

# OCULOCARDIAC REFLEX IN STRABISMUS SURGERY UNDER GENERAL ANAESTHESIA - A STUDY OF SINGAPORE PATIENTS

J L Chong, S H Tan

## ABSTRACT

A study of 80 patients with strabismus undergoing correctional surgery under general anaesthesia was done. A comparison was made with regards to the incidence of oculocardiac reflex between patients premedicated with intramuscular atropine 0.015 mg/kg and non-premedicated patients. We found that premedication with atropine reduces the incidence and the morbidity of the oculocardiac reflex.

**Keywords:** Oculocardiac reflex, Premedication, Atropine.

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## INTRODUCTION

A variety of ocular stimuli produce variation in the heart rate with or without alteration in rhythm. These changes are known as the oculocardiac reflex.

Aschner and Dagnini in 1908 independently reported cardiac slowing after pressure on the eyeballs. Aschner demonstrated by animal investigations that the ophthalmic branch of the Trigeminal nerve is necessary for the reflex to occur. The afferent impulse is carried by this nerve to the vagal centres where the impulses are relayed to the heart via the vagus nerve (1).

The importance of the oculocardiac reflex (OCR) was brought to light when Sorenson and Gilmore (2) in 1956 reported that traction on the medial rectus muscle caused cardiac arrest in a patient. Kirsch (3) in 1958 reported a fatal cardiac arrest following manipulation of the extraocular muscles.

The risk of OCR is higher in patients under general anaesthesia. The number of cardiac arrests associated with surgery on the eye is reported to be as high as 1 per 3,500 anaesthetic by Kirsch (3).

According to earlier studies, the OCR is positive in 90% of children under 15 years of age (4). The vagal effects on the heart have varied from simple sinus bradycardia to sinoatrial block, sinus arrest, wandering pacemaker, nodal and bigeminal rhythm (5).

Two methods routinely used to prevent this reflex are retrobulbar block and premedication with Atropine (3). Although studies were done to show that premedication with Atropine does not protect from OCR and that it may result in unwanted tachycardia and predispose to arrhythmias during laryngoscopy and intubation, many anaesthetists are still premedicating their patients for strabismus operation with atropine (5,6).

We decided to compare the effects of those with and those without premedication with Atropine in our patients presenting for strabismus operation under general anaesthesia.

## AIMS

To study the incidence of the Oculocardiac Reflex in Singapore patients for strabismus surgery and to study the effectiveness of premedication with Atropine 0.015 mg/kg to prevent the occurrence of the Oculocardiac Reflex in strabismus surgery.

## METHODS

The patients were divided into two groups for premedication purposes.

One group was given intramuscular Pethidine 1 mg/kg with Atropine 0.015 mg/kg. The other group was given Pethidine 1 mg/kg only. This was given about 45 minutes before the induction of anaesthesia. None of the patients was on anticholinergics prior to this. The patients were then monitored during the surgery with continuous ECG monitor and an automated BP monitor.

The anaesthetic technique was similar in both premedication groups, being intravenous induction with Thiopentone 4-5 mg/kg, tracheal intubation facilitated by Alcuronium 0.2 mg/kg and anaesthesia maintained with Nitrous Oxide and Halothane with 33% Oxygen. Respiration was maintained with Intermittent Positive Pressure Ventilation.

The pulse rate was noted for any change each time the eye and the extraocular muscles were retracted or manipulated. The oculocardiac reflex was defined as a change in the heart rate of more than 20 percent from control.

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Department of Anaesthesia  
Singapore General Hospital  
Outram Road  
Singapore 0316

J L Chong, MBBS, M MED (Anaesthesia)  
Registrar  
S H Tan, FFARCS, FFARACS  
Head

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## RESULTS

### Age And Sex Distribution Of Patients

There is no significant difference in the age and sex distribution between the 2 groups. However, there is a greater number of male patients in this study compared to the number of females (Table I,II). The mean time between premedication and induction of anaesthesia was 50 minutes with S.D. of 13.2 minutes.

Table I  
AGE DISTRIBUTION (YEARS)

Patient	Atropine Group	No Atropine Group
Children	5.8 (SD 2.1)	6.3 (SD 2.2)
Adults	25.6 (SD 6.9)	25.6 (SD 8.3)

Table II  
SEX DISTRIBUTION (MALE/FEMALE RATIO)

Patient	Atropine Group	No Atropine Group
Children	1.44	1.11
Adults	1.25	1.33

### Duration Of Operation

The mean duration of operation was 51.5 minutes with a standard variation of 15.78 minutes.

There was no significant difference between the 2 groups with regards to the duration of operation.

### Incidence Of Oculocardiac Reflex

The incidence of the oculocardiac reflex in the group without atropine premedication was 77.5% and for the group with atropine premedication, it was only 20%. There was a significant decrease in the incidence of the Oculocardiac reflex with premedication with Atropine 15 ug/kg as compared with the group without Atropine premedication (Table III).

Table III  
INCIDENCE OF THE OCULOCARDIAC REFLEX

	Atropine	No Atropine
No. of OCR (Percentage)	8 (20%)	31 (77.5%)

There seems to be a greater obtundation of the oculocardiac reflex with the use of Atropine in children compared to the adults ( $p < 0.05$ ). See Table IV.

Table IV  
DIFFERENCE IN INCIDENCE BETWEEN ADULTS AND CHILDREN (OCULOCARDIAC REFLEX)

Atropine		No Atropine	
Children	Adults	Children	Adults
No. (%)	No. (%)	No. (%)	No. (%)
2 (10)	6 (30)	14 (70)	17 (85)

### Vagal Escape

There is a tendency for the patient to adapt to the vagal tone with the traction of the extraocular muscle with the heart rate returning to the pretraction rate.

With the use of Atropine, all the patients who had oculocardiac reflex demonstrated vagal escape. In the group not premedicated with Atropine, 2 patients (6.45%) did not show vagal escape and intravenous Atropine had to be given to treat the persistent bradycardia.

None of the patients who had Atropine as premedication had Bigeminy, Sinus Arrest or Complete Atrioventricular Block (Table V).

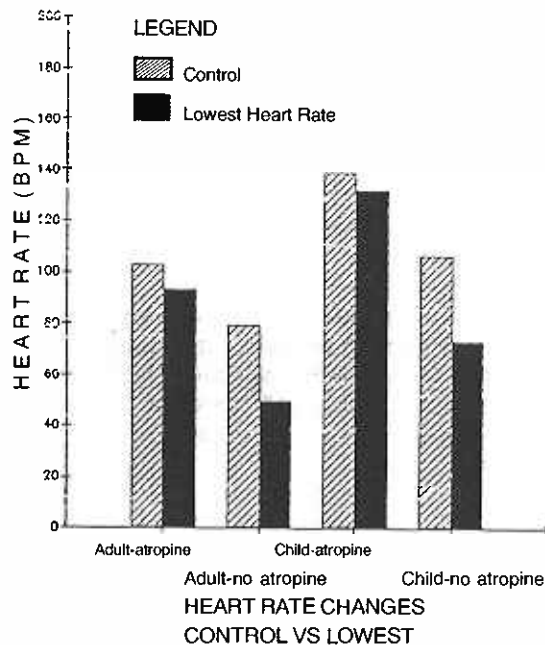
Table V  
TYPE OF PRESENTATION OF THE OCULOCARDIAC REFLEX

OCR	No.	(%)
Sinus Bradycardia	13	(33)
Nodal Rhythm	23	(59)
Bigeminy	2	(5)
Complete Heart Block	1	(2.5)

### Heart Rates Of Patient

The mean heart rates of the adults (just before surgery) who were given atropine was 103 beats per minute (bpm). Those not given premedication Atropine was 79.9 bpm (Fig 1).

FIG 1  
HEART RATE CHANGES  
OCULOCARDIAC REFLEX IN  
STRABISMUS SURGERY



In the paediatric group, those with Atropine had a mean heart rate of 139 bpm and those without had a mean heart rate of 73.8 bpm before surgery (Table VI). In the group of children not premedicated with Atropine, there were only 2 cases whose heart rate fell to less than 60 bpm during the surgery. Both responded to intravenous Atropine.

None in the Atropinised group had bradycardia. In the adults without Atropine premedication, there were 7

Table VI  
**MEAN HEART RATES BEFORE SURGERY AND LOWEST HEART RATE DURING SURGERY. (BEATS PER MINUTE)**

	ATROPINE		NO ATROPINE	
	BEFORE	LOWEST	BEFORE	LOWEST
CHILDREN (S.D.)	139 (14.3)	132 (19.0)	107 (39.7)	73.8 (38.7)
ADULTS (S.D.)	103 (13.2)	93.8 (16.5)	80 (13.9)	49.8 (23.5)

cases whose heart rates fell below 45 bpm during the surgery. None had any fall in BP.

#### Incidence Of Oculocardiac Reflex By Muscles

The incidence of oculocardiac reflex is higher in the medial rectus, as reported by most studies, compared with that of the lateral rectus (Table VII).

Table VII  
**INCIDENCE OF OCULOCARDIAC REFLEX BY MUSCLES**

	No. of muscles	OCR (%)
Lateral Rectus	92	26.0
Medial Rectus	91	34.1
Superior Rectus	7	42.8
Inferior Rectus	2	100.0
Superior Oblique	1	100.0
Inferior Oblique	6	83.3

#### DISCUSSION

Although it is known that premedication with Atropine does not prevent the occurrence of the oculocardiac reflex, unless higher doses are used, we found that it is of benefit to our patients as it reduces the incidence of OCR, promotes vagal escape which reduces overall morbidity and requirement of intravenous Atropine for severe bradycardia.

We have found that the adults have a higher incidence of OCR compared to children, not as reported by other studies that found children to have a higher incidence. Premedication with 0.015 mg/kg of Atropine reduced the incidence of OCR in children as well as adults.

Even as long as 90 minutes after the premedication with the intramuscular dose of Atropine, there was a protective effect on the heart during traction of the extraocular muscles.

The incidence of OCR in our study is not very different from that of other studies, ours being 48.75% overall, 80% in unpremedicated patients and 20% in premedicated patients.

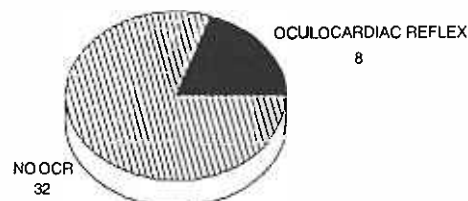
Alexander (4) reported an incidence of 90% using the criteria of 10% change in heart rate as a positive OCR.

The heart rates of patients given atropine as premedication is significantly higher than that of patients who were not atropinised (Fig 1). However, severe tachycardia was never a problem. One study revealed that there was a higher incidence of arrhythmias during

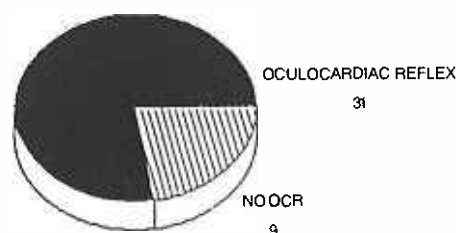
induction of anaesthesia when intravenous atropine was used (7, 8). This was not found in our study. We used alcuronium as a muscle relaxant because it was found in one study that it gives the lowest incidence of OCR when compared to d-tubocurarine, pancuronium and vecuronium (10). We concede that with the use of gallamine OCR is better obtunded. However, it may result in a higher incidence of cardiac arrhythmias when used in combination with halothane.

Although some authors found glycopyrrolate as a better anticholinergic agent to prevent the OCR in that it does not result in as high a heart rate as Atropine, we used Atropine because glycopyrrolate is not readily available in our institution (5, 6).

FIG 2 OCULOCARDIAC REFLEX  
 EFFECT OF ATROPINE PREMEDICATION



EFFECT OF NO PREMEDIATION



#### CONCLUSION

Premedication with intramuscular dose of Atropine 0.015 mg/kg will reduce the incidence of oculocardiac reflex and its serious consequences.

Although children are known to have a higher vagal tone, the oculocardiac reflex is not more frequent than the adult.

OCR is a potentially dangerous cardiac reflex during anaesthesia for strabismus surgery and therefore the heart rate of the patients should always be monitored continuously during the operation with an electrocardiograph monitor.

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