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Original Research

A comparison of isoflurane and halothane in anaesthesia for intra-ocular surgery

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ABSTRACT:
Background: To compare isoflurane and halothane in anesthesia for intra-ocular surgery.**Materials & Methods:**A total of 40 subjects were enrolled. They were divided into two groups with 20 in each as isoflurane group and halothane group. Atropine was given intramuscularly before anesthesia. IOP was measured. Student's t-test was done and the obtained results were processed using SPSS software. The level of significance was set at $p < 0.05$.**Results:**During the pre-induction period, minor disparities existed between the two groups in both intraocular pressure (IOP) and systolic arterial pressure, as indicated by Student's t-test. However, these differences were deemed statistically insignificant**Conclusion:**The use of isoflurane in this approach provides favorable conditions for intraocular surgery.
Keywords:surgery, isoflurane, halothane.

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INTRODUCTION

Cataract and glaucoma are the first and second leading causes of blindness worldwide.[1] Although usually not severe enough to cause blindness, it is not surprising that these two diseases occur simultaneously in many patients. Many studies have demonstrated intraocular pressure reduction after cataract surgery. [2] However, most recent data indicates that IOP reduction after cataract surgery is more significant and sustained than previously thought. [3]Cataract surgery is the commonest single surgical procedure carried out in the developed world. In the developing world, cataract remains the commonest cause of blindness. In 1990 an estimated 37 million people were blind worldwide—40% of them because of cataract. [4] Every year, an extra 1-2 million people go blind. Every five seconds one person in our world goes blind, and a child goes blind every minute. In 75% of these cases the blindness is treatable or preventable. However, 90% of blind people live in the poorest sections of the developing world, and without proper interventions the number of blind people will increase to 75 million by 2020.Various aspects of the surgery for age related cataract have changed substantially in the past five years, and the quality of outcome, plus the improved safety of the modern procedure, has in part driven the increase in numbers of procedures performed.[5]

The mainstay of glaucoma treatment is to lower intraocular pressure. Traditional glaucoma surgeries such a trabeculectomy and tube shunts work well to lower intraocular pressure and decrease progression of glaucoma, but these procedures carry significant risk. [6] Many patients with glaucoma have concurrent cataracts and some studies have suggested that glaucoma itself is a risk factor for cataract development. [7,8] Glaucoma filtering procedures, peripheral iridotomy and some glaucoma medications increase the risk of cataract formation. [9,10] Historically, patients with moderate to advanced glaucoma with concurrent cataracts would have either a combined procedure or a two-stage surgery. [11,12] Surgeons have traditionally felt that cataract surgery lowers IOP in open angle glaucoma (OAG) only slightly and temporarily - despite a paucity of robust data. [13]

Good control of intraocular pressure (IOP) is an important determinant of the success of intraocular

surgery.[14] A variety of measures are employed during general anaesthesia for maintaining a low IOP. Volatile anaesthetics often constitute a part of the overall general anaesthetic technique employed in ophthalmic anaesthesia for intraocular surgery. Halothane has been a popular agent, but there are differing opinions about its effectiveness in controlling IOP.[15,16] Isoflurane is perhaps one of the most commonly used volatile agents now and, although there are some reports about its effects on IOP, the results from these appear to be contradictory. [17,18] Hence, this study was conducted to compare isoflurane and halothane in anesthesia for intra-ocular surgery.

MATERIALS & METHODS

A total of 40 subjects were enrolled. They were divided into two groups with 20 in each as isoflurane group and halothane group. Atropine was given intramuscularly before anesthesia. IOP was measured. Tracheal intubation took place three minutes following the initiation of anesthesia. A cuffed tracheal tube was used after applying 4% lignocaine (4 ml) to the larynx and trachea. Ventilation was maintained as per the pre-established protocol. Intraocular pressure (IOP) measurements were conducted post-tracheal extubation, and the patient was transferred back to the recovery area, breathing oxygen-enriched air through a disposable plastic facemask until consciousness was fully regained. Student's t-test was done and the obtained results were processed using SPSS software. The level of significance was set at $p < 0.05$.

RESULTS

During the pre-induction period, minor disparities existed between the two groups in both intraocular pressure (IOP) and systolic arterial pressure, as indicated by Student's t-test. However, these differences were deemed statistically insignificant. To account for this, comparisons were made based on changes from the control value within each group. Following intubation, both groups experienced a rise in IOP, succeeded by a decline to levels below the control value 10 minutes post-intubation. Throughout the procedure, IOP was consistently maintained at this lower level in both groups. Nevertheless, upon the cessation of anesthesia and reversal of neuromuscular blockade, there was a tendency for IOP to revert to pre-induction values. Notably, no statistically significant differences were observed between the two groups at any of the measurement intervals.

Table 1: Parameters

	Isoflurane	**Halothane**
Number	20	20
Male	8	5
Female	12	15
Age (mean)years	75	80
Weight	66.8	62.5

Table 2: Changes in intraocular pressure in mmHg (baseline =0)

	Intra ocular pressure (mmHg) Halothane	**isoflurane**
Immediately after intubation	+4	+3
Ten minutes after intubation	-7	-7
End of surgery	-6	-7
After extubation	+1	-2

Both groups exhibited a pressor response to intubation, succeeded by a moderate decline after 10 minutes, falling below control values. The isoflurane group sustained this reduction throughout the procedure. However, in the halothane group, there was a trend for values to approach control levels by the conclusion of surgery. The disparity between the groups at this juncture (the fourth measurement) was statistically significant, with $p < 0.05$.

Table 3: Changes in systolic arterial pressure in mmHg (baseline =0)

	Systolicarterial pressure (mmHg) Halothane	**isoflurane**
Immediately after intubation	10	8
Ten minutes after intubation	-20	-35
End of surgery	-15	-36
After extubation	+10	-15

DISCUSSION

The advantages of an anaesthetic technique for intra-ocular surgery which incorporates normocapnic ventilation supplemented with a volatile agent have been described previously.[19] Halothane, enflurane [20] and to a lesser extent trichloroethylene used in this

way produce a satisfactory reduction in intra-ocular pressure (IOP),whilst normocapnia maintains cardiac output and facilitates a rapid return to spontaneous ventilation at the end of the procedure. [21] Isoflurane, the newest and least soluble volatile anaesthetic agent, [22] provides a morefavorable cardiac index than halothane or enflurane which in the predominantly elderly population who present for cataract extraction may be an advantage. [23] Hence, this study was conducted to compare isoflurane and halothane in anesthesia for intra-ocular surgery.

In the present study, during the pre-induction period, minor disparities existed between the two groups in both intraocular pressure (IOP) and systolic arterial pressure, as indicated by Student's t-test. However, these differences were deemed statistically insignificant. To account for this, comparisons were made based on changes from the control value within each group. Following intubation, both groups experienced a rise in IOP, succeeded by a decline to levels below the control value 10 minutes post-intubation. Throughout the procedure, IOP was consistently maintained at this lower level in both groups. Nevertheless, upon the cessation of anesthesia and reversal of neuromuscular blockade, there was a tendency for IOP to revert to pre-induction values. Notably, no statistically significant differences were observed between the two groups at any of the measurement intervals.A study by Craig JF et al, isoflurane 0.75% was compared with halothane 0.5% as the volatile supplement in a normocapnic technique for intra-ocular surgery. Both agents gave satisfactory conditions for operation with a comparable reduction in intra-ocular pressure during the procedure. Systolic arterial pressure, however, was significantly lower in the isoflurane group at the end of surgery and after tracheal extubation than in the halothane group. Isoflurane provides a useful alternative to halothane in anaesthesia for intraocular surgery.[24]

In the present study, both groups exhibited a pressor response to intubation, succeeded by a moderate decline after 10 minutes, falling below control values. The isoflurane group sustained this reduction throughout the procedure. However, in the halothane group, there was a trend for values to approach control levels by the conclusion of surgery. The disparity between the groups at this juncture (the fourth measurement) was statistically significant, with $p < 0.05$.Another study by Mirakhur RK et al, intraocular pressure (IOP) was measured in four groups of patients receiving isoflurane or halothane in consecutively increasing or decreasing concentrations (1.0, 2.0 and 3.0 MAC in 70% nitrous oxide). IOP decreased significantly in all groups irrespective of whether the higher or the lower concentration of the volatile agent was used first. There were no further significant changes in IOP whether the concentrations were increased or decreased, suggesting no dose-relation. Maximum reductions in IOP were slightly greater in those receiving the higher concentrations of the volatile agents first (64 and 66% with isoflurane and halothane, respectively) in comparison to those receiving the lower concentrations first (54 and 46%, respectively).[25] van den Berg AA et al, with hospital ethics committee approval and patient consent, a prospective, randomized, double-blind study of 556 patients undergoing ENT and eye surgery was undertaken to evaluate the effects of halothane, isoflurane and enflurane on vomiting, retching, headache and restlessness until 24 h after anaesthesia. Balanced general anaesthesia was administered comprising benzodiazepine premedication, induction with thiopentone-atracurium-morphine (ENT patients) or fentanyl (eye patients), controlled ventilation and maintenance with either halothane 0.4-0.6 vol% (n = 186), isoflurane 0.6-0.8 vol% (n = 184) or enflurane 0.8-1 vol% (n = 186) in nitrous oxide 67% and oxygen. The three study groups were comparable, and comprised comparable subgroups having ear, nose, throat, intraocular and non-intraocular surgery. Isoflurane induces less postoperative emesis than halothane, but headache is similarly frequent after anaesthesia with any of these agents.[26]In the developing world the problem of cataract blindness is much greater, as most people do not seek advice until the cataract is advanced or an eye has developed painful loss of vision caused by lens induced glaucoma. Some of the reasons for this are lack of awareness about cataract treatment, sex bias, low socioeconomic conditions, and lack of an old age maintenance plan by government. Many countries do not have enough clinicians to meet the demand, and most existing doctors prefer to settle in larger cities because more rural areas have inadequate infrastructure and education and civic amenities. This has resulted in a gross disparity in the distribution of eye care services.[27]In the developing world the lack of trained surgeons and appropriate infrastructure mean phacoemulsification is often not possible. Sutureless manual cataract surgery (known as small incision cataract surgery) is increasingly used as a substitute. In this technique a self sealing incision of about 6.0 mm is made outside the limbus. A tear is made in the anterior capsule, and the firmer portion of the cataract (nucleus) is expressed out of the eye through this incision. When done properly this technique can be performed rapidly, and suturing the incision is seldom needed, making it appropriate for high volume surgery. [28] Although the results are not as predictable as with phacoemulsification, it gives an acceptable outcome and has proved to be economically viable in the developing world. Extracapsular cataract extraction with good micro-surgical technique is important in high volume centres as the technique is affordable, [29] and in such centres this technique involves fewer postoperative complications. [30]

CONCLUSION

The use of isoflurane in this approach provides favorable conditions for intraocular surgery.

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