

Evaluation of Isometric Exercise (Handgrip Test) as Predictor of Early PIH

Devinder Kaur, A.S. Saini, Harjeet Kaur, Arshdeep Singh

Dept. of Obst and Gyn Goet. Medical College, Amritsar (Punjab).

Summary

This study was conducted on 450 patients to evaluate isometric exercise (Handgrip test) as a method to predict pregnancy induced hypertension (PIH) in the early weeks of pregnancy (before 15 weeks). The handgrip test was rated as positive when the systolic blood pressure increased by 15mmHg or more or it decreased by 14 mmHg or more immediately after the exercise. The sensitivity of this test was 51.55%. Positive predictive value was 70.8% and negative predictive value was 92.54%. It was concluded that the handgrip test is simple, easy to perform, safe and can be used routinely in early pregnancy to predict development of PIH.

Introduction

Pregnancy induced hypertension, the most common medical complication of pregnancy continues to be one of the leading cause of maternal and perinatal morbidity and mortality (Lehmann et al, 1987). There is therefore a need to have a method which can predict in early pregnancy the possibility of developing PIH. There is increased vascular sensitivity to pressor substances such as angiotensin II, catecholamines etc. in PIH. The handgrip test is used to assess vascular sensitivity to pressor substances. During sustained muscle contraction blood vessels to and from the contracting muscles are occluded. To overcome this obstruction, endogenous catecholamines are secreted and sympathetic activity is increased resulting in dynamic systemic change (Humphreys and Lind, 1963). When vascular sensitivity is increased as in case of PIH, which occurs very early in pregnancy, the degree of increased blood pressure should be higher than in cases of normotensives. This was assessed by the isometric exercise.

Material and Methods

The study was conducted on 450 normotensive patients attending the Antenatal clinic of Shri Guru Teg Bahadur Hospital, Amritsar. The procedure of the Handgrip test (HG Test) was well explained to them and informed consent taken.

All the patients underwent the HG Test at their first visit prior to the fifteenth gestational week. They were closely followed up to see development of PIH at 20, 24, 28, 32, 36 and 40 weeks of pregnancy.

The patient was allowed to relax in the supine position for 5 minutes to eliminate factors like anxiety, stress, fear, recent activity (which might influence the blood pressure). Forearm of the patient was kept horizontal and well supported and upper arm level with the heart. The blood pressure was recorded with a mercury sphygmomanometer. The cuff was applied firmly without creasing and inflated and deflated smoothly. Blood pressure recording was taken as

recommended by American Heart Association (Martit et al, 1964). After applying the cuff it was inflated to 30mmHg above the point at which the radial pulse disappeared. The pressure within the cuff was then released at a rate of 2-3 mm of Hg per second while auscultation was done over the brachial artery. Thus the baseline blood pressure was measured. The systolic blood pressure was recorded with the appearance of Korotkoff's sounds i.e. phase I and diastolic blood pressure was recorded with muffling of Korotkoff's sounds i.e. phase IV. The subject then used the other hand to grasp a hand grip of 25kg strength for maintaining the grip for 3 minutes. The blood pressure was again recorded during HG test and after the patient released the grip.

Observations and Discussion

Out of 450 patients the number of patients who had a positive handgrip test at 15 weeks was 48. Amongst these only 34 patients had a true positive handgrip test since they developed PIH in later months of pregnancy, 14 patients who had a positive HG test remained normotensive throughout pregnancy i.e. test was false positive in 29.2% and positive predictive value of HG test was 70.8% (Table I).

The number of patients who had a negative HG test was 402. Amongst these 372 patients remained normotensive throughout pregnancy i.e. negative predictive value was 92.54% (Table I). Out of these, thirty patients developed PIH in later months of pregnancy i.e. the test was false negative in 30 patients (7.46%). All

these patients developed mild pre-eclampsia in the later months of pregnancy.

Increased vascular reactivity in those destined to develop PIH explains the pressor response to an infusion of angiotensin-II (Gant et al, 1973) but the angiotensin sensitivity test is not practical and its safety has not been confirmed. Numerous other tests have been proposed including biochemical tests which are expensive and require sophisticated laboratory equipment. Therefore, clinical screening can be utilized to screen the antenatal patients.

Nisell et al (1985) found that both systolic and diastolic blood pressure were significantly higher in patients of PIH than in controls both during and after the isometric exercise when they studied sympathoadrenal and cardiovascular reactivity in PIH

Raisanen et al (1990) found increased response of plasma adrenaline to isometric exercise in PIH patients when compared with suppressed response in normal pregnancy.

Out of 450 patients, 66 developed PIH subsequently giving us an incidence of 14.67%. Out of all patients who belonged to lower socio-economic status 63 developed PIH (15.32%) whereas out of 24 patients from middle socio-economic status 3 patients had PIH (12.50%). None of the 15 upper strata patients had PIH (Table II).

Table I
Result of Hand Grip Test

Handgrip test	No. of patients (n=450)	Percentage
Total positive cases	48	10.66
True positive	34	70.80
False positive	14	29.20
Total negative	402	89.33
True negative	372	92.54
False negative	30	7.46

Table II
Showing relationship of socio-economic status with PIH
(N=450)

Socio-economic status	Income (Rs.) per month	No. of cases	Patients with PIH	%age
Lower	< 1000	411	63	15.32
Middle	1001-2400	24	3	12.50
Upper	> 2400	15	-	-
Total		450	66	14.67

In our series true positive cases by HG test were 34 whereas 66 patients subsequently developed PIH, giving a sensitivity rate of 51.51%. Tomoda et al (1994) however reported a sensitivity rate of 81.8% for predicting PIH. Out of our 402 patients who turned negative for HG test 372 did not develop PIH, the negative predictive value of being 92.54% as compared to 97.5% reported by Tomoda et al (1994).

The isometric exercise seems reliable in predicting PIH. An important aspect is the high negative predictive value (92.54%) which helps to detect those patients who will not develop PIH and the early positive prediction (70.8%) enables one to take preventive measures early thus improving both maternal and fetal prognosis.

The HG test is easily performed, virtually costless and is a valuable screening procedure because of its sensitivity, simplicity and high negative predictive value.

References

1. Humphreys PW, Lind AR: *J. Physiol.*, 166: 120, 1963
2. Gant NE, Chand S, Whalley PJ, MacDonald PC: *J. Clin. Invest.*, 52: 2682, 1973.
3. Lehmann DK, Mabie MC, Miller JM Jr, Pernoll ML: *Obstet Gynaecol.*, 833: 40, 1987.
4. Martit JK, Leo JK, Jarvinen JK: *Amer J. Cardiol.*, 13: 688: 1964.
5. Nisell H, Hjemdahl P, Linde B, Lunell NO: *Brit. Jour. Obstet. Gynaecol.*, 92: 722, 1985.
6. Raisanen I, Salminen K, Laatikainen I: *European Jour. Obstet. and Gynaecol and reproductive Biology* 35: 119, 1990.
7. Tomoda S, Kitanaka T, Ogita S, Hidaka A: *Asia Oceania J. Obst. Gyn.*, 20: 249, 1994.