visual acuity in the eye which was to undergo surgery and in the contralateral eye, and the extent of the impairment of visual function.¹⁵⁻¹⁹ Visual Function was characterized by specific impairments, described by the following: "patient experiences visual impairment from glare", "patient expresses difficulty with recreation, watching television, or reading due to vision", "patient experiences employment limitations due to vision", "patient expresses difficulty with Activities of Daily Living (ADLs)¹⁴ believed in part due to cataract" and "nonspecified visual impairment and no impairment".

The ADLs included "basic" activities, such as bathing, eating, dressing, shopping and light housework. All functional impairments recorded in the patient record were entered into the study database.

The following comorbid ocular conditions were also included in the indications: severe myopia, macular degeneration or retinal detachment, endothelial corneal dystrophy, diabetic retinopathy, open angle glaucoma, previous glaucoma surgery, branch retinal vein occlusion, extraocular muscle palsy, Fuchs heterochromic iridocyclitis and iritis/chorioretinitis. Some ocular diseases were considered to occur so infrequently that they were excluded from the indications.

The panel rating the indications for cataract surgery was composed of nine physicians (5 ophthalmologists, 1 geriatrician, 1 family practitioner and 2 internists). The panelists performed three separate rounds of indication ratings. In each round, each clinical scenario was rated on a scale from 1 to 9. The "appropriate" indications had a median panel rating of 7, 8 or 9, which implied that the expected benefit of the procedure exceeded the risk by a sufficiently wide margin, which justified the risk.

"Inappropriate" meant that the indication had a median panel rating of 1, 2 or 3, signifying the risks were deemed to exceed the benefits. The "uncertain" indications were for procedures which had either a median rating of 4, 5 or 6, or substantial disagreement among the panel

members pertaining to the benefits and risks (i.e., three or more panelists rated the indication as appropriate and three or more rated it as inappropriate). At the end of round 3, 43% of the indications were rated appropriate: 36% inappropriate: 17% uncertain due to a median rating of 4, 5 or 6, and 4% uncertain due to disagreement.^{15,17} The entire list of indications was published in 1993.¹⁵ In addition, all the indications rated as "appropriate" without disagreement were re-rated as "necessity". 32% percent of the indications were rated as "appropriate" and "necessity".¹⁷

Data collection

Appropriateness ratings

The appropriateness ratings in this study were defined as follows: "necessity" or "appropriate" were rated as "appropriate", and "uncertain" or "inappropriate" as "inappropriate".

Vision function-14 (VF-14)

The interview included the VF-14 test, a reliable and valid function impairment test in patients with cataract.^{19,20} The VF-14 is an index that measures the amount of difficulties that patients experience in performing 14 vision-dependent activities of daily living, such as driving day and night, reading small print, watching television and doing fine handwork. For each of the 14 items addressed by the index, a score of four was assigned to a patient who reported "no difficulty" with the activities; and scores of 3, 2 or 1 were assigned to a patient who reported "a little", "a moderate amount" or "a great deal" of difficulty, respectively, and a score of zero was assigned to a patient who was "unable to do" the activity due to his/her vision.

A patient's scores for all the activities that were performed with no difficulties and not performed due to visual impairment were averaged; the yielded average score was between 0 and 4. The average score was then multiplied by 25, which produced the possible final score ranging between 0 (unable to do any applicable activities because of vision) and 100 (able to do all applicable items without difficulty).

Visual acuity

Snellen visual acuity was obtained from the clinical records, and was assessed by the logarithms of minimum angles of resolution (logMAR),^{14,21} in which the scale was extended by assuming that counting fingers is equivalent to 20/1000; hand motion, 20/2000 and light perception, 20/4000.

Satisfaction with vision

Patients were asked questions in relation to the overall satisfaction with their vision; they replied that they were "very satisfied", "moderately satisfied", "moderately dissatisfied" or "very dissatisfied" with their vision; the scores for each reply were 100, 66.7, 33.3 and 0, respectively.

Symptoms with vision

Patients were asked whether they were bothered by any of the six symptoms commonly reported by cataract patients: double or distorted vision, halos or glare, blurry vision, disturbing brightness, color distortion and worsening vision. A score of 3, 2, or 1 was assigned to a patient according to the severity of the symptoms: "very bothered", "somewhat bothered" or "slightly bothered", respectively. A score of 0 was assigned to a patient who did not have any of the symptoms or was not at all bothered by them. A patient's scores for each of the six symptoms were then summed; the result showed that the cataract symptoms score ranged from 0 (no symptoms or not at all bothered by any of the symptoms) to 18 (very bothered by all 6 symptoms).

Satisfaction with overall care

Satisfaction with the overall care was divided into three areas: the first eleven questions related to interpersonal care, the second eleven to explanations by the physician and the last fourteen to satisfaction with the hospital services. In total there were 36 questions. The replies were rated as "extremely satisfied", "very satisfied", "satisfied", "moderately satisfied" or "dissatisfied", with scores of 100, 75, 50, 25 and 0, respectively.

Surgeon characteristics

For the ophthalmologists, years of practice were classified into 1-10 or 11 and longer; the annual volumes of surgery were rated as 5-200 or 201 and

more.

Subjective and relative health status

A patient's subjective and relative health status were rated in 5 levels: "extremely well", "very well", "well", "moderate" and "poor"; with scores of 100, 75, 50, 25 and 0, respectively.

Statistical analyses

The cases of cataract surgery performed in Korea were rated as "necessity", "appropriate", "uncertain", or "inappropriate", based on the RAND/UCLA Ratings. The median was used to measure the central tendency of the nine panelists' ratings and the mean deviation from the median was used to measure the dispersion of the rating in the process of determining the panel's ratings.

Chi-Squared and t-tests were used to compare the general and clinical characteristics, and surgeon characteristics between the appropriate and inappropriate patients. A multiple logistics regression analysis was used to identify the categories of patients associated with appropriateness ratings to surgery. The dependent variable was the appropriate surgery patients, the independent variables were patients' characteristics (age, gender, marital status and education), and the clinical and functional outcome variables (visual acuity, visual function, satisfaction with vision, satisfaction with overall care, subjective and relative health status), operated eye (one or both eyes), other ocular diseases, surgical methods (extracapsular cataract extraction, phacoemulsification) and surgeons' characteristics (years of practice, the annual volume of surgery).

RESULTS

The surgery was rated as follows; 171 (77.0%)

cases were rated as "necessity" or "appropriate" and 51 (23.0%) as "uncertain" or "inappropriate" (Table 2). After applying the appropriate ratings, the general and clinical characteristics, and surgeon characteristics were compared between the appropriate and inappropriate patients (Table 3). Variables, such as visual acuity, VF-14, symptom and age, showed statistically significant differences between the two patient groups. The mean visual acuity, VF-14 and symptom scores were 0.82 and 0.39 ($p < .001$), 61.74 and 79.29 ($p < .001$), and 5.59 and 4.29 ($p < .025$) in the appropriate and inappropriate patients, respectively. The mean ages were 63.8 and 57.9 years, respectively ($p < .004$).

To assess the association between the patient and surgeon characteristics, clinical and functional outcomes, the surgical method and appropriateness of cataract surgery, multiple logistics regression analyses were performed (Table 4). Patients with a higher preoperative VF-14 score (little preoperative dysfunction) were 0.96 times more likely (odds ratio, 0.956; 95% CI, 0.93-0.98) to have appropriate surgery compared to those with a greater preoperative dysfunction. Similarly, those with higher preoperative cataract visual acuity scores (worse visual acuity) were approximately thirty three times more likely (odds ratio, 33.401; 95% CI, 6.66-167.47) to show appropriate surgery compared with those with lower visual acuity scores (better visual acuity). Age was also independently associated with the likelihood of appropriate surgery. Those at an older age were 1.05 times (odds ratio, 1.051; 95% CI, 0.982-1.083) more likely to experience appropriate surgery than those at a younger age, and men were 3.29-fold (odds ratio, 3.289; 95% CI, 0.767-6.809) more likely to experience appropriate surgery than women. Appropriate surgery was related to the clinical and functional outcomes (visual acuity and visual function) and patient characteristics

Table 2. Appropriateness Ratings in Cataract Surgical Patients

Appropriateness ratings	Patients (%)
Appropriate*	171 (77.03)
Inappropriate [†]	51 (22.97)
Total	222 (100.00)

*Sum of necessity (n=68, 30.6%) and appropriate (n=103, 46.4%), [†]Sum of uncertain (n=34, 15.3%) and inappropriate (n=17, 7.7%).

Table 3. Comparison of the Preoperative Characteristics According to the Appropriateness Ratings

Variables	Appropriate(n=171)	Inappropriate(n=51)	p value (χ^2 - test/t- test)
Age, yrs mean \pm SD*	63.78 \pm 12.42	57.90 \pm 13.69	0.004
Gender			
Male	82 (78.10)	23 (21.90)	0.843
Female	89 (76.07)	28 (23.93)	
Education, yrs			
\leq 6	36 (83.72)	7 (16.28)	0.340
7 - 12	56 (81.16)	13 (18.84)	
\geq 13	52 (73.24)	19 (26.76)	
Marital Status			
Married	114 (75.00)	38 (25.00)	0.200
Others [†]	53 (84.13)	10 (15.87)	
Operated Eye VA [‡] mean \pm SD	0.82 \pm 0.48	0.39 \pm 0.34	<.001
VF-14 [§] mean \pm SD	61.74 \pm 23.23	79.29 \pm 25.27	<.001
Symptom Score mean \pm SD	5.59 \pm 3.70	4.29 \pm 3.31	0.025
Satisfaction with Vision mean \pm SD	26.79 \pm 24.81	26.53 \pm 19.22	0.939
Satisfaction with Overall Care mean \pm SD	55.43 \pm 18.21	57.39 \pm 21.04	0.517
Subjective Health Status mean \pm SD	42.01 \pm 25.79	45.00 \pm 24.99	0.458
Relative Health Status mean \pm SD	61.31 \pm 23.18	60.50 \pm 23.74	0.830
Other Ocular Disease			
Yes	24 (64.86)	13 (35.14)	0.087
No	147 (79.46)	38 (20.54)	
Surgical Method			
ECCE	17 (73.91)	6 (26.09)	0.935
Phacoemulsification	135 (77.14)	40 (22.86)	
Operated Eye Side			
One	73 (75.26)	24 (24.74)	0.744
Both	96 (78.05)	27 (21.95)	
Years of Practice, yrs			
\leq 10	30 (78.95)	8 (21.05)	0.923
$>$ 10	141 (76.63)	43 (23.37)	
Annual Volume of Surgery, cases			
\leq 200	42 (76.36)	13 (23.64)	1.000
$>$ 200	129 (77.25)	38 (22.75)	

*Standard Deviation, [†]including Separated and Unmarried, [‡]LogMAR Visual Acuity, [§]Visual Function-14, ^{||}Extracapsular cataract extraction.

Table 4. Multiple Logistic Regression Analysis of the Association between Patient and Ophthalmologist Characteristics, and Preoperative Visual Outcomes and Appropriate Surgeries

Variables	Odds	95% CI [§]	p value
Preop. Operated Eye VA*	33.401	6.662 - 167.471	<0.001
Preop. VF-14 [†]	0.956	0.932 - 0.981	<0.001
Preop. Symptom Score	1.089	0.940 - 1.261	0.258
Preop. Satisfaction with Vision	1.022	0.999 - 1.047	0.065
Preop. Satisfaction with Overall Care	0.994	0.969 - 1.020	0.670
Preop. Subjective Health Status	1.002	0.974 - 1.031	0.876
Preop. Relative Health Status	0.999	0.972 - 1.026	0.916
Other Ocular Disease (yes)	0.473	0.152 - 1.471	0.196
Operated Eye Side (both)	0.735	0.282 - 1.917	0.203
Age	1.051	0.982 - 1.083	0.036
Gender (male)	3.289	0.767 - 6.809	0.046
Education, yrs (ref: 6 or less)			
7-12	1.906	0.573 - 6.348	0.293
13 or more	2.308	0.549 - 9.709	0.254
Marital Status (married)	0.652	0.193 - 2.200	0.490
Surgical Methods (ECCE [‡])	1.752	0.369 - 8.321	0.481
Years of Practice, yrs (11 or more)	0.777	0.104 - 5.778	0.805
Annual Volume of Surgery, cases (201 or more)	2.563	0.433 - 15.176	0.300

*LogMAR Visual Acuity, [†]Visual Function-14, [‡]Extracapsular cataract extraction, [§]Confidence Interval.

(age and gender). The lower preoperative Snellen visual acuity and visual function levels, advanced age and male patients were more associated with appropriate surgery.

DISCUSSION

In the era of "evidence-based medicine", the question "what do we do when the evidence is insufficient?", must be asked. It is untenable to simply stop providing a certain treatment, but surgeons, patients and third-party payers need standards by which they can evaluate the appropriateness of care. To help them make decisions on the treatment for cataract surgery the RAND/UCLA method was used, which is gaining wide acceptance.²²

Although the appropriateness method has been subject to harsh critique, and the sensitivity and specificity of the panel's decision are not fully established,²³ the method provides a framework

for the analysis of the appropriateness of clinical practice. The appropriateness criteria can provide guidance for doctors who rigorously seek clinical decisions in many difficult clinical situations where there is a limited amount of definitive outcome data. Patients could decide to receive services only from doctors who agreed to operate within the guidelines based on the appropriateness, or services that satisfied the generally accepted criteria of appropriateness. Ratings could also be used to prevent the underuse of necessary care.²⁴

Doctors and patients would take a few minutes to enter all the clinical data into a computer, which could be critical in determining whether the procedure should be performed. In a few seconds the computer could produce an appropriateness rating, an analysis explaining the rating, and an indication of the basis for the rating (that is, mostly scientific literature or expert opinion). The patients and doctors could do their own sensitivity analyses (i.e., to examine with the

aid of the computer how changes in the patient's symptoms, signs or responses to treatment would alter the appropriateness of the procedure) and explore ways of alleviating adverse clinical circumstances.²³

In this study, the cataract surgery procedures were rated as follows: "appropriate surgery" (77.0%) as "necessity" (30.6%) or "appropriate" (46.4%), and "inappropriate surgery" (23.0%) as "uncertain" (15.3%) or "inappropriate" (7.7%). Tobacman et al.¹⁴ demonstrated in 1996 that 39% of procedures were "necessity", 52% "appropriate", 7% "uncertain" and 2% "inappropriate"; the inappropriate rating was close to the 1.7% result of the earlier Inspector General's report and the 2.5% estimate of the 1993 General Accounting Office.^{25,26} In this study, it was found that the appropriate (necessity or appropriate) rating was 14% lower and the inappropriate (uncertain or inappropriate) rating 14% higher than the 1996 study result.

7.7% of the inappropriate rates in this study were higher than those of previous studies. Some of this discrepancy was owing to the lack of a consistent definition as to what was considered appropriate and some to the fact that the U.S. appropriateness ratings were applied to our study patients.

The general, clinical and surgeon characteristics were tested between the appropriate and inappropriate patients. The results found lower levels of the mean visual acuity and VF-14 scores, and the higher symptom scores and older ages were in the appropriate rather than inappropriate patients.

A multiple logistics regression analysis was used to identify the factors of associated with appropriate cataract surgery. The lower preoperative visual acuity and visual function, which were the clinical and functional outcomes, older age and male, which were the patient characteristics, were associated with appropriate surgery. Tobacman et al.,¹⁴ in 1996, founded that the majority of the surgeries rated as necessity or appropriate had lower levels of visual acuity and visual function in the surgical eye, reflecting the assignment of the indication that the panel had rated as necessity or appropriate. The result of this study was similar to that of the previous investigation in 1996, where the lower levels of

visual acuity and visual function in cataract surgery patients were more appropriate to the ratings than the higher levels of acuity and function. Previous research has demonstrated that the resulting loss of visual acuity has important implications for physical function,²⁰ potentially cognitive function²⁷ and independent living. Applegate et al.²⁰ previously reported that the most appropriate indication for the surgical procedure was the patient-reported visual function disability attributable to the presence of cataracts.²⁰ Schein et al.²⁸ reported that the lower levels of VF-14 and a preoperative age of 74 or younger were predictors of better patient outcomes, which were defined as an improvement in one or more of the measures - visual acuity, symptom score or VF-14 score - 4 months after cataract surgery, but there were gaps in the meaning of the comparison of an appropriate surgery and better outcomes. With an appropriate surgery the expected benefit from the procedure should exceed that of the risk,¹⁵ and would ultimately be considered the better outcomes. Our results were different, in that older age was associated with appropriate surgery, and an age of 74 or younger was associated with better outcomes. The reason for this difference could be that the mean age of the patients was younger in this study (mean \pm standard deviation; 62 ± 13) than in the previous study (72 ± 8 years).²⁸ The male patients were associated with appropriate surgery in our results. A previous study¹⁴ showed that patient's characteristics, such as age and gender were not associated with appropriate surgery. The differences in the surgery of one or both eyes and the surgeon's annual volume of surgery between the study and excluded patients were found to be unrelated to the results of appropriate surgery.

This study did have its limitation, in that its result could not be applied generally, as it was conducted only in university and general hospitals. Future study will be required to apply our practice settings to cataract surgery so that they can be evaluated by a modified version of the indications developed by the RAND/UCLA appropriateness. In addition, updating the ratings to incorporate new research findings is essential. We conclude that, appropriate surgery was re-

lated to the clinical and functional outcomes (visual acuity and visual function) and patient characteristics (age and male).

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