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## Original Research Article

## Comparison of incidence of oculocardiac reflex between hang-back and conventional rectus recession in horizontal strabismus surgery

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## ABSTRACT

**Purpose:** To compare the incidence of oculocardiac reflex(OCR) between hang-back and conventional method of rectus muscle recession in horizontal strabismus.

**Materials and Methods:** In this prospective, randomized, double blind study, 40 consecutive patients of horizontal strabismus were evaluated. The patients were randomized into two groups based on the type of surgical recession technique employed for squint correction. Twenty patients were operated by Hang-back technique (group-1) and 20 by conventional rectus muscle recession where the muscle tendon was sutured directly to the globe (group-2). All patients underwent pre-operative evaluation which included refraction, keratometry and assessment of angle of deviation etc. ECG was monitored before surgery. During surgery heart rate (HR) was recorded as heart rate baseline (HRB), after 5 minutes of intubation (HR5), during muscle traction (HRT), Minimum heart rate during traction of muscle (HRMin), Maximum increase in heart rate (HRMax). OCR was defined as > 20% reduction in HR during muscle traction as compared to baseline HR.

**Results:** Out of total 40 patients 17(42.50%) were having exotropia and 23 (57.50%) had esotropia. The overall incidence of OCR in conventional recession was found to be greater than that in hang-back recession. The mean baseline HR was  $72.00 \pm 7.391$  beat/min in conventional recession group and  $77.55 \pm 7.494$  beat/min in hang-back recession group.

The mean HR reduction in conventional procedure was  $56.05 \pm 8.787$  beat/min. and that in hang-back procedure  $61.80 \pm 9.317$  beat/min., which was statistically significant ( $p < 0.01$ ). This was probably attributed to the shorter duration of surgery and lesser manipulation during surgery in hang-back as compared to conventional procedure.

**Conclusion:** OCR is a common complication encountered during manipulation of muscle during strabismus surgery. Hang-back recession is a safe and effective method of muscle recession as it offers a shorter surgical time and better exposure along with lesser incidence of OCR with similar success rates when compared to conventional muscle recession.

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## 1. Introduction

Strabismus is the most common paediatric eye disorder second to refractive error and frequently seen in ophthalmology and optometry practice. The national

prevalence of squint is 5.4% and this suggests that there are 7.02 million patients with strabismus in a population of 130 million.<sup>1</sup> Recession of rectus muscle is the a most commonly performed surgery for horizontal strabismus<sup>2</sup> which can be done by the conventional technique in which the muscle tendon is sutured directly to the globe after muscle recession or by hang-back technique also called

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suspension-recession, where muscle is suspended on an absorbable suture to the original insertion.<sup>3</sup> Advantages of hang-back technique over conventional recession are better surgical exposure, shorter duration of surgery and lesser risk of surgical complications like scleral perforation.<sup>3-5</sup>

Another common complication of strabismus surgery is the oculocardiac reflex (OCR) or trigemino-vagal reflex which is mainly caused by the manipulation of the extraocular muscle (EOM) during traction, re-traction and cutting. The common manifestations of the OCR are appearance of sinus bradycardia, arrhythmia, reduction in arterial pressure, ventricular fibrillation, asystole, or cardiac arrest.<sup>6-9</sup> The degree of stimulation of EOM in strabismus surgery is variable.

Therefore this study was conducted to compare the incidence of OCR between conventional and hang-back procedure of horizontal strabismus surgeries involving either medial or lateral rectus muscle.

## 2. Materials and Methods

This prospective, randomized, double blinded study was conducted at the department of ophthalmology and department of anaesthesiology, Institute of Medical Sciences, Banaras Hindu University, Varanasi, UP. from October 2018 to September 2020. The Study was approved by the Ethical Committee of Institute of Medical Sciences, Banaras Hindu University and adhered to the tenets of the Declaration of Helsinki. Prior informed written consent was obtained from the study participants. All patients having horizontal strabismus were included. Patients with previous strabismus surgery and a postoperative follow-up < 6 months were excluded.

Study was conducted on 40 cases. The cases were randomized through computer generated random numbers between 2 treatment groups. Twenty patients were operated by Hang-back technique (group-1) and 20 by conventional rectus muscle recession (group-2). Clinical examination was carried out and findings were recorded in a predesigned and pre-tested proforma. Each case was subjected to following clinical examination: Visual acuity by using Snellen's chart, vision with pin hole, orthoptic check-up and extraocular movement refraction, slit lamp examination, cover/uncover test, Hirschberg test and prism bar cover test were also performed. The patients who were selected for the study of OCR were taken to the operation room (OR), all the standard A S A monitors i.e ECG, NIBP, SPO<sub>2</sub>, EtCO<sub>2</sub> and temperature monitor was attached and the anaesthesia was started by giving injection.

Midazolam 20 microgram/kg IV and Fentanyl 1microgram/kg IV as premedication. Then the patient was induced by injection Propofol in the range of 1-2.5mg/kg till the patient lost verbal response. Injection Vecuronium 0.1mg/kg was given to achieve neuromuscular blockade and after 3 minutes of preoxygenation the

patients airway was secured by appropriate size I gel. The maintenance of anaesthesia was done by O<sub>2</sub>, N<sub>2</sub>O and Isoflurane with intermittent doses of injection Fentanyl and injection Vecuronium as needed. The following parameters were recorded during the surgery:

(HRB) (Baseline heart rate): The heart rate measured after 1 minute of giving injection midazolam and fentanyl.

(HR5): The heart rate after 5 minutes of intubation.(it is supposed that the sympathetic activity due to intubation will be weaned off after 5 minutes) (HRT): Heart rate just after traction of muscle

(HRMin): Minimum heart rate during traction of muscle

(HRMax): Maximum increase in heart rate

## 3. Results

A total of 40 patients who met the inclusion and exclusion criteria and undergoing horizontal strabismus surgery were included in this study. Of these 20 underwent hang-back recession (group-1) and 20 conventional recession of rectus muscle (group-2) respectively. Twenty five (62.50%) patients were female (13 in group-1 & 12 in group-2) and 15(37.50%) were male (7 in group-1 & 8 in group-2) Maximum number of patients belonged to age group 21-30 years (50% in Group 1 & 45% in Group-2) and 11-21 years (35% in Group 1 & 25% in Group-2). The mean age at surgery was similar in both the groups.

The amblyopia was found in 15 (37.5%) patients 9 (22.5%) were treated by hang-back procedure and 6 (15.0%) patients by conventional surgery. Out of total 40 patients 17 (42.50%) were having exotropia and 23 (57.50%) had esotropia (Table 1). None of the patients in either group had superior oblique over action.

OCR occurred in 25 (62.50%) patients. Baseline HR was higher in patients without OCR. Table 2 shows heart rate at different steps of surgery. The mean baseline HR was  $77.55 \pm 7.494$  beat/min in hang-back recession (group-1) and  $72.00 \pm 7.391$  beat/min in conventional recession (group-2). HR 5 minutes after intubation was  $68.90 \pm 8.239$  beat/min. in group-1 and  $66.15 \pm 8.431$  beat/min. in group-2 patients which was not statistically significant.

The mean reduction in heart rate during muscle traction (HRT) in group-1 was  $61.80 \pm 9.317$  beat/min and  $56.05 \pm 8.787$  beat/min. in group-2 patient which was statistically significant ( $p < 0.01$ ).

## 4. Discussion

Horizontal strabismus is one of the most common ophthalmic problem. Rectus muscle recession and resection are an acceptable surgical option for squint correction. Rectus muscle recession could be done either by conventional technique where tendon of rectus muscle sutured directly to the sclera or by hang-back technique in which muscle suspended on a absorbable suture running to

**Table 1:** Patients characteristics. (N = 40)

Characteristic	Group-1(Hang-back technique)	Group-2 (Conventional technique)
Number of Patients	20	20
Sex, Male/Female	7/13	8/12
Mean age at surgery	22.55±7.6	22.50±6.8
With Amblyopia	9	6
Esotropia	11	12
Exotropia	9	8
Muscle traction time,Sec	110±35.0	160±55.0
Mean duration of Surgery, mints	28	34

**Table 2:** Comparison of heart rate during surgery in two group

Heart Rate	Group	Mean	SD	p-value
Baseline HR	Group-1	77.55	7.494	0.166
	Group-2	72.00	7.391	0.285
HR5 min after Intubation	Group-1	68.90	8.239	0.285
	Group-2	66.15	8.431	0.303
HRT during Muscle traction	Group-1	61.80	9.317	0.303
	Group-2	56.05	8.787	0.018
HRT (Max) 5 min.	Group-1	69.80	8.889	0.198
	Group-2	65.85	8.286	0.154
	Group-2	19.49	5.601	0.184

the main point of muscle insertion. Hang-back procedure offers several advantages over conventional method; it is easy and safe technique, provides better exposure of surgical field and requires shorter surgical time.<sup>2</sup> While conventional recession is a lengthy procedure require longer muscle traction time and associated with risk of globe perforation.

The oculocardiac reflex (OCR) is a common occurrence in strabismus surgery due to manipulation of extraocular muscle. OCR has the afferent pathway by ophthalmic division of the trigeminal nerve and the efferent pathway by the vagus nerve. Manifestation of OCR is in the form of bradycardia which can cause dangerous complications like sinus bradycardia, atrioventricular block, ventricular tachycardia or asystole. OCR is defined as a > 20% reduction in the heart rate from baseline value at the first traction of the muscle. In our study 62.50% patients had OCR during muscle recession. Other study also reported similar incidence of OCR during strabismus surgery.<sup>9–11</sup> The occurrence of OCR during squint surgery depends on the various risk factors such as the age and sex of the patient, use of premedication drug like atropine, anaesthetic technique & depth of anaesthesia, number & sequence of muscle undergoing surgery and surgical technique employed.<sup>10,12–14</sup> In this study occurrence of OCR was higher in female patients reason could be because of more female participants. Several studies reported no difference between the gender of patient and OCR.<sup>10,12</sup>

Suk-Gyu Ha et al. 2018 reported more occurrence of OCR in the resection of extraocular muscle; however they did not find significant association between specific muscle

and OCR,<sup>9</sup> however other researchers reported that medial rectus surgery is strongly associated with OCR due to difference in the afferent pathways involved in medial and lateral rectus muscle.<sup>11–13,15</sup> In our study We compared the incidence rates of the OCR in two different surgical technique. To the best of our knowledge, no earlier study has reported the comparison of the incidence of OCR in hang-back recession and conventional recession technique for correction of horizontal strabismus.

Duration of anaesthesia and surgery can significantly influence the incidence of OCR. In our study we found that mean duration of surgery in conventional group was 34 minutes which was significantly higher than the mean duration of hang – back technique which was around 28 minutes. After comparing the mean decrease in surgical duration it was found to be statistically very significant with a p value of <0.0001. The mean muscle traction time was 110 ± 35.0 sec. in hang-back group and 160±55.0 sec. in conventional group.

In our study incidence of OCR was more in conventional recession procedure as compared to hang-back method of recession. The mean reduction of heart rate in conventional procedure was 56.05±8.787 beat/min and 61.80±9.317 beat/min in hang-back procedure, which was statistically significant. This was probably attributed to shorter duration of surgery and less manipulation during surgery in hang-back as compared to conventional procedure. There was an increase in heart rate on sustained traction of muscle greater than 5 seconds which was due to adrenergic phase which comes into action.

## 5. Conclusion

Oculocardiac reflex is an important surgical consideration for squint patient. Incidence of OCR is higher in conventional method of rectus muscle recession. Hang-back technique has shorter duration of surgery and hence associated with lesser occurrence incidence of OCR. Ophthalmologists and anaesthesiologists both should closely monitor signs of OCR during strabismus surgery. Minimal manipulation of extraocular muscle has been advocated during squint surgery.

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None.

## 7. Conflict of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this article.

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