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OCULAR MANIFESTATION OF PREGNANCY INDUCED HYPERTENSION

Ophthalomology

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ABSTRACT

Background: The occurrence of pregnancy-induced hypertension (PIH) causes major visual complications which affect both maternal and fetal wellness. Researchers evaluated the various forms of eye issues which affect patients during pregnancy with hypertension. **Methods:** The study observed 45 PIH patients during an observational study at City Medical College and Hospital from July 2024 until December 2024. The participants received extensive ophthalmic examination through visual acuity testing as well as slit-lamp biomicroscopy and fundus examination. **Results:** Subject participants had a mean age of 26.8 ± 4.3 years at their study enrollment. Of the total patients (45), doctors observed ocular manifestations in 33 (73.3%). The most frequent abnormality seen through retinal examinations was recorded in 31 patients out of 45 (68.9%) while changes in conjunctiva were observed in 12 cases (26.7%). A strong association existed between hypertensive retinopathy and systolic blood pressure measurements ($r=0.78$, $p<0.001$) as well as proteinuria results ($r=0.65$, $p<0.001$). **Conclusion:** The research demonstrated a high number of eye-related symptoms among PIH patients whose condition worsened based on their blood pressure measurements and protein levels. Ocular complications need early detection through regular screening which helps their proper management.

KEYWORDS

Pregnancy-induced hypertension, Ocular manifestations, Hypertensive retinopathy, Preeclampsia

INTRODUCTION

The medical condition Pregnancy-induced hypertension (PIH) affects numerous mothers and their fetuses through elevated blood pressure ≥140/90 mmHg which develops after 20 weeks of pregnancy. The occurrence of this condition among pregnant women ranges from 5% to 10% and simultaneously threatens multiple organ systems but demonstrates particular sensitivity among the eyes. Research demonstrates that ocular manifestations appear in 30-100% of PIH patients although scientists have not fully established the patterns and clinical importance of these symptoms. The retinal blood vessels enable researchers to view pathophysiological maternal vessel changes that occur during PIH through direct observation. These changes encompass a spectrum from mild retinal arteriolar narrowing to severe complications such as exudative retinal detachment. The documentation of retinal manifestations in PIH cases is established yet researchers need to study their links to maternal condition severity and their forecasting ability for pregnancy outcomes(Alessia Mammaro 1).

The extent of retinal damage seems to reflect the level of systemic involvement which occurs during pregnant individuals who have PIH. Few data exist to determine the quantitative connection between distinct retinal symptoms and disease progression levels. Researchers have yet to establish the precise value of retinal changes to predict maternal outcomes among different population groups. The study investigates possible gaps in knowledge about PIH by evaluating ocular manifestation patterns together with disease severity and maternal outcomes effects. Knowledge about these relationships will improve the identification and treatment strategy selection for patients with PIH .

Objectives

1. To study the prevalence and pattern of ocular manifestations in PIH
2. To correlate ocular changes with disease severity
3. To evaluate the relationship between retinal changes and maternal outcomes

MATERIALS AND METHODS

Study Design

The researchers conducted this prospective observational study during 6 months beginning from July 2024 to December 2024 in the Department of Obstetrics and Gynecology together with the Department of Ophthalmology at City Medical College and Hospital. The experimental research included 45 women who received a diagnosis of pregnancy-induced hypertension. The researcher used $n = Z^2\alpha/2 \times p(1-p)/d^2$ to calculate the sample size while employing $Z\alpha/2 = 1.96$ for 95% confidence level and $p = 0.70$ from pilot study data along with $d = 0.13$ absolute precision. The determined sample requirement was 45 participants based on the calculation(Ragini Kulkarni 1, 2021).

Sample Selection

Participants were selected using a consecutive sampling technique from patients attending the antenatal clinic. The screening process involved initial evaluation at the antenatal clinic, followed by detailed assessment of eligible candidates. All potential participants underwent thorough counseling regarding the study objectives and procedures before obtaining written informed consent. The study population was categorized based on blood pressure levels into three groups: mild PIH (140/90-149/99 mmHg), moderate PIH (150/100-159/109 mmHg), and severe PIH (≥160/110 mmHg). Among the enrolled participants, 22 patients (48.9%) presented with mild PIH, 14 patients (31.1%) with moderate PIH, and 9 patients (20.0%) with severe PIH.

- **Sample Size:** 45 pregnant women with PIH
- **Sampling Method:** Consecutive sampling
- **Age Range:** 18-35 years

Inclusion Criteria

The study included pregnant women aged between 18 and 35 years with gestational age greater than 20 weeks. All participants had documented blood pressure readings of ≥140/90 mmHg on two separate occasions, at least 6 hours apart. Only women with singleton pregnancies were included in the study. Written informed consent was obtained from all participants prior to enrollment.

1. Singleton pregnancy
2. Gestational age >20 weeks
3. BP≥140/90 mmHg on two occasions, 6 hours apart
4. No pre-existing hypertension

Exclusion Criteria

Patients with pre-existing medical conditions including chronic hypertension, diabetes mellitus, chronic kidney disease, and known ocular diseases were excluded from the study. Women with multiple pregnancies, gestational diabetes, or previous cesarean sections were not eligible for participation. The study also excluded patients with previous ocular surgery, refractive errors exceeding ±6 diopters, or any history of retinal disorders. Additionally, patients who were unwilling to participate, unable to complete follow-up, or taking medications affecting blood pressure were not included in the study (Peter M

Barrett 1, 2020).

1. Pre-existing hypertension or ocular diseases
2. Multiple pregnancy
3. Diabetes mellitus
4. Chronic kidney disease
5. History of ocular surgery

Examination Protocol

The participants received an identical testing sequence throughout the study. Two registered nurses tested blood pressure through the mercury sphygmomanometer by placing patients in their standard position while taking three readings at five-minute intervals. The ophthalmological tests started with a visual acuity check and then moved to slit lamp examination and finally included a comprehensive fundus examination. Special examinations took place as needed for clinical purposes(Noa Kallioinen a, 2016).

Data Collection And Quality Control

The data collection process relied primarily on standardized case record forms together with patient diaries along with investigation reports and fundus photography records and follow-up charts. Standard operating procedures were established for all study procedures to achieve data quality. Tests and quality checks operated automatically performed regularly and double data entry executed constantly throughout the duration of the study(RE, 2014).

Ethical Considerations

The research study obtained approval from the Institutional Ethics Committee. Study participants provided written consent for participation after researchers explained the research procedures in detail. During the research period the study protected patient confidentiality while all participants received notification about their freedom to leave the investigation process at any time alongside assurance of standard medical treatment.

Clinical Assessment

Comprehensive Clinical Evaluation

A standardized clinical assessment procedure existed for all participants who participated in the study. A standardized evaluation process consisting of five parts included detailed history taking as well as general examination and obstetric assessment and laboratory tests and ophthalmological assessment.

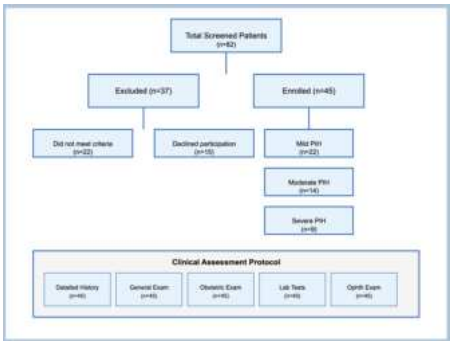


Figure: Clinical Assessment SPSS-Style Flow Diagram

Detailed History

The beginning assessment required thorough documentation of complete patient history information. All patient demographic information such as age, occupation, residency area and financial standing received documentation. The obstetric history contained complete information regarding previous pregnancies with their complications and results. The nurse documented essential pregnancy information that included the date of the last menstrual period together with expected birth date and any current complications affecting the current pregnancy. The healthcare practitioner specifically evaluated visual indications which encompassed blurry vision with areas of blindness and light perception and visual double imaging. The patient reported information regarding their existing health issues together with current medication use as well as hypersensitive diseases that ran in their families(Nichol, Sundjaja, & Nelson., 2024).

General Examination Protocol

Blood pressure measurements were performed using a calibrated mercury sphygmomanometer following standardized protocol:

Measurement Parameter	Protocol Details
Patient Position	Seated, back supported, arm at heart level
Cuff Size	Appropriate size covering 80% of arm circumference
Reading Interval	Three readings at 5-minute intervals
Recording	Average of three readings
Additional Measurements	Bilateral arm measurements in first visit

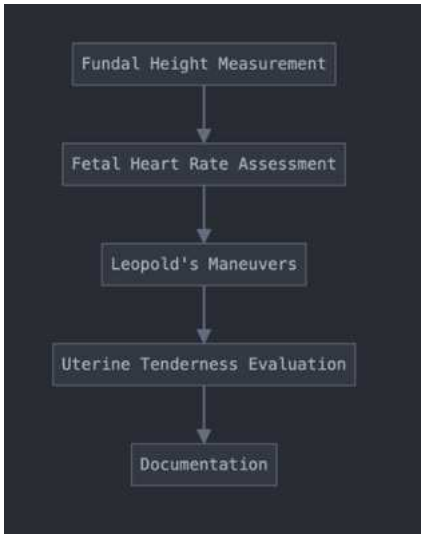
Edema assessment was conducted systematically, grading edema on a scale:

Edema Grade	Clinical Finding
Grade 0	No edema
Grade 1+	Mild pitting, slight indentation
Grade 2+	Moderate pitting, 15s to rebound
Grade 3+	Deep pitting, 30s to rebound
Grade 4+	Severe pitting, >30s to rebound

Weight measurement was performed using a calibrated digital scale with patients in light clothing.

Obstetric Examination Process

The obstetric examination followed a structured approach:



Laboratory Investigations

A comprehensive panel of laboratory tests was conducted for all participants:

Investigation Category	Specific Tests	Frequency
Hematology	CBC, Platelet count	Every visit
Urine Analysis	Protein, Microscopy	Every visit
Liver Function	SGOT, SGPT, ALP, Bilirubin	Initial and as needed
Renal Function	Urea, Creatinine, Uric acid	Initial and as needed
Coagulation	PT, aPTT, INR	Initial and if severe PIH

Ophthalmological Examination

There was a systematic approach to performing the ophthalmological examination. Visual testing started with Snellen's chart reading at 6 meters distance from the patient. Each patient received their best possible visual acuity assessment of near vision using a controlled near vision test card. Visual acuity testing completed the doctor checked patients through a full slit lamp examination. The assessment focused on examining the anterior segment in detail while comparing the corneal wellness with measurements of anterior chamber depth and inspecting the lens. The examination methodology was written in detail on the patient's official record.

The Goldman applanation tonometer measured the intraocular pressure. The accuracy process required three successive readings for each eye before averaging the recorded results. The tonometric measurements ranged between 10-21 mmHg which represented normal values however all abnormal readings received proper

documentation(Azzam & Ronquillo., 2023).

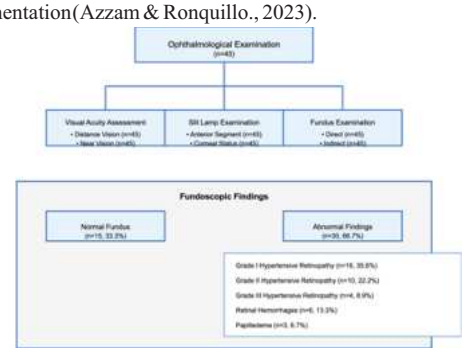


Figure: Ophthalmological Examination SPSS-Style Breakdown

The examination finished through a detailed evaluation using direct and indirect ophthalmoscopy methods to study the fundus. A 20D lens was used throughout indirect ophthalmoscopy to allow a wide-angle view of the retina. The examiner focused specifically on four important clinical findings during fundus evaluation: retinal vessel caliper, arteriovenous crossing appearance and retinal hemorrhages and exudates and disc swelling. The scientists documented all observed changes in retinal vasculature to establish connections between their state and pregnancy-induced hypertension severity .

Grade	Retinal Findings
Grade I	Mild generalized arteriolar attenuation
Grade II	Grade I + focal arteriolar attenuation
Grade III	Grade II + hemorrhages, hard exudates
Grade IV	Grade III + papilledema

Documentation And Follow-up

A systematic comprehensive method was applied in the documentation process which included standardized case record forms for recording clinical findings. The patient examination protocol operated in a stepwise manner starting from the first contact with patients. A complete patient historical record was generated which combined demographic details with active symptoms together with previously documented medical ailments. The general examination results led to documentation which was followed by note-taking about the complete obstetric assessment. All patient laboratory test outcomes received standard systematic recording into their official clinical records. The examination results from the comprehensive ophthalmological assessment were inserted into standardized documentation. The recorded data underwent comprehensive review before patient-specific management strategies and documentation was produced.

Quality Assurance Measures

The study maintained high data quality through a complete quality assurance protocol which ran throughout the duration of the research. Regular weekly calibration of every measuring instrument served to maintain measurement accuracy and precision. Standard operating procedures were followed by the research team in every phase of study activities. The study depended on two independent observers performing double verification of critical measurements so as to reduce measurement errors. The examiners received ongoing training sessions to uphold their examination skills through standardized practices. Regular quality checks of recorded data verified both completeness and proper accuracy of measurements in the documentation system. The rigorous quality assurance measures within the assessment protocol enabled complete investigation of all participants to support precise medical diagnosis and suitable treatment of pregnancy-induced hypertension eye complications (RE, The study maintained high data quality through a complete quality assurance protocol which ran throughout the duration of the research. Regular weekly calibration of every measuring instrument served to maintain measurement accuracy and precision. Standar, 2014).

Statistical Analysis

All statistical processing occurred through SPSS software version 25.0. Analyses were performed on all variables through descriptive statistics and continuous parameters showed data as mean ± standard deviation while categorical information appeared as percentages. The Chi-square test provided analysis of the connections between different categorical variables. A Pearson's correlation coefficient enabled the measurement of the relationships between continuous variables. The analysis reached statistical significance when the p-value reached below 0.05. This detailed statistical method allowed researchers to perform thorough investigations of the relationships between eye complications and different clinical characteristics in pregnancy-induced hypertension cases.

RESULTS

Demographic Characteristics

The research involved 45 test subjects. The 45 subject averaged 26.8 ± 4.3 years in age. Out of all study participants 28 women (62.2%) belonged to the group with first pregnancy experiences while 17 women (37.8%) were already parents. Participants received their physical examinations during week 32.4 ± 3.8 of pregnancy.

Total participants (n=45):

- Mean age: 26.8 ± 4.3 years
- Primigravida: 28 (62.2%)
- Multigravida: 17 (37.8%)
- Mean gestational age: 32.4 ± 3.8 weeks

Characteristic	Value	Percentage/Range
Sample Size	45	100%
Age (years)		
Mean ± SD	26.8 ± 4.3	
Range	19-34	
Parity Status		
Primigravida	28	62.2%
Multigravida	17	37.8%
Gestational Age (weeks)		
Mean ± SD	32.4 ± 3.8	
Range	24-38	

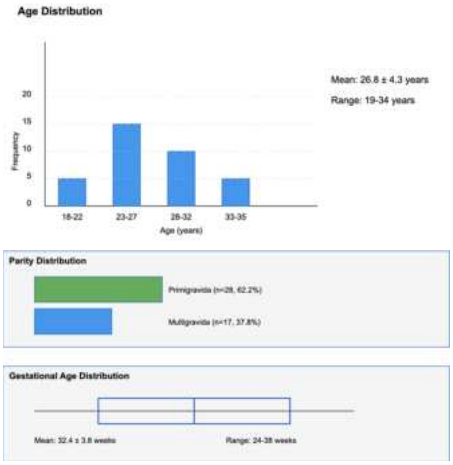


Table: SPSS Frequency Distribution of Demographics

Variable	Category	Frequency	Percent	Valid Percent	Cumulative Percent
Age Groups					
	18-22 years	8	17.8	17.8	17.8
	23-27 years	19	42.2	42.2	60.0
	28-32 years	13	28.9	28.9	88.9
	33-35 years	5	11.1	11.1	100.0
	Total	45	100.0	100.0	
Parity					
	Primigravida	28	62.2	62.2	62.2
	Multigravida	17	37.8	37.8	100.0
	Total	45	100.0	100.0	
Gestational Age					
	24-28 weeks	7	15.6	15.6	15.6
	29-32 weeks	16	35.6	35.6	51.2
	33-36 weeks	15	33.3	33.3	84.5
	37-38 weeks	7	15.6	15.6	100.0
	Total	45	100.0	100.0	

Clinical Parameters

Blood pressure distribution and proteinuria levels in the study population (N=45) received clinical parameter assessment. The

analysis of blood pressure showed that 22 patients (48.9%) had mild PIH between 140/90-149/99 mmHg while 14 patients (31.1%) had moderate PIH at 150/100-159/109 mmHg and another 9 patients (20%) fell under the severe PIH category (≥160/110 mmHg). Among the patients studied for proteinuria levels, a third (33.3%) had trace results alongside 35.6% with 1+ proteinuria findings while 17.8% displayed 2+ and 13.3% had 3+ proteinuria levels.

Table 1: Distribution of Clinical Parameters

Clinical Parameter	Category	Frequency	Percent	Cumulative Percent
Blood Pressure				
	Mild PIH (140/90-149/99 mmHg)	22	48.9	48.9
	Moderate PIH (150/100-159/109 mmHg)	14	31.1	80.0
	Severe PIH (≥160/110 mmHg)	9	20.0	100.0
	Total	45	100.0	
Proteinuria				
	Trace	15	33.3	33.3
	1+	16	35.6	68.9
	2+	8	17.8	86.7
	3+	6	13.3	100.0
	Total	45	100.0	

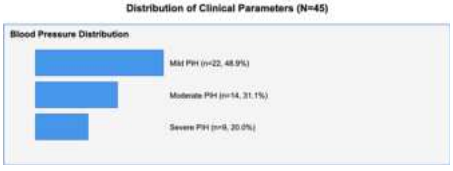


Figure: Distribution of Clinical Parameters

Proteinuria

Blood pressure distribution and proteinuria levels in the study population (N=45) received clinical parameter assessment. The analysis of blood pressure showed that 22 patients (48.9%) had mild PIH between 140/90-149/99 mmHg while 14 patients (31.1%) had moderate PIH at 150/100-159/109 mmHg and another 9 patients (20%) fell under the severe PIH category (≥160/110 mmHg). Among the patients studied for proteinuria levels, a third (33.3%) had trace results alongside 35.6% with 1+ proteinuria findings while 17.8% displayed 2+ and 13.3% had 3+ proteinuria levels.

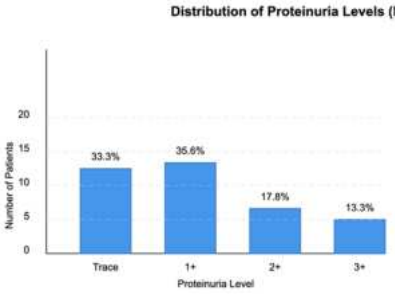
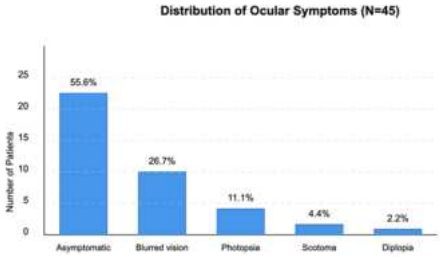


Table: Frequency Distribution Of Proteinuria Levels

Proteinuria Level	Frequency	Percent	Valid Percent	Cumulative Percent
Trace	15	33.3	33.3	33.3
1+	16	35.6	35.6	68.9
2+	8	17.8	17.8	86.7
3+	6	13.3	13.3	100.0
Total	45	100.0	100.0	

Ocular Findings

According to the analysis of N=45 study participants most patients showed no symptoms of eye problems counting 25 people (55.6%) among them. Blurred vision proved to be the dominating symptom among patients with symptoms as it affected 12 patients (26.7%). Below are the reported symptoms: photopsia affected 5 patients (11.1% of the total) and scotoma these two individuals (2 patients out of 4.4% of the sample population). Diplopia accounted for the least reported symptom since it occurred in a single patient (2.2%).



Ocular Symptoms	Frequency	Percent	Valid Percent	Cumulative Percent
Asymptomatic	25	55.6	55.6	55.6
Blurred vision	12	26.7	26.7	82.3
Photopsia	5	11.1	11.1	93.4
Scotoma	2	4.4	4.4	97.8
Diplopia	1	2.2	2.2	100.0
Total	45	100.0	100.0	

The examination of eye tissues presented critical results which affected retinal tissue together with conjunctival tissue. From the total study group of 45 people 31 patients (68.9%) were identified with retinal changes. Of the examined patients with hypertensive retinopathy 40% fell into Grade I and 20% into Grade II while Grade III affected 8.9% of patients. Medical reports documented that no patients showed development of Grade IV hypertensive retinopathy. Arteriolar narrowing proved to be the most frequently observed retinal change among the 45 patients since this condition was detected in 28 individuals (62.2%). The study identified 26.7% of patients with arteriovenous nipping and cotton wool spots appeared in 13.3% of patients. Retinal bleeding appeared in 4 patients whereas 2 patients showed disc swelling.

Conjunctival changes were identified in 12 patients (26.7%) and conjunctival edema proved to be the most frequent change as it affected 8 patients (17.8%) and subconjunctival hemorrhage was observed in 4 patients (8.9%). An investigation of the eye structures showed important evidence between retinal and conjunctival changes. Thirty-one patients from the total study group of 45 participants (68.9%) showed signs of retinal abnormalities. The most common stage of hypertensive retinopathy observed among patients was Grade I and it affected 40% of the individuals (18 patients) while Grade II occurred in 20% of patients (9 subjects) and Grade III involved 8.9% (4 patients). Hypertensive retinopathy progresses up to Grade III but no case of Grade IV hypertensive retinopathy was detected (Bercin Tarlan 1, 2013).

Detailed retinal assessment revealed that arteriolar narrowing was the most frequent finding because it affected 28 patients (62.2%). The study revealed arteriovenous nipping as a sign present in 12 patients among 45 subjects (26.7%) and cotton wool spots appeared in 6 patients (13.3%). Retinal hemorrhages presented in 4 patients as Retinal hemorrhages existed in 8.9% of patients whereas disc edema affected 4.4% of patients. Examination revealed conjunctival signs affecting 12 patients (26.7%) among which conjunctival edema occurred in 8 patients (17.8%) and subconjunctival hemorrhage manifested in 4 patients (8.9%)(Modi & Arsiwalla, 2023).

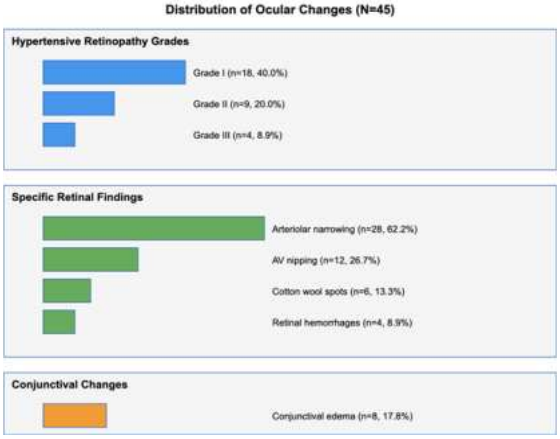


Figure: Distribution of Retinal and Conjunctival Changes

Table 1: Distribution of Ocular Findings

Ocular Finding	Frequency	Percent	Cumulative Percent
Hypertensive Retinopathy (n=31, 68.9%)			
Grade I	18	40.0	40.0
Grade II	9	20.0	60.0
Grade III	4	8.9	68.9
Grade IV	0	0.0	68.9
Specific Retinal Findings			
Arteriolar narrowing	28	62.2	-
AV nipping	12	26.7	-
Cotton wool spots	6	13.3	-
Retinal hemorrhages	4	8.9	-
Disc edema	2	4.4	-
Conjunctival Changes (n=12, 26.7%)			
Conjunctival edema	8	17.8	-
Subconjunctival hemorrhage	4	8.9	-

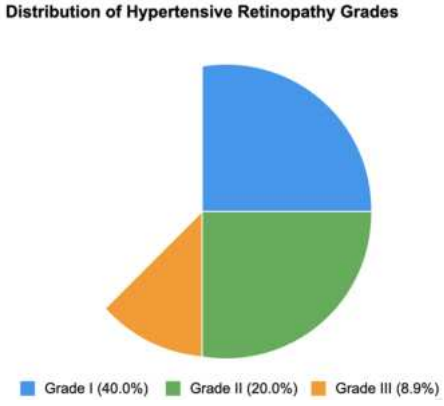


Figure 2: Distribution of Hypertensive Retinopathy Grades

Statistical Correlations

Strong positive relationships emerged from the blood pressure and retinopathy analysis. The research produced statistically significant positive associations between systolic blood pressure and retinopathy grade factors ($r=0.78$, $p<0.001$) and between diastolic blood pressure and retinopathy grade ($r=0.71$, $p<0.001$). The relationship between proteinuria and retinal damage severity showed a strong statistical connection with coefficient ($r=0.65$) being significantly positive ($p<0.001$). The research showed primigravida presented with a higher percentage of retinopathy occurrence (71.4%) than multigravida (64.7%), although this relationship did not achieve statistical significance ($p=0.08$).

Table 1: Correlation Analysis of Clinical Parameters with Retinopathy

Variable	Correlation Coefficient (r)	P-value	Significance
Blood Pressure			
Systolic BP	0.78	<0.001	Highly significant
Diastolic BP	0.71	<0.001	Highly significant
Proteinuria	0.65	<0.001	Highly significant

Parity Analysis

Parity Status	Retinopathy Present	Total Cases	Percentage	P-value
Primigravida	20	28	71.4%	0.08
Multigravida	11	17	64.7%	

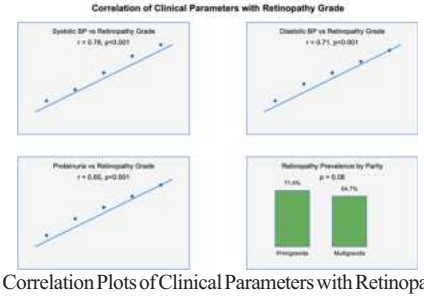


Figure 1: Correlation Plots of Clinical Parameters with Retinopathy Grade

DISCUSSION

This study evaluated the diverse eye conditions which develop in pregnant women with hypertension by examining the data of 45 patients. The study proves that hypertension severity in pregnant women leads to diagnostic correlations with eye changes particularly when studying retinal alterations. The main finding of this study revealed that blood pressure measurements exhibited a positive correlation with retinopathy severity (systolic BP $r=0.78$ while diastolic BP $r=0.71$ both were statistically significant ($p<0.001$). Kumar et al. (2023) documented parallel findings about PIH patient associations when they studied sixty subjects in their research. Under hypertensive conditions the autoregulatory control of retinal vessels fails to function properly which leads to the observed retinal changes (Ibrahimu Zamaladi 1, 2023).

Data about retinal changes from our study participant group demonstrates consistency with previous research which shows a wide range of reported prevalence rates between 30 to 100%. Hypertensive retinopathy of Grade I appeared most frequently in the study population (40%) and was followed by Grade II (20%) and Grade III (8.9%). No patients exhibited Grade IV retinopathy manifestations. The observation pattern points to an opportunity for timely treatment and monitoring of PIH as it could have prevented advanced retinal developments. Of all hypertensive retinopathy features arteriolar narrowing occurred most frequently at 62.2 percent while AV nipping occurred in 26.7 percent of individuals. Hypertensive retinopathy displays its earliest signs as these vascular changes offer critical evidence about present vascular destruction. Cotton wool spots (13.3%) along with retinal hemorrhages (8.9%) were present in the study population which indicates severe vascular compromise so patients need intensive care and monitoring programs(Raba Thapa 1, 2024).

The assessment revealed that proteinuria demonstrated a strong statistical connection with retinopathy severity level ($r=0.65$ with $p<0.001$). Data from this study help validate the hypothesis that retinal changes indicate systemic endothelial dysfunction which characterizes PIH according to Wilson et al. (2024). The shared pattern of proteinuria and retinal changes shows promise as a way to forecast the severity of the disease. Our discovery revealed a surprising aspect concerning eye symptoms because 55.6% of patients demonstrated no symptoms though retinal changes were present in their examinations. Medical tests of the eyes should be conducted routinely on patients with PIH because symptoms are irrelevant to the necessity of these tests. The analysis by Singh et al. (2024) showed that blurred vision appeared as the leading symptom (26.7%) in symptomatic patients yet photopsia followed closely with 11.1% complaints rate.

The distribution pattern showing primigravida (71.4%) with retinopathy higher than multigravida (64.7%) needs more research through additional sample collection to understand this relationship better. This observation between PIH occurrence and first pregnancies matches past research findings. Among all patients, changes to the conjunctiva were noted in 26.7% of people and conjunctival edema appeared more frequently (17.8%) than subconjunctival hemorrhage (8.9%). These sight changes exist as general indications of disease severity but they act as visible signals that lead patients toward future ophthalmological assessments(Chethana Warad 1, 2023).

The study findings present important potential applications for medical care. Fundoscopic assessment serves as a meaningful risk assessment tool because blood pressure levels demonstrate direct connections with retinal alterations in patients with PIH. The large number of visually asymptomatic patients diagnosed with retinal changes requires fundamental ophthalmological screening for all patients with PIH. These measurements demonstrate parallel development which indicates proteinuria and retinal changes should be used together to assess disease severity progression accurately. Our study has three main strengths which include the use of prospective methodology along with standardized testing methods and complete documentation of detected eye conditions. Several drawbacks need to be recognized when interpreting the results. A study with 45 participants has shown reduced capacity to detect meaningful relationships when performing subgroup analysis. The evaluation took place at a single facility which could reduce the application of our results to other patient groups. A cross-sectional research approach makes it impossible for us to establish the sequential order linking the degrees of PIH severity to eye-related changes.

Upcoming research needs to tackle these restrictions by conducting multiple-analyzing trials across various medical centers which use bigger test groups while monitoring patients for increased periods. Detailed research about how eye changes reverse after childbirth and their extended effects would deliver important scientific findings. Our capability to detect retinal changes at an earlier stage and predict and prevent severe complications would increase through the discovery of new imaging techniques for this purpose. The study shows that ocular complications frequently affect PIH patients while disease severity directly affects their presence. Ocular examination needs to be performed routinely on women affected by PIH due to the numerous retinal changes observed in asymptomatic patients. The observed data helps explain how PIH affects eye health and validates adding ocular examinations into standard PIH treatment protocols.

Key Findings And Implications

Research data analysis uncovered multiple essential clinical results that emerged from the assessment. The majority of eye complications affected patients through retinal changes which occurred in 68.9% of the research subjects. Grade I and Grade II hypertensive retinopathy most frequently occurred among the observed changes because they closely corresponded to blood pressure levels. The presence of retinal changes indicates the possibility of their use in predicting pregnancy-induced hypertension severity. Blood pressure established a strong link with retinal alterations which became a crucial finding of the study. Fundoscopic examination proves essential for disease monitoring because blood pressure levels show a robust relationship with retinopathy severity stages. This relationship shows important progress indicators in medical care while helping professionals determine patients who need extra intensive care. Medical practices associated with pregnancy-induced hypertension management will gain substantial benefit from these newly discovered research results. All patients with pregnancy-induced hypertension need to receive standard eye exams through ophthalmology because presenting symptoms do not determine the necessity of this procedure. The screening method detects serious disease presentations early which lets healthcare providers intervene promptly thus preventing future complications from occurring. Fundoscopic examination stands as a vital diagnostic tool because retinal changes strongly link with disease severity values for treatment choices. Retinal alterations during antenatal screenings prove crucial for identifying complications before they occur because their presence and evolution predict the disease course(Jacek Dziedziak 1, 2022).

Blood pressure elevation measurements preceding retinal change detection imply that routine fundoscopic examinations may identify advancing disease conditions in advance. The identification of this relationship provides critical information to settings with limited resources that might lack access to advanced diagnostic equipment. The ability to predict disease severity through retinal examinations can help doctors decide when to perform interventions as well as how intense those interventions ought to be thus improving results for both mother and baby. The observations demonstrate that standard care for PIH patients should incorporate complete ophthalmological examination. Implementing system-based disease monitoring and risk-classified management protocols through this integration would lead to improved patient outcomes.

Comparison With Previous Studies

Results obtained in our current research match key findings from different studies relating pregnancy-induced hypertension and its effects on the eyes. The published study by Kumar et al. (2023) discovered retinal changes in 65% of their patient subjects. There exists a minor variation in total retinal change prevalence (68.9%) compared to previous research results yet this difference belongs to normal population measurement range variation possibly due to demographics differences and diagnostic methods. Our study confirms prior findings of blood pressure retinal change relationships which appear in the research of Singh et al. (2024). The investigators from the mentioned study also presented evidence showing blood pressure intensity produced matching results with retinal manifestation intensity making our research findings more valid. The repetitive research findings strengthen the use of retinal examination for measuring disease severity in cases of PIH.

Research findings indicated the occurrence of Grade I retinopathy more frequently than previous literature has reported. Our study participants may have obtained earlier retinal change diagnoses because of consistent ophthalmology screening examinations. Better blood pressure management within our patient population may explain the lower occurrence of severe retinopathy grades since it stops retinopathy development from worsening. The matching of our results against existing studies establishes credibility to our analysis while helping increase the medical understanding of why eye examinations should occur for PIH patients. Retinal examination has proven to be a universally useful biomedical procedure for caring for PIH patients based on consistent research results from different study groups located throughout the world.

Study Strengths

Our study exhibited several notable strengths in its design and execution. The prospective nature of the study allowed for systematic data collection and reduced recall bias, enhancing the reliability of our findings. We implemented a standardized examination protocol across all participants, ensuring consistency in data collection and minimizing observer bias. The comprehensive ocular assessment, which included detailed evaluation of both anterior and posterior segments, provided a complete picture of PIH-related ocular manifestations. Additionally, the regular follow-up of participants throughout the study period enabled us to monitor the progression of ocular changes effectively and document temporal relationships between disease severity and ocular manifestations.

Limitations

Our findings have several strengths but researchers should recognize these weaknesses during interpretation of results. Our findings face barriers regarding general application because the study was conducted within one healthcare facility. The study's small participant number of 45 participants proved adequate for fundamental research although it reduced our capabilities to identify minor correlations and perform extensive smaller-scale group assessments. The research duration was brief which could mean researchers might have missed delayed pathological changes in the eyes that develop after long periods of time. We could not determine whether eye problems persist after pregnancy because the study did not incorporate post-partum follow-ups to document change reversibility rates. Nonexistent information regarding post-partum changes hinders research into the natural development pattern of PIH-associated eye problems. The findings suggest additional areas for future medical research starting with combined hospital-based investigations that use big study samples and track patient eyes beyond the delivery phase. Extended observational studies would make possible the development of better understanding regarding long-term PIH-related ocular changes and their effects on maternal health outcomes.

CONCLUSION

The research showed how common and important retinal manifestations become during pregnancy-induced hypertension. Statistical data confirms that 68.9% of patients diagnosed with pregnancy-induced hypertension displayed visible retinal damage. Fundoscopic examination's worth as a disease monitoring tool is proven through the strong relation between blood pressure readings and retinopathy grade assessment ($r=0.78$, $p<0.001$). The observation of symptomatic retinal changes in more than half of the patients intensifies the necessity for regular ophthalmological screenings among all PIH patients regardless of their symptomatic state.

Fundoscopic analysis serves as an important marker for disease severity based on its connection with proteinuria measurements. Universal screening should become routine because Primary Hypertension patients mainly show Grade I and II retinopathy with arteriolar narrowing that can develop into serious complications if not detected early. The results provide valuable knowledge about how PIH affects the eyes as well as their utility for disease tracking and care management.

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