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Doppler Ultrasound for Fetal Middle Cerebral Arteryresistance Indexes in Preeclampsia Patients For Predicting Fetal Outcome

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Abstract:*Introduction: Preeclampsia (PE) Is A Pregnancy Complication Characterized By High Blood Pressure, Proteinuria And Edema. It Threatens The Maternal And Fetus Life, It Is The First Cause Of Intrauterine Growth Retardation (IUGR), And Fetal Prematurity Doppler Ultrasound (US) Has Been Considered As A Good Tool In Assess And Prediction Of PE.Objective: To Assess Doppler Studies Of Fetal Middle Cerebral Artery (MCA) Resistance Index (RI) In PE Patients To Demonstrate The Accuracy Of Resistance Index For Predicting Fetal Outcomes.Material And Methods: A Descriptive Cross Sectional Study On 100 Pregnant Women (70 With Preeclampsia And 30 With Normal Pregnancy) At ≥26 Gestation Weeks Of Fetal MCARI Was Performed Using Doppler US.Perinatal Outcomes Were Monitored And Statistically Analyzed.Results: The Data Was Discussed And Presented In Percentage Between Patients' Age, GA, Parity, Diastolic, Systolic And RI, Doppler Analysis And Its Correlated To Fetal Outcome Were Discussed. Then Statistically The Results Were Analyzed.Conclusions: Doppler Study Is The Non-Invasive Modality For The Detection & Follows Up Of PE To Prevent Mortality & Morbidity.RI-MCA Is A Sensitive Modality Of Assessing IUGR.*

Keywords: *Preeclampsia (PE), IUGR, Doppler, US, MCA, RI*

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I. Introduction:

Preeclampsia Is A Pregnancy Condition In Which High Blood Pressure Develops With Proteinuria (Protein In The Urine) Or Edema (Swelling). If The Hypertension Is Neglected, The Patient May Develop Seizures That Can Be Life-Threatening To Both Mother And Fetus. (1)

Severe Preeclampsia May Develop In Some Cases And Refers To The Severity Of Hypertension And Proteinuria. Severe Preeclampsia Generally Indicates That The Patient Must Be Delivered Immediately. Eclampsiarepresents The Occurrence Of Seizures Or Coma In A Preeclamptic Patient. (1)

Pre-Eclampsia Has Been Shown To Be Associated With An Increased Middle Cerebral Artery Blood Flow Velocity (MCAFV) And Abnormal Transcranial Doppler (TCD) Findings Compared With The Healthy Pregnant State. (2)

It Has Been Well Established That The Use Of Doppler Velocimetry Can Significantly Reduce Perinatal Death And Unnecessary Induction Of Labor In The Preterm And IUGR Fetus. (3)

The Pathophysiology Of PE Is Based On The Incapability Of The Trophoblast To Invade Properly The Myometrium Causing A Limited Remodeling Of Spiral Arteries. (4)

The Impaired Placental Perfusion Caused By Vascular Abnormalities Precedes Clinical Manifestations Of PE And It Can Be Detected By Doppler Ultrasound (US). The Latter Has Been Considered A Useful Method For Prediction Of PE And Adverse Pregnancy Outcome. (5, 6)

In This Study We Aimed To Assess The Fetal Middle Cerebral Artery By Using Doppler US Technology By Measuring RI Parameter In Preeclampsia Patients For Predicting Fetal Outcomes.

Objective:

To Assess Doppler Studies Of Fetal Middle Cerebral Artery (MCA) Resistance Index (RI) In PE Patients To Demonstrate The Accuracy Of Resistance Index For Predicting Fetal Outcomes.

II.Material And Methods:

A Descriptive Cross Sectional Study, Deal Withdoppler Ultrasonography Findings For Fetal MCA RI In PE Patients, And The Study Was Conducted In Sudan At Omdurman Maternity Hospital Feto-Maternal Unit,After Obtaining Hospital Ethics Committee Approval, During The Period From May 2016 To August 2017.

One Hundred Pregnant Women Aged Between 17 To 42 Years Old, With Singleton Pregnancy Between The 26–40 Gestational Age(GA) Which Was Documented By Confirmed Last Menstrual Period (LMP) And/Or First-Trimester Ultrasound Dating, Were Included And Divided In Cases (70 Patients) And Controls (30 Patients) Groups. The Cases Group Consisted By Diagnosed PE Women, Which Was Defined As An Arterial Pressure Greater Than 140/90 Mm Hg, With Associated Proteinuria (>1+ On Dipstick And/ Or >0.3 G Litre On A 24-H Collection), Occurring After The 20th Week Of Gestation.Pregnant Women With Multiple Pregnancies, Coexistent Medical Disease, Congenital Malformation And Middle Cerebral Artery Pathology Were Excluded.

All The Patients Were Subjected To Routine Ultrasound Followed By Color Doppler Using Toshiba Power Vision 6000, With 3.5 Mhz Probe, Of Middle Cerebral Artery (MCA) With Respect To Resistance Index (RI).All The Measurements Were Performed With The Patients In Supine Position And Did Not Talk Or Move During The Examination.

A Previously Reported Mentioned That Error Formca Measurements Are Less Than 10%.[7- 9]

A Transverse View Of Fetal Head Was Obtained At The Level Of Cerebral Peduncles, Then The Sample Volume Was Placed After 1cm From The Origin Of MCA Which Is Often Found With Color Doppler U\S Over Lying The Anterior Wing Of The Sphenoid Bone Near The Base Of The Skull. An Angle Of Zero Degree Is Used Typically. Only One Exam On Each Patient Was Carried Out At The Recruitment Time Include One Middle Cerebral Artery.

Maternal Variables Including: Patients Age, Parity, Gestational Age, Blood Pressure, Then Fetal Outcome Monitored And MCA Doppler Measurements.

All Data Were Tested For Normality Of Distribution By Visual Comparison Of, As Well As By Visual Evaluation Of A Statistical Package For Social Sciences (SPSS) Comparing Each Distribution With The Normal Distribution.

Results:

A Total Of 100 Sudanese Women Were Divided In Two Groups: 70 Formed The Cases Group And 30 Were The Control Group.

Age Of Patients, GA, Parity, Diastolic, Systolic, Doppler Analysis And Its Correlated To Fetal Outcome Are Detailed In The Following Tables:

Descriptive Study Of Cases Group:

Table (1) Shows The Distribution Of Age In PE Patients Inthe Present Study**:**

Age group	Frequency	Percent	Valid Percent	Cumulative Percent
17-25 years	24	34.3	34.3	34.3
26-33 years	34	48.6	48.6	82.9
34-41 years	11	15.7	15.7	98.6
more than 41 years	1	1.4	1.4	100.0
Total	70	100.0	100.0	
Minimum =17, maximum=44, mean= 28.39, St. Deviation =6.106				

Table (2) Shows Minimum, Maximum,Mean And Std. Deviation For Systole, Diastole And RI

Variable	N	Minimum	Maximum	Mean	Std. Deviation
GA	70	26	40	33.14	3.957
diastolic	70	89	120	99.09	8.435
RI	70	.39	1.08	.6921	.12393
systolic	68	140	196	150.16	9.990
Valid N (list wise)	68				

Table (3) Shows The Distribution Of Parity In PE Patients:

para	Frequency	Percent	Valid Percent	Cumulative Percent
1	8	11.4	11.4	11.4
2	11	15.7	15.7	27.1
3	13	18.6	18.6	45.7
4	5	7.1	7.1	52.9
5	3	4.3	4.3	57.1
6	4	5.7	5.7	62.9
7	1	1.4	1.4	64.3
8	1	1.4	1.4	65.7
PG	24	34.3	34.3	100.0
Total	70	100.0	100.0	

Distribution Of Fetal Outcome Among Cases Group:

Table(4) Distribution Of Preterm:

Preterm	Frequency	Percent	Valid Percent	Cumulative Percent
no	53	75.7	75.7	75.7
yes	17	24.3	24.3	100.0
Total	70	100.0	100.0	

Table (5) Distribution Of IUD:

IUD	Frequency	Percent	Valid Percent	Cumulative Percent
No	64	91.4	91.4	91.4
Yes	6	8.6	8.6	100.0
Total	70	100.0	100.0	

Table (6) Fetal Death Distribution:

Fetal Death	Frequency	Percent	Valid Percent	Cumulative Percent
No	66	94.3	94.3	94.3
Yes	4	5.7	5.7	100.0
Total	70	100.0	100.0	

Table (7) IUGR Distribution:

IUGR	Frequency	Percent	Valid Percent	Cumulative Percent
No	47	67.1	67.1	67.1
Yes	23	32.9	32.9	100.0
Total	70	100.0	100.0	

Table (8) Eclampsia Distribution:

Eclampsia	Frequency	Percent	Valid Percent	Cumulative Percent
No	61	87.1	87.1	87.1
Yes	9	12.9	12.9	100.0
Total	70	100.0	100.0	

Correlation Of MCARI And Adverse Perinatal Outcome

Table (9) Correlation Of MCA RI And IUD:

RI	IUD		Total
	No	Yes	
0.3-0.55	10	2	12
0.56-0.80	44	4	48
0.81-1.50	10	0	10
Total	64	6	70
P value = 0.378			

Table (10) Correlation Of MCA RI And Preterm:

RI	Preterm		Total
	No	Yes	
0.3-0.55	6	6	12
0.56-0.80	39	9	48
0.81-1.50	8	2	10
Total	53	17	70
P Value = 0.074			

Table (11) Correlation Of MCA RI And IUGR:

RI	IUGR		Total
	No	Yes	
0.3-0.55	5	7	12
0.56-0.80	37	11	48
0.81-1.50	5	5	10
Total	47	23	70
P Value = 0.030			

Table (12) Correlation Of MCA RI And Intrauterine Fetal Death:

RI	Fetal Death		Total
	No	Yes	
0.3-0.55	11	1	12
0.56-0.80	46	2	48
0.81-1.50	9	1	10
Total	66	4	70
P Value =0.702			

Descriptive Statistic For Control Group

Table (13) Shows Minimum, Maximum,Mean And Std. Deviation For Age, GA, Systole, Diastole And RI For Control Group:

	N	Minimum	Maximum	Mean	Std. Deviation
Age	30	18	39	26.97	5.183
GA	29	26	41	35.97	3.689
Systolic	30	100	120	113.33	7.581
Diastolic	30	60	80	74.67	6.814
RI	30	.56	1.11	.7923	.09216
Valid N (list wise)	29				

Table(14) IUGR Distribution In Control Group:

	Frequency	Percent	Valid Percent	Cumulative Percent
No	28	93.3	93.3	93.3
Yes	2	6.7	6.7	100.0
Total	30	100.0	100.0	

III.Discussion:

In The Present Study Out Of 100 Cases Sub-Divided In Two Groups: 70 Cases Group And 30 Control Group. Mean Maternal Age Was28.39 For The Cases And 26.97 For The Controls. 48.6% Of Cases Group Were Between 26-33years (Table 1), This Result Matches To Padmini C. P.Et. Al, [(10)] Who Reported That PE Is A Disease Of Young.

The Median Of Gestational Weeks(GW) Was 33.14 For The Cases (Ranging From 26 To 40 GW). And 32 (Ranging From 24 To 37 GW) For Controls (Table 2), So It Shows No Differences Between Study Groups.

The Mean Of Diastolic Was 99.09 (Ranging 90-120) And The Mean Of Systolic Was 150.16 (Ranging From 140- 196) For Cases Group, 74.67 (Ranging 60- 80) And 113.33 (Ranging 100-120) Respectively For Control Group (Table 2).

The Mean Of RI Was 0.6921 (Ranging From 0.39 To 1.08) For Cases Group And 0.7923 (Ranging .56-1.11) For Control Group (Table 2). This Matches The Finding Reported By M. BELFORT Et. Al, [(11)] And Riskin-Mashiahs Et. Al, [(12)] That RI Is Predictive Of Pre-Eclampsia.

Out Of 70 Cases Group 24 (34.3%) Were Primigravida (Table 3). This Result Is Similar To Those Reported By Padmini C. P.Et. Al, [(10)] Who Said Preeclampsia Is A Disease Of Young Primigravidae. Andersch B Et Al, [(13)] Also Observed That Primiparity Was Almost Twice As Common In Preeclampsia Groups Compared With Randomly Selected Controls.

In Control Group 6 Patients Were PG.

In The Present Study Out Of 70cases Group, Studied In 3rd Trimester 27 Patients Showed Decreased RI In Middle Cerebral Artery(Less Than The Mean= 0.69) Indicating Presence Of Decreased Impedance To Cerebral Circulation. Such Fetuses Are At High Risk Of Poor Perinatal Outcome, 17 Cases (24.3%) Showed Preterm Delivery (Table4), 6cases (8.6%) Showed IUD (Table 5), 4 Cases (5.7%) Showed Fetal Death (Table 6),23 Cases(32,9%) Showed IUGR, P Value =0.03 (Table 7) And9 Cases (12.9%) Were Developed Eclampsia (Table 8) (Ultrasound Estimation Of Fetal Weight (Using Fetal Biometry) Below 10th Percentile For That

Gestational Age Was Labeled As IUGR). These Results Were Correlated To Those Findings Reported By B. Mallikarjunappa Et. Al, [(14)]Who Found Among 100 PE Cases, Preterm Deliveries 32%, Perinatal Death 16%, Low Birth Weight 38%, Fetal Distress 14%.

IV.Conclusion:

Doppler Study Should Be The Primary Tool Of Choice For Fetal Surveillance In PE Patients.Abnormal Waveforms Are Associated With The Adverse Perinatal Outcome In Our Study. Doppler Study Helpsus To Take Time To Plan And Managethe Patients In Future Deliveries.RI From MCA May Be Considered As Tools To Determine Hemodynamicrepercussion Caused By PE.

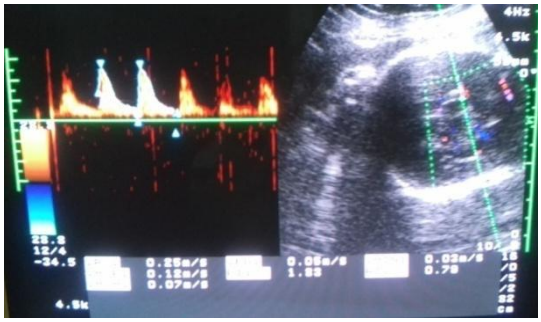

Figure (1) MCA Wave Forms In PE With GA = 30 Weeks.

Figure (2) MCA Wave Forms In PE Patient With GA = 34 Weeks.

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