

The Mobile Eye Treatment Center project

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Abstract

In China, there are estimated to be 4.4 million cases of cataract blindness. Most of these cases reside in poor remote rural areas without access to modern medical facilities. A self-contained mobile eye treatment center was therefore constructed in order to treat cataract blindness cost-effectively in these areas. This mobile center is based on a thirty-foot truck chassis with separate compartments for consultations, operations and postoperative recovery. It was commissioned in December 1995 jointly by the Asian Foundation for the Prevention of Blindness and the Hong Kong Society for the Blind. Two hundred and one operations for extracapsular cataract extraction and intraocular lens implantation were performed in five selected locations in rural Canton, China. The overall results were very satisfactory. Serious complications were few and results compared favourably to those obtained at a well-equipped city hospital. The mobile eye treatment center is considered to be a safe and cost-effective means to combat cataract blindness in remote rural China.

Key words: *Mobile, Rural, China, Cataract, Blindness*

Introduction

Cataracts are a major cause of blindness in China. Results from the National Sample Survey of Blindness and Low Vision¹ reveal that 8.7 million people in China are registered as legally blind, of whom 4.4 million are blinded by cataracts.

Cataracts have become a severe problem facing China and many other third world countries. It is a disease readily treatable with surgery, but as yet there are no effective prophylactic or therapeutic measures available to date. This makes the treatment process slow and inefficient. Many patients are also debilitated by this condition and

accessibility to major hospitals where surgical facilities are located has become a major problem.

Adding to the complexity of the problem, most of the cases are scattered in the remote areas of China where surgical facilities are sub-optimal and manpower is inadequate. Surgical equipment is also poorly maintained by untrained technicians, adding to the cost of surgery. There is no standardised training programme for mainland Chinese ophthalmologists and their expertise varies tremendously. The post-operative results have been unpredictable and sub-optimal.

Other countries facing similar problems, like India and Nepal, have mobile eye services, bringing the facilities and experts to the patients. Cataract eye camps are very common in India. Simple low cost intracapsular cataract extractions (ICCE) are performed in rural areas using local schools as temporary hospitals. However, severe complications in well over 10% of cases have been reported. In Nepal, 7% of those operated on for cataracts have been irreversibly blinded by complications arising from the procedure.² The surgical outcome of ICCE is also far from optimal. It was reported that at least half of the people who have undergone allegedly successful surgery are blind, because they do not have aphakic glasses. The poor surgical results and the high complication rates have been an impetus for the move to extracapsular cataract extraction with primary intraocular lens (ECCE + PCIOL) implants. In one series, 74% of the patients have best corrected vision greater or equal to 6/18.³ Furthermore, patients are no longer depending on thick, inconvenient aphakic glasses for optical correction. However, the initial set-up and running costs of this type of surgery are high, and surgical skills are also more demanding than with ICCE, thus requiring a longer period for training.

In Hong Kong, impelled by the ideals of cost-effectiveness and optimal operative results, the idea for the Mobile Eye Treatment Center (METC) came into being. The aim of the Treatment Center is to centralise the facilities and human

resources such that administrative and surgical management can be standardised and supervised effectively, thus delivering high standard ophthalmic services to the rural parts of China. The Treatment Center will be involved in pre-operative assessment and operations as well as post-operative follow-up. It has the additional value of providing a platform where experienced ophthalmologists can transfer their skills to local mainland ophthalmologists.

Construction of the Mobile Eye Treatment Center (METC)

In 1994, the Shaanxi Provincial Disabled Persons Rehabilitation Office initiated the "Sight Saving and Poverty Relieving" project. The aim of the project is to screen and treat patients with cataracts in Shaanxi Province in central western China. With assistance from the Hong Kong Society for the Blind and the Asian Foundation for the Prevention of Blindness, the Mobile Eye Treatment Center (METC) began to materialise.

The design and construction of the METC has involved a team of ophthalmologists and engineers from Hong Kong and China. The ultimate goal is to create a safe, efficient and cost-effective work place that is suitable for rural parts of China. The same group of ophthalmologists will also be involved in training and education, transferring the surgical techniques of extracapsular cataract extraction and intraocular lens implantation (ECCE + PCIOL) to mainland ophthalmologists.

The initial funding for the project came from a Hong Kong philanthropist who generously donated HK\$3 million. None of the Hong Kong participants had any experience working in rural China, but did know that they were going to work in an environment in which self-reliance and self-sufficiency was essential. The METC had to be both mobile and robust. Not only would it have to withstand extreme weather conditions and rugged terrain, but would also have to provide an optimal operating environment inside the center at all times.

Our first METC was finally constructed on a converted thirty-foot tourist bus chassis and consisted of three separate compartments:

- (1) a consultation room fully equipped with modern ophthalmic diagnostic equipment such as a slit-lamp, a biomicroscope fitted with applanation tonometer, direct and indirect ophthalmoscopes, an A-scanner and a hand-held keratometer.
- (2) an operating room fitted with a full-function operating microscope with a separate binocular assistant eye-piece and a mounted video camera. To reduce the time between cases, a quick-cycle autoclave was installed. Two complete sets of micro-surgical instruments were supplied to alternate between operating sessions.
- (3) a separate living compartment at the rear end of the vehicle was provided for the working medical team. This was also used as a postoperative recovery room for the patients.

Field-Test of the METC in Canton Province

A field test was carried in Canton Province before the METC was committed to service. Five rural hospitals in Canton were selected as intermediate stops en route to Shaanxi. Prior to our arrival, suitable cataract cases were assembled by local ophthalmologists in each hospital. All the necessary preoperative assessments including slit-lamp biomicroscopy, A-scan biometry, corneal keratometry and IOL power calculation were also performed in the local hospital. All cataract operations were standard ECCE and PCIOL, scheduled to be performed on-board in the METC.

During the operation, the operating eye was dilated with gutt tropicamide 1% and gutt phenylephrine 2.5%. The periorbital skin and the conjunctival cul-de-sac were prepared with undiluted Betadine solution. A standard extracapsular cataract extraction with posterior chamber intraocular lens implantation was routinely performed. However, modifications were made to cut down the cost of the surgery.

- Hartmann's solution instead of Balanced Salt Solution was used as the irrigating solution;
- Air instead of viscoelastics was used to tamponade the anterior chamber during lens implantation;
- A pack of double-armed 10-0 nylon was routinely shared between two cases;
- No subconjunctival antibiotics injection were given. Postoperative topical gutt dexamethasone 0.1% and gutt chloramphenicol 0.5% were used.

Results

A total of 201 patients underwent cataract surgery in the METC. Of these patients 90% had visual acuity less than 6/60 and most could see either hand movements or light perception only. Fewer than 10% had visual acuity at 6/60 or better. Most of the cataracts removed were dense brunescant with many cataracta nigra. The rest were simple mature white cataracts.

The age of patients ranged from 12 years old, with bilateral congenital cataracts, to 91 years old (Table 1). Most of the patients were between 60 to 80 years old, similar to the cataract age group currently seen in Hong Kong. There were 79 males and 122 females (Table 2).

Table 1. Age Distribution of the Operated Cataract Patients.

Age (years old)	Number of Cases	% of Distribution
< 40	7	3.50
41-50	13	6.50
51-60	27	13.00
61-70	72	36.00
71-80	66	33.00
81-90	15	7.50
>90	1	0.50
Total	201	100.00

Table 2. Gender Distribution.

Sex	Number of Cases	% of Distribution
Male	79	40
Female	122	60
Total	201	100

Fifteen cases were complicated by marked fibrinous anterior chamber reactions during the first few postoperative days (Table 3). Fortunately, they all resolved quickly after treatment with topical steroid but their cause remained uncertain. It may be related to residual lens matter, but this fibrinous reaction did not occur in subsequent cases after extra time and attention were given to irrigation in cases with particularly dense dark nuclei.

Table 3. Complications of Cases.

Nature of Cases	Number of Cases	% of Total Distribution
Fibrinous reaction	15	7.5
Vitreous loss	7	3.5
Glaucoma (Pupil Block)	1	0.5
Hyphaema	1	0.5
Endophthalmitis	-	-
Total	24	12%

Seven cases had vitreous loss, which occurred mainly during nucleus expression. There was one case of pupil block glaucoma resulting in a formal surgical peripheral iridectomy. No cases of endophthalmitis were encountered. The overall complication rate compares favourably with similar operations carried out in standard hospitals.

Financial Implications

Mainland China does not have free healthcare services. The average reimbursement for a standard cataract extraction with lens implants has been fixed by the central official policy machinery at approximately HK\$3,000 (RMB3,500 - 4,000) per case. One of our main objectives was to make this capital project self-supportive. The actual cost of consumables used in the standard ECCE + PCIOL operations performed in the METC is shown in Table 4. The total cost is estimated to be HK\$592 per case. The IOL was the single most expensive item and constituted approximately 50% of the total cost.

As founders of the METC, the Hong Kong Team will pay for all the initial equipment costs, including all consumables used during the 201 skill-transferring exercise cases. Once the Mainland Local Team inherit the METC and become experienced with the surgical procedure, they will be expected to perform cataract surgery in remote areas in China. It is estimated that a fee of HK\$800 (RMB1,000) will be charged for each case. The higher fee in relation to the cost is to create a safety net so that the 'poorest of the poor' can have their cataract operations free of charge. The rest of the revenue will be used to pay for the staff and the maintenance of the METC, keeping this project financially viable. The ultimate goal is to ensure that the METC can be self-sustaining.

Table 4. Consumable Cost of Each Case.

Nature of Cost	HK\$	US\$ Equivalent
IOL	310	38.75
Viscoelastics/air	25	3.13
10-0 nylon (1 for 2 cases)	62	7.75
Hartmann's solution	14	1.75
Topical antibiotics/steroid	6	0.75
Others Including:	175	21.88
- Local anaesthetics	-	
- Dressings	-	
- Chemical Preparation etc.	-	
Total cost per case	592	74.10

The Future

One of the main problems facing ECCE in rural areas is posterior capsular opacity (PCO). One study in Vietnam with one year of follow-up³ showed that some degree of PCO was found in 40% of the cases, but was graded visually significant only in 4% of eyes. However, this does not exclude the likelihood that visually insignificant PCO will become visually significant in the long term. Compared to the incidence of PCO of 21%⁴ in urban hospitals, the higher incidence in rural settings could be related to poor surgical techniques and incomplete cortical clean-up.⁵ While the true incidence of PCO in rural settings remains to be established, the development of a low cost YAG laser may be a solution.⁶

To further reduce the cost of operations, one can use locally made intraocular lenses. It has been reported that high quality posterior chamber lenses can be manufactured locally for approximately US\$7.00.⁴

Ultimately, this project goes far beyond the simple improvement of visual acuity in cataract patients. Since many of the patients are under 50 and the bread-winners in their families, the restoration of their eyesight not only enables them to join the work force again, but also gives them back their independence and confidence.

Epilogue

Thanks to Mr Y. K. Ho, another three METC vehicles were built and delivered to three other provinces in mainland China in September 1997. We aim at "one METC, one province in mainland China". It would be a meaningful gesture indeed, if the METC project could eventually become a symbol of goodwill to our mainland brethren from the people in Hong Kong.

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