Published in final edited form as:

Asia Pac J Ophthalmol (Phila). 2012 ; 1(3): 147–151. doi:10.1097/APO.0b013e3182531e89.

Inequities in Cataract Surgery and Postsurgical Quality-of-Life Outcomes in Handan, China

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Abstract

Purpose—This study aimed to describe the rate of cataract surgical coverage (CSC) and the quality-of-life (QoL) outcomes after cataract surgery in rural China.

Design—Cross-sectional study.

Methods—A clustered, random sampling procedure was used to select 7557 Chinese patients aged 30 years and older from Handan, China. Comprehensive eye examinations, including standardized refraction and classification of lens characteristics, were offered to all eligible subjects. Visual impairment was defined as any individual with presenting visual acuity of less than 20/60 in the better-seeing eye. The main outcome measures were CSC rate and a summary measure assessing QoL in visually impaired (VI) participants.

Results—Of 5592 participants older than 40 years, there were 41 cataract patients operated on and 54 VI cataract patients not operated on. The CSC rate among individuals with VI was 43.2%. Older age was significantly negatively associated with a history of cataract surgery (adjusted odds ratio, 0.44 per 10-year increase in age; 95% confidence interval, 0.26–0.74). Women were less likely to have had cataract surgery compared with men, although not significantly (adjusted odds ratio, 0.44; 95% confidence interval, 0.17–1.12). The QoL summary measure was significantly better in the cataract group operated on than that not operated on ($P < 0.01$).

Conclusions—There is a large unmet need for cataract surgery in rural Handan, China. Those who had surgery were more likely to have better QoL outcomes than those who did not. There is a potential need to promote cataract surgery and develop age- and sex-sensitive interventions in rural China.

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The authors have no conflicts of interest to declare.

Keywords

cataract surgical coverage rate; cataract surgery; quality of life; rural China

Cataract is the leading cause of blindness worldwide, accounting for nearly half of all cases of blindness.¹ In rural China, it is estimated that approximately a third of blindness is due to cataract.² As the rural Chinese population ages, the cataract prevalence and associated morbidities will increase, generating a greater burden on the Chinese health care system. Consequently, there is a need to identify effective approaches toward reducing this burden, especially because most of the Chinese population still resides in the countryside.

In China, the rate of cataract surgical coverage (CSC) among bilaterally blind and visually impaired (VI) individuals was estimated at 48% in Shunyi County (Beijing) and 9% in Harbin (a more remote region), respectively.^{3,4} Possible reasons for the low CSC in China have been described as negative perceptions of local health services and lack of knowledge about cataract surgery.⁵ Important sociodemographic factors associated with a lower access to cataract surgery, such as older age, fewer years of education, and female sex, have been described.^{3,6} Studies have found suboptimal quality of cataract surgery in China, noting less-than-desired improvement in postsurgical presenting visual acuity (PVA), visual function, and quality-of-life (QoL) outcomes.^{3,6,7} Despite these findings, there is still a knowledge gap surrounding current conditions of cataract surgery in rural China. This study aimed to address this gap and assess the CSC rate, the socioeconomic barriers toward obtaining cataract surgery, and the postsurgical QoL outcomes in rural China.

MATERIALS AND METHODS

Study Site and Study Participants

The study was part of the Handan Eye Study (HES), a population-based study of eye disease prevalence and risk factors among persons aged 30 years and older living in a rural county of Handan, China. Details of the HES study design, sampling plan, methodology, and baseline characteristics have been reported.² Of 7557 eligible patients, 6830 (90.4%) were examined in HES. The ethical committee in Beijing Tongren Hospital approved the research (no. TREC2006-22).

All selected individuals in the parent study were confirmed in a door-to-door census conducted by the study team. Persons were considered ineligible if they had moved out of the village, had not lived there in the past 6 months, were deceased, or were terminally ill with an estimated life expectancy of less than 3 months. Within this population, this study focused on patients 40 years and older with a history of cataract surgery or with visual impairment caused by cataract not operated on.

Data Collection

At the study clinic, all participants underwent comprehensive and standardized examination procedures, where PVA in each eye was obtained. Presenting visual acuity was measured following the Early Treatment Diabetic Retinopathy study protocol, recorded using the logarithm of the minimum angle of resolution chart at a distance of 4 m. For those who could not see any letters on the chart at 4 m, vision was tested at 1 m, allowing acuities as low as 1/40 (0.025) to be measured. If no letters could be read correctly at a 1-m distance, visual acuity was assessed and recorded as counting fingers, hand movements, or light perception. Visual impairment was defined in concordance with the World Health Organization's guidelines and was specified as any individual with low vision or worse (PVA < 20/60 in the better-seeing eye).⁸ Visually impaired patients with cataract not

operated on were those individuals whose main cause of visual impairment in the better-seeing eye was cataract. Cataract was regarded as the main cause of visual impairment if the fundus was obscured by lens opacity or if there were no evidence of fundus abnormalities in eyes with significant cataract. If there were other etiologies for visual loss, 2 senior ophthalmologists assessed the proportion of visual loss from each eye condition and used their clinical judgment to determine the main cause for low vision or blindness.

Any cataract surgery was defined as the absence, in at least 1 eye, of the crystalline lens. When comparing the VI due to cataract with those who had prior cataract surgery, the assumption was that those who had had surgery had a PVA worse than 20/60 in the better-seeing eye at the time of the surgery.

The study administered a visual function and a QoL questionnaire that were developed for a clinical trial of cataract surgery in India and subsequently used in other developing countries.^{7,9} The visual function questionnaire consisted of 1 general vision question and 12 additional questions that addressed the domains of visual perception, sensory adaptation, peripheral vision, and depth perception. The QoL questionnaire contained 12 items that focused on how visual difficulties have affected the domains of self-care, mobility, social interaction, and mental well-being. These 2 questionnaires assessed, using a 4-point scale, the amount of difficulty an individual was having with each item. Finally, socioeconomic data were collected (ie, sex, age, marital status, and education level) when subjects were initially enrolled into the study.

Data Analysis

Standard descriptive analysis was conducted to identify socioeconomic differences between cataract patients operated on and not operated on for the VI population. To calculate the CSC rate for persons with visual impairment, we assessed the ratio of cataract patients operated on to the total number of persons with cataract-causing visual impairment (ie, the sum of those operated on and those not operated on). In assessing factors associated with a history of any cataract surgery, we conducted a χ^2 analysis followed by a multiple logistic regression analysis. Possible confounding variables were prespecified before analysis and included common socioeconomic indicators (ie, sex, age, marital status, and education) used in health services analyses.¹⁰

To assess differences in visual function and QoL outcomes between patients operated on and not operated on, we constructed summary measures for each of these areas. Total visual function score and total QoL score were the sum of the responses for the individual items, converted as a percent of the maximum possible score. Thus, a score of 0 reflects a maximum problem and a score of 100 reflects no visual function problem.

Once these summary measures were constructed, we conducted a t test followed by a multiple linear regression analysis. Possible confounding variables were prespecified before analysis and included common socioeconomic indicators that are used in the analysis of health services.¹⁰ All data were analyzed with STATA 11 (Stata Corp, College Station, Tex).¹¹

RESULTS

Study Participant Characteristics

Of 5592 participants older than 40 years, there were 41 cataract patients operated on and 54 VI cataract patients not operated on (Table 1). The latter group included 15 bilaterally blind cataract patients not operated on. In the first group, 16 patients (39.0%) and 25 patients (61.0%) underwent bilateral and unilateral cataract surgery, respectively. Among those who

received unilateral cataract surgery, the mean (SD) PVA (Snellen) and logMAR PVA in the eye not operated on was 0.23 (0.32) and 0.45 (0.40), respectively.

LogMAR PVA in the better-seeing eye was significantly better among those who had undergone cataract surgery when compared with those who had not [0.5 (0.4) vs 1.2 (0.6), $P < 0.01$; Table 1]. Males and younger individuals were more likely to have had cataract surgery than their counterparts. Eighty-nine percent (48/54) of those with cataract not operated on were older than 60 years versus 75.6% (31/41) of those who had undergone cataract surgery ($P = 0.09$).

In the cataract group operated on, the response rates for the visual function and QoL questionnaires were 92.7% (38/41). However, the response rate for these questionnaires was much lower in the group not operated on (48.1%, 26/54). This low response rate in the group not operated on was because a large proportion of these individuals were examined outside a clinical setting and were either too frail or unwilling to respond to questionnaires.

Surgical Coverage

The CSC rate was 43.2% (41/95) among the VI patients. More specifically, the CSC rates for women and men were 36.7% (22/60) and 54.2% (19/35), respectively ($P = 0.10$). When the CSC rates were analyzed according to age, the rate was 62.5% (10/16) in patients younger than 60 years and 39.2% (31/79) in patients 60 years and older ($P = 0.09$).

Factors Associated With a History of Cataract Surgery

Increasing age was significantly associated with lower odds for a history of any cataract surgery (Table 2). For every 10-year increase in age, starting from age 40, the odds of having a history of any cataract surgery decreased on average by 56% [adjusted odds ratio (AOR), 0.44; 95% confidence interval (CI), 0.26–0.74]. In addition, there was a tendency for females to have lower odds for a history of any cataract surgery than their male counterparts (AOR, 0.44; 95% CI, 0.17–1.12).

Visual Function and Quality of Life

The total visual function score and all subvisual function scores, except for general vision, were significantly higher in the group operated on than in the group not operated on (Table 3). After controlling for known confounders, the total visual function score was 6.5 points (95% CI, 1.6–11.3) higher in the group operated on than in the group not operated on (Table 4).

Quality-of-life scores for all dimensions were significantly higher in the group operated on than in the group not operated on (Table 3). When multiple linear regression analysis was conducted, the total QoL score was 9.1 points (95% CI, 2.9–15.4) significantly higher in the group operated on than in the group not operated on (Table 4).

DISCUSSION

In rural Handan, China, close to 60% of the cataract VI population never had cataract surgery. Although specific reasons for not obtaining surgery were not elicited in these groups, older age and female sex were strongly associated with not having surgery. Those who obtained surgery had, on average, significantly better visual function and QoL outcomes than their VI counterparts who did not obtain surgery.

The CSC rate among the VI in this study was higher than that found in Harbin (China), Rwanda, and the Philippines but was similar to that found in Pakistan.^{4,12} The estimate from

the current study may be too high. Certainly, some of those who had prior cataract surgery were not bilaterally VI at the time of the surgery. Indeed, some of the patients with unilateral cataract surgery had relatively good current PVAs in the eye not operated on. However, to obtain the most conservative estimate of the CSC among the VI in an underserved and underresourced population, we assumed all patients operated on were VI at the time of the surgery.

Older persons with vision-impairing cataract were less likely to have had cataract surgery than younger persons. This finding is consistent with what was seen in Harbin and Shunyi China and the study of Gandaki Zone, Nepal.^{3,4,13} Reasons for the elderly not obtaining surgery were not obtained, but it is most likely multifactorial, including cost, lack of knowledge about such services, fatalism, and negative perception of cataract surgery. In developing future health services plans for an aging Chinese population, it is important to describe and address key reasons for why the elderly are less likely to obtain surgery.

Females were less than half as likely to have had cataract surgery than their male counterparts, but differences in this study were not statistically significant at the 5% level most likely because of the small numbers involved. Such a trend is consistent with other publications that demonstrate a clear sex inequity in the use of cataract surgical services and other health services.^{14,15} Once again, efforts to improve cataract surgical service uptake need to address why women are substantially less likely to use these services than men are.

Visual function and QoL outcomes were significantly better among the cataract blind patients operated on than those not operated on even after controlling for possible confounders. This was contrary to what was found in Shunyi, China, showing no significant differences.⁷ It is possible that our study overestimated the effects of cataract surgery because the preoperative visual status of patients operated on may not have been as poor as we assumed. However, these results may underestimate the overall benefits of surgery because it does not account for other potential health benefits including reduced chance of falls and injury.¹⁶ Policy makers should combine this information that shows positive postsurgical functional outcomes with more objective clinic outcome measures. When such information is collated, they can effectively mitigate any misconceived notions about the quality of cataract surgeries and increase its demand in Handan, China.

This is a cross-sectional study, making it difficult to assess causality. The difference in visual function and QoL may not be due to the effects of the surgery but to the underlying baseline differences that lead some to obtain surgical services and others to remain not operated on despite poor vision. In addition, there were a relatively large number of individuals in the cataract group not operated on who that did not respond to the visual function, QoL, and health outcome surveys. These nonrespondents were examined outside the clinics and at their homes because they were too sick or unwilling to make it to the local clinic and did not answer our questionnaires. When the PVAs of these non-respondents were assessed, they were worse than those of the respondents. This implies that our results are most likely an underestimate of the true differences between the groups operated on and not operated on. Last, although in most areas of rural China, besides obvious lens opacity, reduced visual acuity (<0.3) was commonly included as one of criteria for cataract surgery but not universal. The criteria for surgery for cataract patients vary from center to center. Therefore, those with cataract operated on might not be visually impaired before surgery and we might have slightly overestimated the CSC rate.

In summary, in Handan, China, there are a sizeable number of persons with poor vision due to cataract, who have not had cataract surgery despite demonstrated positive outcomes. These subjects not operated on tended to be of older age and women, reflecting inequities

within the delivery of health care in the rural Chinese setting. In developing plans to effectively provide cataract surgeries in these locations, policy makers need to address these inequities, develop a better understanding for why certain individuals do not seek or cannot seek surgery, and develop appropriate interventions. With such effort, policy makers can alleviate the future burden of cataract in rural China.

Acknowledgments

Supported by the National Basic Research Program of China (973 Program; no. 2007CB512201) from the Ministry of Science and Technology, Beijing, People's Republic of China; the Program of Health Policy for Blindness Prevention, People's Republic of China; the Key Technologies R&D Program (no. 2006-10903), Bureau of Science and Technology of Handan City, Hebei Province, People's Republic of China; Beijing Tongren Hospital, Beijing, People's Republic of China; and the Bureau of Health, Handan City, Hebei Province, People's Republic of China.

Biography

“Let no feeling of discouragement prey upon you, and in the end you are sure to succeed.”

Abraham Lincoln

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TABLE 1

Sociodemographic Characteristics of VI Cataract Patients by Surgical Status

Sociodemographic Factors	VI Cataract Patients		<i>P</i>
	Cataract Patients Not Operated on (n = 54) *	Cataract Patients Operated on (n = 41) †	
Male, n (%)	16 (29.6)	19 (46.3)	0.09
Age, mean (SD), y	74.8 (9.0)	67.8 (10.1)	<0.01
Literate, n (%)	25 (46.3)	26 (53.7)	0.10
Marital status (with partner), n (%)	31 (57.4)	26 (63.4)	0.55
PVA in better-seeing eye, mean (SD), logMar	1.2 (0.6)	0.5 (0.4)	<0.01
Type of cataract extraction (pseudophakic), n (%)	N/A	32 (78.1)	N/A

* Presenting visual acuity worse than 20/60 in the better-seeing eye.

† All cataract patients operated on are assumed to have had a PVA worse than 20/60 in the better-seeing eye at the time of surgery.

TABLE 2

Sociodemographic Factors Associated With a History of Any Cataract Surgery Among VI Cataract Patients (Multiple Logistic Regression)

Regression Variables	VI [*] (n = 95)
Age (per 10-y increase)	0.44 (0.26–0.74) [†]
Sex	
Male	1.00
Female	0.44 (0.17–1.12) [‡]
Literacy	
Nonliterate	1.00
Literate	1.19 (0.46–3.11)
Marital status	
No partner/spouse	1.00
Married/partner	0.71 (0.26–1.90)

Values are odds ratio (95% CI).

^{*} Presenting visual acuity worse than 20/60 in the better-seeing eye in patients not operated on; includes all cataract patients operated on.

[†] $P < 0.05$.

[‡] $P = 0.09$.

TABLE 3

Visual Function and QoL Scores in VI Cataract Patients by Surgical Status

Domain Scores on Questionnaire	VI Cataract Patients		P
	Cataract Patients Not Operated on (n = 26) [*]	Cataract Patients Operated on (n = 38) [†]	
Visual function, mean (SD)			
General vision	34.6 (9.0)	36.8 (7.4)	0.28
Vision perception	52.8 (17.5)	63.1 (10.9)	<0.01
Peripheral vision	58.7 (19.9)	70.4 (11.4)	<0.01
Sensory adaptation	40.0 (17.3)	50.9 (10.2)	<0.01
Depth perception	61.5 (21.5)	69.7 (0.05)	0.05
Total score	60.0 (11.5)	67.3 (6.2)	<0.01
QoL, mean (SD)			
Self-care	65.6 (15.9)	74.3 (4.06)	<0.01
Mobility	60.3 (23.3)	73.5 (5.07)	<0.01
Social	61.5 (21.5)	71.7 (10.4)	0.01
Mental	65.4 (15.0)	72.4 (7.8)	0.02
Total score	63.5 (16.6)	73.2 (5.1)	<0.01

^{*} Presenting visual acuity worse than 20/60 in the better-seeing eye.

[†] All cataract patients operated on are assumed to have had a PVA worse than 20/60 in the better-seeing eye at the time of surgery.

TABLE 4

Factors Associated With Visual Function and QoL Among VI Cataract Patients (Multiple Linear Regression)

Regression Variables	Total VF Score [†] (n = 64)	Total QoL Score [‡] (n = 64)
History of cataract surgery		
No	Reference	Reference
Yes	6.5 (1.6 to 11.3) *	9.1 (2.9 to 15.4) *
Age (per 10-y increase)	−0.8 (−3.6 to 1.9)	1.5 (−2.1 to 5.1)
Sex		
Male	Reference	Reference
Female	−3.3 (−8.5 to 2.0)	−2.0 (−8.8 to 4.9)
Literacy		
Nonliterate	Reference	Reference
Literate	−1.3 (−6.6 to 3.9)	1.1 (−5.7 to 7.9)
Marital status		
No partner/spouse	Reference	Reference
Married/partner	0.8 (−3.5 to 6.0)	1.3 (−5.5 to 8.1)

Values are odds ratio (95% CI).

* $P < 0.05$.[†]Visual function score.[‡]Quality-of-life score.