# The Oculocardiac Reflex

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Aschner (1908) observed that the application of pressure to the eyeball resulted in a slowing of the heart. The afferent limb of this reflex is the opthalmic division of the trigeminal nerve, from which fibres pass to the gasserian ganglion and thence to the main sensory nucleus of the trigeminal nerve; the efferent pathway is the vagus nerve. The reflex is abolished by trigeminal anæsthesia, but may be elicited, even in the absence of the globe, by stimulation of the V nerve, for example by a tense orbital hæmatoma following enucleation. Those patients most commonly at risk, however, are healthy young children undergoing surgical correction of strabismus, when traction on the extraocular muscles may evoke the reflex.

The reported incidence of the oculocardiac reflex has varied as have the anæsthetic techniques employed in the different series. If a positive response is assumed to be a decrease in heart rate of 10% or more, the incidence has been reported as 82% (Bosomworth *et al.* 1958), 56% (Welhaf & Johnson 1965) and 67% (Apt *et al.* 1973). Recently, Alexander (1975) considered any reduction in heart rate to constitute a positive response, and recorded an incidence of 90%. In addition to a decrease in heart rate, arrhythmia has been reported in association with the oculocardiac reflex. Bosomworth *et al.* (1958) noted this in 9 of his 28 patients in whom aerterial oxygenation and carbon dioxide contents were normal, and irregularities of cardiac rhythm are described by Alexander (1975).

The incidence of the oculocardiac reflex was studied at the Royal Devon and Exeter Hospital, Exeter (Dewar & Wray 1972, unpublished) in 36 patients undergoing routine surgical correction of strabismus. The drugs used for preoperative medication and induction of anæsthesia were not standardized but, following endotracheal intubation, each patient breathed nitrous oxide, oxygen and halothane spontaneously; no other agents were employed. During operation the electrocardiograph was recorded. The mean heart rate for 10 seconds before and for 10 seconds immediately after the application of traction to the extraocular muscle were compared. There was a reduction in heart rate in 35 of the 36 patients following muscle traction. Using the 10% reduction criterion, the incidence of the oculocardiac reflex was 67%. In our 36 cases, the application of tension to the medial rectus caused a mean reduction in heart rate of 24%, while the same tension applied to the lateral rectus resulted in a slowing of 9%. This phenomenon was independent of the order in which the two muscles were handled and confirms previous observations (Bosomworth *et al.* 1958, Apt *et al.* 1973) that the oculocardiac reflex is elicited more readily by traction on the medial rectus muscle although there is no published evidence of a direct comparison of the two muscles in the same eye. Cardiac arrhythmias (usually junctional rhythm or bigeminal rhythm) were observed in 20% of these patients.

A controlled study of the oculocardiac reflex is in progress at the Western Infirmary, Glasgow, comparing various means of reducing the frequency of the reflex from the overall incidence of 67% noted in the initial assessment. Vagolytic agents have been advocated as a prophylactic measure and we are comparing the relative merits of atropine (Bosomworth *et al.* 1958) and gallamine (Deacock & Oxer 1962). In 48 healthy children anæsthesia was induced by the same anæsthetist using nitrous oxide, oxygen and halothane. The trachea was intubated and anæsthesia maintained using the same agents, the patients breathing spontaneously. No premedicant drugs were given. Intravenous atropine (0.019 mg/kg to a maximum of 0.6 mg) or gallamine (0.9 mg/kg) were given in a random manner before the commencement of surgery. The electrocardiograph was monitored continuously on an oscilloscope and recorded when required on a chart recorder. During surgery, traction was applied to the rectus muscles using a sterile muscle hook attached to a strain guage transducer which produced a deflection on the chart recorder proportional to the force exerted by the surgeon. We thus ensured that the same degree of tension had been applied; this is important as previous workers have not estimated the degree of traction employed, and Alexander (1975) attributes some apparent discrepancies in his results to differences in the strength of muscle traction used by the surgeon.

The mean age in the group receiving atropine was 5.2 years and in those given gallamine, 5.4 years. Using the 10% index of a positive response, the oculocardiac reflex occurred in 5 (21%) of the gallamine group and in none of the atropine group. The percentage change in heart rate was

*Table 1*

**Heart rate before and after traction to the medial and lateral rectus muscles in 5 patients showing a positive response**

| | *Heart rate (beats/min) before and after traction to Medial rectus* | | | *Lateral rectus* | | |
|---|---|---|---|---|---|---|
| *Case No.* | *Before* | *After* | *Percentage decrease* | *Before* | *After* | *Percentage decrease* |
| 1 | 150 | 78 | 48 | 150 | 102 | 32 |
| 2 | 104 | 64 | 38 | 120 | 98 | 18 |
| 3 | 135 | 106 | 21 | 145 | 135 | 7 |
| 4 | 104 | 86 | 17 | 112 | 102 | 9 |
| 5 | 120 | 82 | 32 | 120 | 120 | 0 |

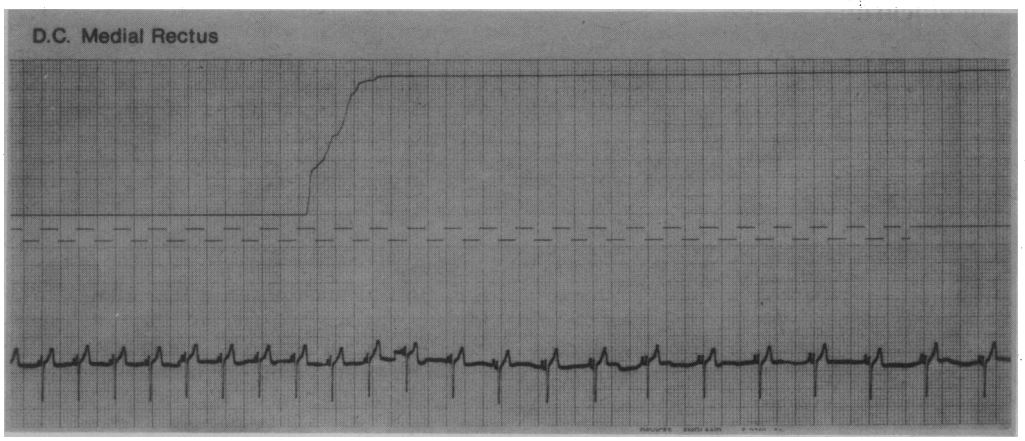


Fig 1 *Upper trace, tension applied to medial rectus muscle; upwards deflection denotes increase in tension. Lower trace, ECG; note slowing of rate (paper speed 10 mm/s)*

more marked following traction on the medial rectus (Table 1). The control heart rates were high and, despite the substantial changes, the rates after traction would not give cause for anxiety. For comparison, Fig 1 shows the electrocardiogram of a patient not in the series, who did not receive a vagolytic drug before surgery and in whom traction on the medial rectus muscle caused a reduction in heart rate from 64 to 39 per minute. Cardiac arrhythmia occurred in this series and was observed on the intravenous injection of either atropine or gallamine, or following the application of traction. Although arrhythmia in association with gallamine has been described, it has not been reported in patients undergoing ophthalmic surgery (Deacock & Oxer 1962, Smith *et al.* 1972). Seven of 24 patients receiving gallamine in the present study had a cardiac arrhythmia. The association of atropine with cardiac arrhythmia is well known (Katz & Bigger 1970) and 9 of 24 patients given atropine in our study developed an arrhythmia on injection or on muscle traction. The type of arrhythmia was not specific to either drug, being most frequently sinus tachycardia with aberrant conduction, or sinus tachycardia with ventricular extrasystoles from variable ventricular foci. In all cases, the cardiac irregularity was of brief duration and did not require treatment.

*Conclusions*

The incidence of the oculocardiac reflex may be unacceptably high; the administration of either atropine or gallamine before commencing surgery may reduce or even abolish the problem, although both may increase the risk of cardiac arrhythmia.

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The following paper was also read:

**Factors Controlling Intraocular Pressure**
Dr I MacDiarmid and Dr K B Holloway
(*Department of Anæsthetics, Western Infirmary, Glasgow G11 6NT*)

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*Meeting 7 November 1976*

Papers were read on the subject of **Psychological Sequelæ of Anæsthesia in Surgery and Intensive Care,** as follows:

**Psychological Sequelæ of Anæsthesia and Surgery in Children**
Dr H T Davenport (*Department of Anæsthetics, Northwick Park Hospital, Harrow, Middlesex*)

REFERENCE

**Davenport H T & Werry J S** (1970) *American Journal of Orthopsychiatry* **40**, 806

**The Intensive Care Patient** Dr H G Schroeder
(*Department of Anæsthetics, Hallamshire Hospital, Sheffield*)

**Adverse Psychiatric Sequelæ of Psychotropic Drugs** Professor K Rawnsley
(*Department of Psychological Medicine, Welsh National School of Medicine, Cardiff*)