

Intraocular Pressure Changes Following Three “Head below the Heart” Postures in Yoga Practitioners – A Prospective Observational Study

Abstract

Context: Intraocular pressure (IOP) increases during “sirasasana” and may be a risk factor for the progression of glaucoma. Other “head below heart” asanas may also cause increase in IOP. **Aims:** To determine the change in IOP following three “head below the heart” postures-“meruasana”, “viparithakarni,” and “sarvangasana”. **Settings and Design:** Prospective observational study conducted in a tertiary care hospital over 3 weeks. **Materials and Methods:** Willing, regular yoga practitioners recruited by purposive sampling performed “meruasana”, “viparithakarni,” and “sarvangasana” in random order according to a 3 × 3 periods cross over study design after baseline measurement of IOP, blood pressure (BP), and pulse rate. Each asana was held for 30 s. Within 15–30 s of completion of asana, IOP, BP, and pulse rate were recorded. There was an interval of 30 min between the asanas. **Statistical Analysis Used:** Normality of data was tested using the Kolmogorov–Smirnov test. Repeated measures of ANOVA with Tukey-Kramer multiple comparisons was used to compare changes in IOP, BP, pulse rate following asana. $P \leq 0.05$ was accepted as statistically significant. **Results:** There were 33 participants with a mean age of 29.6 ± 10.5 years (95% confidence interval [CI]: 26.02, 33.18). The mean baseline IOP was 15.5 ± 3.4 mm Hg (95% CI: 14.34, 16.66) in the right eye and 16.7 ± 3.4 mm Hg (95% CI: 15.54, 17.86) in the left eye. IOP showed a significant reduction following each of the three asanas ($P < 0.0001$). However, neither pulse rate ($P = 0.53$) nor BP ($P = 0.27$) showed any change following the asanas. **Conclusions:** “Meruasana,” “viparithakarni,” and “sarvangasana” when held for 30 s by healthy yoga practitioners resulted in post-asana drop in IOP with no significant change in pulse rate or BP.

Keywords: Blood pressure, glaucoma, heart rate, intraocular pressure, yoga

Introduction

An ancient Indian practice of specific postures, breathing and meditation, yoga has rapidly gained popularity worldwide. At present, yoga forms an important component of mind-body therapy with proven benefits in numerous chronic diseases.^[1-3] Tangible physical effects on the body warrants caution in the prescription and practice of yoga “asanaas.”^[4-7]

“Sirasasana” or the head stand posture is treated by ophthalmologists with caution as intraocular pressure (IOP) is known to almost double during the posture.^[8-10] Other “head below the heart” postures may also cause an increase in IOP.^[11]

We hypothesized that there would be an increase in IOP following three other “head below the heart” postures namely “meruasana,” “viparithakarni,”

and “sarvangasana.” This would warrant caution when such asanas are practiced by glaucoma patients. Further, these may explain progression in glaucoma despite adequately controlled IOP as measured in clinic settings. The purpose of this study was to investigate the change in IOP immediately following three postures.

Materials and Methods

The study was conducted in accordance to the tenets of Declaration of Helsinki. After obtaining Institutional Ethics Committee permission (IHEC: Faculty/2014/15), willing yoga practitioners who routinely perform “meruasana”, “viparithakarni,” and “sarvangasana” were recruited for the study by purposive sampling. All participants underwent ocular examination and those with shallow anterior chamber or evidence of glaucoma were excluded. This

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prospective observational study was conducted in a tertiary care hospital over 3 weeks.

Baseline blood pressure (BP) and pulse rate were measured for all participants before starting the asana. IOP (both eyes) was measured using hand held rebound tonometer as per manufacturers’ instructions (icare, Finland).^[12] Central corneal thickness (CCT) was measured by ultrasound pachymeter (Pachette2, DGH technologies, USA) which provided an average of 25 readings.^[13]

Procedure for performing the asanas [Figure 1].

Meru asana

From the standing position, both arms are lifted above head with inhalation. Torso is bent forward with exhalation till the hands are flatly placed on the ground. The knees are to be maintained tight and straight. Then heels and hands are pushed to lift the buttocks as high as possible. Posture is held with normal breathing for 30 s. With slow inhalation, standing position with arms raised above head is achieved.

Viparita Karani asana

From the supine shava asana, with inhalation, both legs are lifted simultaneously. Buttocks are lifted off the ground and both arms are used to support the lower back. The weight of the body should be balanced on elbows and arms and not on the shoulders. With normal breathing, the posture is held for 30 s. On slow exhalation, the posture is released to return to the supine position of shava asana.

Sarvanga asana

From the supine shava asana, with inhalation, both legs are lifted simultaneously. Buttocks are lifted off the ground and both arms are used to support the lower back. Trunk and legs are maintained in a straight line by supporting the entire trunk on the shoulders. With normal breathing, the posture is held for 30 s. On slow exhalation, the posture is released to return to the supine position of shava asana.

The participants were asked to perform the three asanas in the randomized and sequenced order obtained by 3×3 periods cross over study design. Participants drew lots to decide their

order of performing the asana from the 6 orders depicted in Table 1. Each asana posture was held for 30 s. Within 15 – 30 s of completion of asana, their IOP was recorded followed by recording of BP and pulse rate. After an interval of 30 min, the procedure was repeated for the 2nd asana and after a further interval of 30 min, for the 3rd asana.

IOP was corrected for CCT according to correction factor by Ehlers *et al.* and the two eyes were analysed separately.^[14,15] Data were assessed for the normality using GraphPad InStat version 3.06 for Windows 95, (GraphPad Software, San Diego California USA, www.graphpad.com). As all data passed normality testing by Kolmogorov – Smirnov test, statistical analysis was carried out using the repeated measures of ANOVA with Tukey-Kramer multiple comparisons test to compare differences between the intervention techniques and $P < 0.05$ were accepted as indicating significant differences for pre- and post comparisons.

Results

There were 33 participants in the study with 18 males and 15 females and mean age of 29.6 ± 10.5 years (range: 16–64 years; 95% confidence interval [CI]: 26.02, 33.18). Of these, only 4 participants above the age of 40 years and none was hypertensive. The mean duration of yoga practice was about 7.2 years (95% CI: 4.1, 10.3). The mean baseline IOP in the right eye was 15.5 ± 3.4 mm Hg (95% CI: 14.34, 16.66) and in the left eye was 16.7 ± 3.4 mm Hg (95% CI: 15.54, 17.86) [Table 2].

The IOP in both eyes showed a statistically significant reduction following each of the three asanas. However, neither the pulse rate nor the BP (systolic and diastolic) showed a statistically significant change following 30 s of the three asanas [Table 3].

Discussion

In this study three “head below the heart” postures held for 30 s by healthy yoga practitioners resulted in a decrease in IOP after the postures with no discernible change in BP and pulse rate.

Physical activities are known to improve ocular physiological functions. In the eye, physical exercises



Figure 1: Posture of the three “head below the heart” Asanas. (a) Meruasana, (b) Viparitakarani, (c) Sarvangaasana

Table 1: Randomisation and sequencing of the three techniques

Sequence	Technique 1	Technique 2	Technique 3
ABC	A	B	C
BCA	B	C	A
CAB	C	A	B
ACB	A	C	B
BAC	B	A	C
CBA	C	B	A

Duration of each technique was 30 s. A: Meru asana, B: Viparita Karani and C: Sarvanga asana

cause changes in ocular blood flow-almost double the perfusion pressure and increase the choroidal blood flow to about 140%.^[16] Both these effects increase the blood flow to the optic nerve head and are therefore neuroprotective. However, these findings cannot be extrapolated to all types of physical activities, especially yoga in which specific postures are maintained for a period of time.

IOP is known to change with posture. Moving from sitting to supine posture has been observed to cause an increase in IOP.^[17] These postural changes in IOP are larger in patients with autonomic dysfunction and also in those with glaucoma.^[9,17,18] In patients suspected of being at risk for glaucoma, measuring IOP in the supine position had been historically used as a diagnostic test. Thus, the positional change in IOP and the risk to progression of glaucoma that it poses cannot be overemphasized.

Anecdotal reports as well as a few studies have observed a significant increase in IOP during the head-stand (sirasasana) posture.^[8,10] In addition, similar observations were also made in a few other head-below-the-heart postures.^[11] Such observations have caused the practice of yoga to be considered as a possible reason for normotensive glaucoma and unexplained progression of glaucomatous optic neuropathy.^[10]

Baskaran *et al.* studied the changes in IOP during and after sirasasana (maintained for 5 min) among 75 yoga practitioners with mean age of 49 years. The IOP almost doubled from the baseline values “immediately after”

the posture was achieved and this increase in IOP was maintained at 5 min of maintenance of the posture. “Immediately after” resuming sitting posture, the IOP dropped to almost baseline values. The time denoting “immediately after” has not been mentioned. The method of assuming the sirasasana position in this study involved an initial forward bend from the standing posture with head below the heart which was held for a few seconds before the sirasasana position. Thus even for the IOP measured immediately after achieving the posture, the participant would have been in a head-below-heart posture for some time. With their observations, they did not recommend routine ocular examination to rule out glaucoma in young subjects practicing Sirasasana.^[8]

In the study by Jasien *et al.*, glaucoma subjects in their 60 s were significantly older than the non-glaucomatous group who were in their 30 s. The pose was held for 2 min for each asana and an increase in IOP was observed for this duration with a return to almost the baseline IOP immediately on resuming preasana position in both the groups. While in nonglaucomatous group IOP was observed to be marginally below the pre-asana values following Halasana and Viparitamarni, in the glaucomatous group all the post-asana values were a little above the pre-asana values.^[11]

In this study, the participants were notably younger than the above mentioned studies. Also the asana was maintained for only 30 s compared to the 2–5 min in the previous studies. These could explain the observations of a small drop in IOP following an asana. However, IOP during the asana, which was measured in the previous studies was not measured in this study and is a limitation. Furthermore, further IOP measurements to determine the time taken for IOP to return to baseline values was not recorded. It will be interesting to note if the duration for which an asana is held influences the IOP and if it is possible to define a “safe” duration for which such head-below-heart asanas do not cause a rise in IOP.

Conclusions

The three head-below-heart postures of “meruasana,” “viparithakarni,” and “sarvangasana” when held for 30 s by healthy yoga practitioners resulted in a post-asana drop in IOP with no significant change in the pulse rate or BP.

Table 2: Demographics, baseline systemic and ocular parameters

Parameter	Mean±SD	Range
Age (years)	29.6±10.5	16–64
Duration of yoga practice (years)	7.2±9.1	0.5–40
CCT (RE) (microns)	525.2±31.3	466–626
CCT (LE) (microns)	526.9±31.1	467–630
IOP (RE) (mm of Hg)	15.5±3.4	11–22
IOP (LE) (mm of Hg)	16.7±3.4	10–24
Resting pulse (min)	74.2±10.5	56–97
Systolic BP (mm of Hg)	117.4±11.0	100–146
Diastolic BP (mm of Hg)	71.1±10.4	52–92

CCT: Central corneal thickness, IOP: Intraocular pressure, RE: Right eye, LE: Left eye, BP: Blood pressure, SD: Standard deviation

Table 3: Blood pressure, pulse rate and intraocular pressure changes following the three asanas

Parameters	Baseline	Meru asana	Viparitarakarni asana	Sarvanga asana	P (rm ANOVA)
IOP (RE)	15.62±3.38	13.87±2.76**	14.03±3.00*	13.19±3.49***	<0.0001
IOP (LE)	16.87±3.38	15.13±3.14***	15.15±2.84***	14.97±2.67***	<0.0001
Systolic pressure	117.75±11.02	115.81±10.97	118.59±11.47	118.34±11.01	0.2723
Diastolic pressure	70.91±10.52	67.09±14.36	68.81±10.25	68.91±10.16	0.2956
Pulse rate	73.72±10.18	72.47±10.64	73.93±10.37	73.53±11.63	0.5333

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$ are values when compared with baseline values by Tukey–Kramer multiple comparison test. Values are given as mean±SD. IOP: Intra ocular pressure, RE: Right eye, LE: Left eye, SD: Standard deviation

Ethical statement

Approval was obtained from Institutional Human Ethics Committee, Sri Balaji Vidyapeeth (IHEC: Faculty/2014/15).

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Conflicts of interest

There are no conflicts of interest.

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