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Cataract operations in national institute of ophthalmology and hospital in Bangladesh: Comparison between manual small incision cataract surgery and phacoemulsification

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Abstract
A cataract is a clouding of the lens in the eye which leads to a decrease in vision. Cataracts often develop slowly and can affect one or both eyes. Symptoms may include faded colors, blurry vision, halos around light, trouble with bright lights, and trouble seeing at night. This may result in trouble driving, reading, or recognizing faces. Poor vision caused by cataracts may also result in an increased risk of falling and depression. Cataracts are the cause of half of blindness and 33% of visual impairment worldwide. However the present study has conducted to compare outcomes of phacoemulsification [Phaco] with manual small incision cataract surgery (MSICS) for age-related cataract, to assess intraoperative and postoperative complications related to these 2 types of cataract surgery and to compare the financial cost between two types of cataract surgery. The study was conducted at National Institute of Ophthalmology and Hospital. The study was cross sectional type. Purposive sampling method was used for the study. Total 200 respondents were selected for the study. 100 respondents of Manual Small Incision Cataract Surgery were selected and 100 respondents of Phacoemulsification were selected. Data were collected from primary and secondary sources. Questionnaire was used for data collection. Data were collected by face to face interview with the respondent. Collected data were analyzed by using Computer Program Microsoft Excel. From the result it was found that cataract occurs illiterate, farmers and in aged person. The result revealed that in 90% respondents get 6/6 visual acuity in Phacoemulcification but 42% respondents get 6/6 visual acuity in MSICS in case of Phacoemulcification 5% respondents get 6/12 visual acuity but in case of MSICS 38% respondents get 6/12 visual acuity and 5% respondents get 6/18 visual acuity in case of Phacoemulcification and 20% respondents get 6/18 visual acuity in case of MSICS. In case of Intra-Operative Complications 95% respondents replied that no complication occur in Phacoemulcification but 70% respondents replied that no complication occur in MSICS, 2% respondents replied that Hyphema occur in Phacoemulcification but 12% respondents replied that Hyphema occur in MSICS, 2% respondents replied that Posterior lens capsule tear occur in Phacoemulcification but 12% respondents replied that Posterior lens capsule tear occur in MSICS and 1 % respondents replied that Vitrious loss occur in Phacoemulcification and 7% respondents replied that Vitrious loss occur in MSICS. In case of Post operative Complications 94% respondents replied that no complication occur in Phacoemulcification but 68% respondents replied that no complication occur in MSICS, 2% respondents replied that Corneal edema occur in Phacoemulcification but 17% respondents replied that Corneal edema occur in MSICS, 3% respondents replied that Hyphema in Phacoemulcification but 10% respondents replied that Hyphema occur in MSICS and 1 % respondents replied that Anterior uveitis in Phacoemulcification and 5% respondents replied that Anterior uveitis occur in MSICS. Phacoemulcification require less time than MSICs. After operation patients had stay more time in MSICs than Phacoemulcification. But cost is more in case of Phacoemulcification.

Keywords: cataract, phacoemulcification, small incision cataract surgery, complication, outcomes

Introduction

Cataract is a major cause of curable blindness in the world. Cataract extraction is the most frequently performed surgical procedure in patients above 60 years of age. An estimated 670 million people, worldwide, are visually impaired-39 million of which, are blind and 269 million have low vision. Cataract one of the most common eye diseases and leading cause of blindness worldwide, accounts for 50% of the global burden of blindness, representing more than 20 million people worldwide6. Subsequently cataract presents a significant public health challenge and is responsible for a visual acuity of 6/60 or worse in more than 100 million eyes. In most developing countries, blindness is associated with considerable economic and social implications which impacts on the current difficulties of vulnerable populations who reside in under-served areas. An estimated 90% of people who are affected with cataracts reside in developing countries, which have limited capacity, infrastructure and technology to care for the visually impaired. Moreover, these areas have limited eye care capabilities to cope with the high demand for cataract surgery. Thus, these countries exhibit the largest backlog of cataract surgeries, most of which are intumescent, mature and hyper-mature lenses (white cataracts).

Eye care services in Bangladesh are provided by the government, local and international non-governmental organizations (NGO), and charitable organizations. The NGO sector has important funding, collaborative, and logistical roles with Bangladesh service providers. The 500 trained, qualified ophthalmologists of Bangladesh work in either the government or the private sector. Most are concentrated in the urban centers and few are trained in extracapsular cataract extraction and intraocular lens surgery. Eye camps (with principally intracapsular cataract surgery) used to be the main approach of the non-governmental organizations; however, more recently modular eye care

programmes have been developed.

These cataract outcomes in Bangladesh can be compared with the outcomes of cataract surgery in two other population-based studies in the Indian subcontinent, Nepal and Rajasthan. It is interesting that the presenting visual outcomes in Bangladesh and Nepal are similar, whereas the proportion of poor outcome is greater in Rajasthan, which may be attributable to the smaller proportion of intraocular lens surgeries, presumably due to a predominance of eye camp surgeries in Rajasthan.

Cataracts are treatable through cataract surgery, the most common procedure performed in ophthalmology and supplemented with a pair of spectacles. Near normal vision can be restored through the surgical removal of the opacified lens, facilitated by the implantation of an intraocular lens (IOL). To overcome the burden of cataract blindness, there must be sufficient surgical coverage and good surgical outcomes viz. safety, early visual rehabilitation and postoperative emmetropia. In the 20th century Intracapsular Cataract Extraction (ICCE) was the main form of lens removal but this technique had numerous disadvantages when the patient used aphakic spectacles for optical correction, such as image magnification, restricted visual fields, poor co-ordination and physical discomfort. The method that was preferred in the 1980s was extracapsular cataract extraction ECCE. Phacoemulsification (Phaco) has emerged, in recent years, as the most popular procedure to treat cataracts in patients in the developing world. The reasons for this popularity are that Phaco is safe and gives better visual outcomes, such as early visual rehabilitation and emmetropia. However, several studies have shown that despite Phaco surgery being popular in developing countries, it is not suitable for developing countries that have a significant backlog of patients requiring surgery, as the technique is associated with high costs, including the cost of the Phaco machine, maintenance and upgrades of the machine and facilities, staff wages and the cost of consumables. Therefore the Phaco technique is often unaffordable to disadvantages individuals and communities. Driven by the need for more cost effective options, an increasing trend in developing countries is the use of manual sutureless Small Incision Cataract Surgery (SICS), which some have claimed is comparable to Phaco in terms of obtaining excellent visual outcomes, is faster, less costly and has fewer complications. Furthermore, the higher cost of the Phaco machine and the disposable items needed for its functioning and its demand for more advanced surgical training, have to some degree, limited the use of this technique in most developing countries. It is therefore critical that SICS be evaluated as an alternative for developing countries such as in South Africa, and other African countries. But Phaco may be applicable to the people of developed countries and the people are willing to spend more money for treatment like Bangladesh. The present report evaluates these two techniques, Phaco and SICS using some questionnaire surveys.

Objectives of the Study

The objectives of the study are as follows

1. To compare outcomes of phacoemulsification [Phaco] with manual small incision cataract surgery (MSICS) for age-related cataract.
2. To assess intraoperative and postoperative complications related to these 2 types of cataract surgery.
3. To compare the financial cost between two types of cataract surgery.

Rationale of the Study

Age-related cataract is a major cause of blindness and visual morbidity worldwide. It is therefore important to establish the optimal technique of lens removal in cataract surgery. In Bangladesh, eye care services are provided in hospital based clinical services, which are usually based in urban areas, usually without outreach facilities, surgical eye camps and, more recently, comprehensive eye care, which links activities in the community with primary eye care and tertiary services. Surgical eye camps have been popular because the services are usually provided free.

However, it has been reported that they have recently been undertaken less frequently because of advances in surgical techniques and awareness of a need for high quality surgery and good postoperative follow up. For cataract treatment, latest cataract operation technology is practicing in Bangladesh. In this process latest technology is used for better result. Conventional treatment of cataract operation is time consuming and less effective. As a result, treatment failure is reported. In an attempt to fulfill the need for a reliable and quick treatment cataract operation was proposed.

Methodology of the Study

Study area: The study was conducted at National Institute of Ophthalmology and Hospital.

Study design: The study was cross sectional type.

Sampling method: Purposive sampling method was used for the study.

Sample size: Total 200 respondents were selected for the study. 100 respondents of Manual Small Incision Cataract Surgery were selected and 100 respondents of Phacoemulsification were selected.

Sources of data: Data were collected from primary and secondary sources.

Sources of Primary data: Primary data were collected from the respondents of the study area.

Variables

1. Patient's satisfaction
2. Surgery outcomes
3. Average surgery duration
4. Reported pain level
5. Post-operative recovery time
6. Costs

Sources of secondary data: Secondary data were collected from the books, research report, journal and internet etc.

Tools for data collection: Questionnaire was used for data collection.

Method of data collection: Data were collected by face to face interview with the respondent.

Analysis of data: Collected data were analyzed by using Computer Program Microsoft Excel.

Definition of Key Terms

Cataract

Common eye disease, involves clouding of the eye lens. Cause of half of all blindness and one-third or all visual impairment worldwide. Cataract Leads to vision loss if untreated. It can occur in one eye or both eyes. It is not contagious.

Symptoms of Cataract
Blurry vision, difficulty seeing in dim light, seeing halos around lights, faded colors, discomfort in bright lights.

Predominant cause
Predominant cause aging; by the age of 80, half of all Americans had cataracts.

Other causes
Trauma, radiation exposure, eye surgery complications etc. Can be present from birth for some patients.

Fig 1: Mature Cataract eye (Left Eye) and Normal eye (Right eye)

Prognosis
Develop slowly over time. Do not disturb eyesight initially. Gradually interfere with vision, causing difficulty in driving, reading, recognizing faces.

Risk factors
Diabetes, tobacco, alcohol, directs sun exposure. Increases risk of falling and onset of depression.

Cataract Surgery
Cataract surgery is the removal of the natural lens of the eye (also called "crystalline lens") that has developed pacification, which is referred to as a cataract. Metabolic changes of the crystalline lens fibers over time lead to the development of the cataract and loss of transparency, causing impairment or loss of vision. Many patients' first symptoms are strong glare from lights and small light sources at night, along with reduced acuity at low light levels. During cataract surgery, a patient's cloudy natural cataract lens is removed and replaced with a synthetic lens to restore the lens's transparency. Cataract Surgery is simple, safe, fast surgery method.

Phacoemulsification (Phaco)
The phacoemulsification procedure was first performed on the human eye by Charles Kelman in 1967. This was the beginning of Phaco to address problems associated with healing, inflammation, suture related problems and astigmatism. Phaco is a technique employed for the removal of cataracts using machine and micro-surgical instruments. The Phaco technique usually involves making a temporal 3.0 mm scleral tunnel incision and a separate clear corneal stab for the second instrument. A trypan blue-assisted, continuous curvilinear capsulorhexis is then created followed by hydro-dissection just below the anterior capsule rim. Phaco is usually performed using a phacoemulsification system in combination with a phaco-chop method. The tip of the instrument is introduced into the eye through the incision. The tip generates localized, high frequency waves that break up the cataract in small fragments/ pieces.
These fragments/pieces are sucked out through the tip. After cleaning the opaque cataract, a thin shell is left behind and the capsular bag is filled with hydroxypropy. This procedure is followed by a lens implant into the capsular bag. The lens could be either folded or nonfoldable. If a folded lens is implanted, the 3 mm incision that was made does not need to be enlarged and a stitch is not required because the wound is self-sealing and watertight. However, the incision must be enlarged to 5.0 to 5.5 mm, when a fixed lens is inserted and a stitch is required.

Small Incision Cataract Surgery (SICS)
SICS was developed in the United States and Israel and made popular in India, with the large proportion of surgeries undertaken. In this technique, extracapsular extraction is performed. The nucleus is prolapsed and removed through a 6 mm scleral tunnel and aspirates the remaining cortex. Venkatesh *et al*. (2010) report that a 6.5-7.0 mm superior frown-shaped sclero-corneal tunnel was constructed. Thereafter, a trypan blue-assisted capsulorhexis is created and the nucleus is prolapsed from the capsular bag with a Sinskey hook or by hydrodissection injection, followed by extraction using an irrigating vectis. A single-piece rigid IOL (poly methyl methacrylate) with a 6.0 mm optic is then implanted in the capsular bag and the anterior chamber pressurized. The tunnel is self-sealing and the wound does not need sutures in most cases.

Results and Discussion

Table 1: Sex of the respondent

Sex	Percent
Male	62.5%
Female	37.5%
Total	100.0%

From the result it was found that 62.5% respondents were male and 37.5 and respondents were female.

Table 2: Age of the respondents

Age group	Percent
40-49 Years	8.8%
50-59 Years	36.2%
60-69 Years	37.5%
70-79 Years	13.8%
80 Years and Above	3.8%
Total	100.0%

From the result it was found that age group 60-69 years were 37.5% which was maximum and age group 80 years and above was 3.8% which was minimum. On the other hand 8.8% respondents were age group 40-49 Years, 36.2% respondents were age group 50-59 Years and 13.8% respondents were age group 70-79 Years.

Table 3: Profession of the Respondents

Name of Profession	Percent
Business	11.0%
Engineer	5.0%
Private Service	10.0%
Govt. Service	12.0%
House wife	19.0%
Rickshaw Puller	3.0%
Farmer	27.5%
Teaching	12.5%
Total	100.0%

The result revealed that 27.5% respondents were farmers which were maximum and 3.0% respondents were Rickshaw Puller which was minimum. On the other hand 11.0% respondents were businessmen, 5% respondents were Engineer, 10.0% respondents were Private Service holders, 12.0% respondents were Govt. Service holders, 19.0% respondents were House wife, 12.5% respondents were teacher.

Table 4: Visual acuity

Vision	Phacoemulcification		MSICS	
	Before Operation	After Operation	Before Operation	After Operation
6/6		90%		82%
6/12	41%	5%	38%	8%
6/18	59%	5%	62%	10%
Total	100%	100%	100%	100%

The result revealed that in 90% respondents get 6/6 visual acuity in Phacoemulcification but 42% respondents get 6/6 visual acuity in MSICS. In case of Phacoemulcification 5% respondents get 6/12 visual acuity but in case of MSICS 38% respondents get 6/12 visual acuity and 5% respondents get 6/18 visual acuity in case of Phacoemulcification and 20% respondents get 6/18 visual acuity in case of MSICS.

Table 5: Intra-Operative Complications

Complications	Phacoemulcification	MSICS
No complication	95%	70%
Hyphema	2%	12%
Posterior lens capsule tear	2%	11%
Vitrious loss	1%	7%
Total	100%	100%

From the result it was found that 95% respondents replied that no complication occur in Phacoemulcification but 70% respondents replied that no complication occur in MSICS, 2% respondents replied that Hyphema occur in Phacoemulcification but 12% respondents replied that Hyphema occur in MSICS, 2% respondents replied that Posterior lens capsule tear occur in Phacoemulcification but 12% respondents replied that Posterior lens capsule tear occur in MSICS and 1 % respondents replied that Vitrious loss occur in Phacoemulcification and 7% respondents replied that Vitrious loss occur in MSICS

Table 6: Post-operative Complications

Complications	Phacoemulcification	MSICS
No complication	94%	68%
Corneal edema	2%	17%
Hyphema	3%	10%
Anterior uveitis	1%	5%
Total	100%	100%

From the result it was found that 94% respondents replied that no complication occur in Phacoemulcification but 68% respondents replied that no complication occur in MSICS, 2% respondents replied that Corneal edema occur in Phacoemulcification but 17% respondents replied that Corneal edema occur in MSICS, 3% respondents replied that Hyphema in Phacoemulcification but 10% respondents replied that Hyphema occur in MSICS and 1 % respondents replied that Anterior uveitis in Phacoemulcification and 5% respondents replied that Anterior uveitis occur in MSICS.

Table 7: Time required for completing operation

Time	Phacoemulcification	MSICS
15 minutes	46%	
20 minutes	54%	
35 minutes		17%
40 minuets		33%
45 minutes		50%
Total	100%	100%

From the result it was found that 46% respondents replied that 15 minutes required tocomplete Phacoemulcification operation but 54%respondents replied that 20 minutes required completing Phacoemulcification operation. In case of MSICs operation 17% respondents replied that they required 35 minutes to complete their operation, 33% respondents replied that they required 40 minutes to complete their operation and 50% respondents replied that they required 45 minutes to complete their operation.

Table 8: Staying time in Hospital after operation

Days required	Phacoemulcification	MSICS
2 days	57%	
6 days		44%
7 days		43%
Total	100%	100%

From the result it was found that in Phacoemulcification operation 57% respondents replied that they stayed 2 days in Hospital after operation but 43%respondents replied that they stayed 3 days in Hospital after operation. In case of MSICs operation 13% respondents replied that they stayed 5 days in Hospital after operation, 44% respondents replied that they stayed 5 days in Hospital after operation and 43% respondents replied that they stayed 5 days in Hospital after operation.

Table 9: Cost comparison (in taka)

Complications	Phacoemulcification	MSICS
Anesthetics	100	500
Viscoelastics and other materials	120	240
Disposables	1500	1000
Intraocular lens	2500	1000
Total	4220	2740

From the result it was revealed that cost requirement is more in case of Phacoemulcification in comparison to MSICS.

Conclusion and Recommendations

In developing countries with limited health resources and large populations, such as Bangladesh, cataract extraction should comprise of the following features: cheap and affordable, early rehabilitation to avoid economic loss, near emmetropic visual status postoperatively, minimal complications, minimal wound suturing (Malik *et al*., 2002), faster with increased surgical coverage and safe and effective. Phaco has all the above features except an increase in surgical coverage, but all these merits are available with SICS in settings where it has been widely used. Phaco is costly with its preand post-operative medicines, anesthetic agents, viscoelastic materials, disposables, instrumentation and IOLs. It also has a steep learning curve which is also costly as illustrated above. The advantage that SICS has over Phaco is that it is faster and cost-effective especially for advanced white cataracts. Capital, maintenance and per-case disposable costs that are associated with Phaco are avoided with SICS. In a developing country, the importance of surgical speed and efficiency are crucial as there is a shortage of human resources for eye surgeries (ophthalmic surgeons). It is crucial, therefore, to institute a surgical technique that is capable of serving the majority of those disadvantaged in developing countries. In order to cut the costs associated with Phaco and increase efficiency, the alternative is SICS given the relatively similar post-surgical outcomes.

It should be noted that the above recommendations emanating from the meta-analysis are in contrast to that of Cook *et al*. (2011). Although these authors are aware that scleral tunnel extra capsular surgery has been recommended as an alternative in middle- and low-income countries, they advocate a transition to Phaco. They did find that uncorrected and corrected VA to be better in Phaco and less astigmatism in Phaco treated patients at 8 weeks which may have been the basis for their conclusion. However, their study was based on a non-expertise design which may be a limitation as compared to the prospective randomized, expertise designs of the comparative studies on Phaco vs. SICS. They however draw their conclusions from their experience in cataract programs via the Christian Blind Mission's (CBM).

As Cook (2011) stated in his presentation: "The transition to phacoemulsification cataract surgery is a logical transition that is taking place within CBM supported programmes" where ophthalmologist are "keen to do phacoemulsification", "numbers justify added capital expense, "a proportion of eyes are suitable for phacoemulsification", "addition costs for instruments and consumables can be accommodated in the project budget and "where training of ophthalmologists could be prioritized for the transition (2011)." The study by Venkatesh *et al*. (2005: 1083) indicates clearly that high quality; high volume SICS "can be attained in a high-volume setting" using "standardized protocols, standardized training of surgeons and paramedical personnel, and an overall organizational structure that supports high volume patient flow". From the study it can be concluded that Phacoemulcification is better than MSICS. In case of Phacoemulcification visual acuity is more, less complications occur during operation and after operation in Phacoemulcification but more complications occur during operation and after operation in MSICS, few pain occur in Phacoemulcification but much pain occur in MSICS, less time is required in Phacoemulcification but more time is required in MSICS, patients had to stay few days in hospital after operation in Phacoemulcification but patients had to stay more days in hospital after operation. In Phacoemulcification cost is more but cost is less in MSICS. Regarding complications less in Phaco than MSICS.

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