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Visual evoked potentials and visual acuity after transurethral resection of the prostate

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Summary

Changes in visual evoked potentials, visual acuity, blood ammonia levels and serum electrolytes (Na^+ and K^+) after transurethral resection of the prostate using glycine as an irrigating fluid performed under subarachnoid block were studied in 12 patients, in the pre-operative and immediate postoperative periods. Visual evoked potentials (p_{100} latency), recorded by shift of a checkerboard pattern, increased significantly from a pre-operative value of mean (SEM) 101.18 (1.63) msec in the right eye, and 102.5 (1.47) msec in the left eye to 108.91 (1.8) msec ($p < 0.01$) and 108.08 (2.53) msec ($p < 0.01$) respectively in the postoperative phase. There were no changes in visual acuity as assessed by a Snellen's chart, blood ammonia levels and serum electrolyte concentrations. The amount of glycine used intra-operatively for irrigation ranged from 3 to 31 litres.

Key words

Complications; glycine absorption.
Surgery, urological; transurethral resection of the prostate.
Monitoring; visual evoked potentials.

Transurethral resection of the prostate (TURP) syndrome, comprising central nervous system (CNS) and cardiovascular disturbances, has been recognised for many years.[1–8] These complications, which include prolonged sedation after surgery,[1,2] coma,[3,4] visual disturbances,[5–7] cardiovascular instability and even cardiac arrest[8] are thought to be caused by excessive absorption of irrigating fluid during surgery. Glycine is widely used as an irrigating fluid for TURP. Recently, the cause of altered visual physiology, prolongation of visual evoked potential (VEP) latency, has been attributed to glycine itself[6] or its metabolite.[9]

The present study was designed to evaluate changes in VEPs and visual acuity after TURP using glycine as an irrigating fluid, and to correlate these with changes in concentrations of blood ammonia and serum electrolytes. Although suppression of VEPs after TURP have been reported,[6,9] changes in visual acuity assessed by a Snellen's chart have not been studied before, to our knowledge.

Methods

The protocol for the study was approved by the ethics committee at Nizam's Institute of Medical Sciences, Hyderabad. Thirteen consecutive patients scheduled for elective TURP were studied, after obtaining informed consent. The patients belonged to ASA 1 and 2.

The patients were not premedicated. Pre-operative VEPs and visual acuity were determined approximately 1–2 hours before surgery. VEPs were recorded using the Neuromatic 2000 c (Dantec) electromyographic and evoked potential system. Active and reference electrodes were placed at O_z and C_z positions respectively with the ground electrode strapped around the wrist. The visual stimulus used was a checkerboard (check size 15 mm) pattern reversal at 2 Hz which was placed at a distance of 1.5 m from the patient. The squares reversed colour (black/white) without changing the total light output (luminance). Filter settings

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used were 0.5 Hz (lower) and 1 kHz (upper). At least 200 responses were averaged (using the autorejection mode) to form the VEP. The recording was repeated to see the reproducibility of VEP waveforms, and only consistently reproducible potentials were accepted for analysis. The latency of P_{100} was measured electronically by placing the cursor over the tip of the P_{100} peak. The amplitude of P_{100} was also noted. Each eye was studied separately by patching the other. Visual acuity was studied using the Snellen's chart placed at a distance of 6 m from the patient. Patients who wore spectacles continued to wear them while VEPs and visual acuity were studied.

A 16-G cannula was placed in a peripheral vein under local anaesthesia, and samples taken for estimating blood ammonia and serum electrolyte concentrations. An infusion of lactated Ringer's solution was started via the peripheral vein. Subarachnoid block with 5% lignocaine was performed under aseptic conditions at the $L_{3\text{-}4}$ interspace, with the patients in the sitting position. They continued in that position for the next 10 minutes to obtain a saddle block. Glycine 1.5% was used as the irrigating fluid during the operation. Monitoring during surgery was by continuous ECG and automated noninvasive blood pressure by Datex Cardiocap. Blood loss was estimated subjectively by the surgeon. Resection time and amount of glycine used for irrigation were noted.

A venous blood sample was obtained to estimate serum electrolytes and blood ammonia concentrations at the end of surgery. Postoperative VEPs and visual acuity were studied within an hour after surgery. Blood ammonia was estimated by the ultraviolet enzymatic method using the commercial kit supplied by Boehringer–Mannheim. Normal values were considered to be 25–94 μg/dlitre for men.

Data were analysed using the paired t-test and coefficients of correlation (rho) for comparing the variables wherever appropriate. Statistical significance was considered at $p < 0.05$. All data are presented as mean (SEM).

Results

One patient with bilateral cataract in whom pre-operative VEPs could not be obtained, was excluded from the study. In another patient VEPs could not be obtained from a blind right eye. These factors resulted in the analysis of VEPs and visual acuity from 23 eyes in 12 patients. The patients' ages ranged from 60 to 83 years with a mean of 68.28 (2.29).

Resection time ranged from 30–120 minutes with a mean of 53.75 (7.27) minutes during which 14.38 (2.59) litres (range 3–31) of 1.5% glycine was required for irrigation. During operation, all patients were haemodynamically stable and had no alteration in mental status. Blood loss as assessed subjectively by the surgeon, ranged from 150 to 300 ml. Infusion of lactated Ringer's solution during the surgery ranged from 500–1000 ml. No patient required blood transfusion.

There was a statistically significant prolongation of the VEP latency and suppression of amplitude after surgery (Table 1). There were no changes in visual acuity after operation in 11 patients, while a decrease from 6/9 (both eyes) to 6/12 was observed in one patient. This patient demonstrated an increase in the VEP latency from 100 msec (right eye) and 98 msec (left eye) to 102 msec and 104

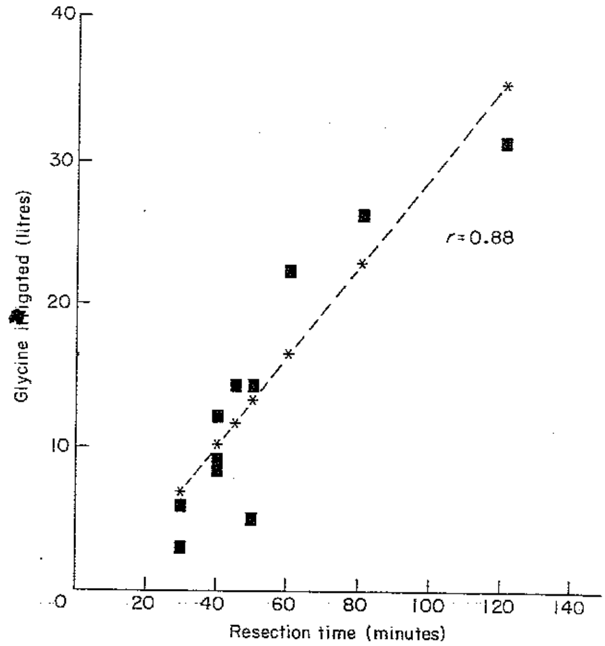

Fig. 1. Correlation between resection time and amount of glycine irrigated.

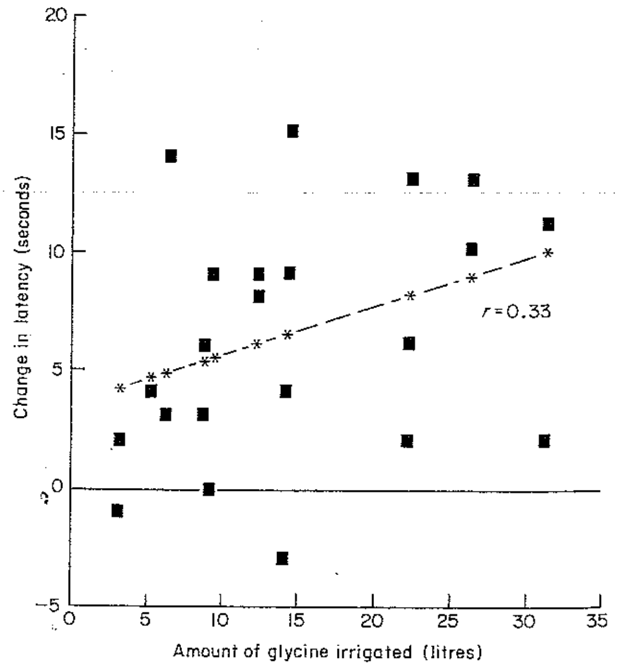

Fig. 2. Correlation between amount of glycine irrigated and change in latency.

Table 1. Changes in VEPs after TURP, mean (SEM).

VEP	Before operation	After operation	p value
Latency of right eye; msec	101.18 (1.63)	108.91 (1.80)	<0.01
Latency of left eye; msec	102.50 (1.47)	108.08 (2.53)	<0.01
Amplitude of right eye; μV	8.22 (0.89)	5.37 (0.78)	<0.05
Amplitude of left eye; μV	8.10 (1.12)	5.31 (0.59)	<0.01

Table 2. Changes in blood ammonia and serum electrolyte concentration, mean (SEM).

	Before operation	After operation	p value
Blood ammonia; μg/dlitre	57.15 (13.38)	58.88 (12.39)	ns
Serum Na; mmol/litre	142.33 (1.55)	141.33 (1.90)	ns
Serum K; mmol/litre	4.46 (0.13)	4.09 (0.14)	ns

ns, not significant.

msec respectively. There was a strong correlation between the resection time and the amount of glycine irrigant ($r = 0.88$, $p < 0.01$, Fig. 1). No such relationship could be found between the latter and the change in VEP latency ($r = 0.33$, Fig. 2). There were no changes in blood ammonia and serum electrolyte concentrations (Table 2).

Discussion

TURP syndrome results from excessive absorption of the irrigating fluid via the open prostatic venous sinuses during resection. Visual disturbances[5] including total blindness[7] and prolongation of VEP latency[6,9] following TURP with glycine irrigation have been well documented. These aberrations in the visual physiology are thought to be caused by the action of glycine as an inhibitory neurotransmitter in the CNS and retina.[10] The role of glycine in suppressing the VEP responses is also demonstrated by experimental studies.[11,12]

VEPs which reflect the functional integrity of the retina and the optic tracts provide an objective and a highly sensitive method of analysing their abnormalities. Pattern shift and luminance change are the two commonly used stimuli for recording VEPs. The former was preferred in this study because of its higher sensitivity and lower variability.[13] Objective assessment of visual acuity was found to be lacking in the available literature. Blood ammonia and serum electrolyte concentration were estimated because hyperammonaemia[2] and dilutional hyponatraemia[3] have been implicated in the pathogenesis of the TURP syndrome.

Postoperative suppression of VEPs demonstrated in this study correlate well with the results of the two clinical studies reported earlier.[6,9] Glycine absorbed into the systemic circulation is probably responsible for alterations in the VEPs. The amount absorbed is determined by the duration of resection, quantity of the irrigant fluid used, number of open prostatic venous sinuses and the amount of the fibrous tissue in the gland. The influence of these last two factors may account for the lack of correlation between the amount of glycine irrigant and the change in VEP latency in our observation. Dramatic elevation of glycine level is often associated with normal levels of ammonia following TURP with glycine irrigation.[2,6] It may be inferred that our patients could have had an elevated systemic glycine concentration because there were no changes in the blood ammonia levels. Glycine itself and/or other metabolites other than ammonia may be responsible for the changes in visual electrophysiology observed in our study.

No changes occurred in the visual acuity of our patients despite prolonged VEP latency, as was shown in an earlier study.[9] In a recent study by Wang *et al.*,[6] subjective visual disturbances correlated better with serum glycine levels than with the increase in VEP latency. These authors considered that retinal condition and cerebral cortical condition are affected by different mechanisms in the TURP syndrome.

We have demonstrated significant prolongation of P_{100} latency in the immediate postoperative period following TURP surgery with glycine irrigation. There were no subjective changes in vision. No alterations in blood ammonia or serum electrolyte concentrations were observed.

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