Frontiers in Health Informatics
ISSN-Online: 2676-7104
2024; Vol 13: Issue 8
www.healthinformaticsjournal.com
Open Access

Gender-Based Variations In Hemodynamic Characteristics And Power Doppler Ultrasound Indices In Developmental Dysplasia Of The Hip (DDH)

[*1]Nazanin Abubaker Muhamad, [2]Fatiheea Fatihalla hassan
[*1,2]Department Medical Physics Unit, Department of Pharmacology and Medical Physics and Clinical Biochemistry, College of Medicine, Hawler Medical University, Erbil, Iraq.
[*1]Corresponding Author: nazaninbarznji2004@gmail.com

Cite this paper as: Nazanin Abubaker Muhamad, Fatiheea Fatihalla hassan, (2024) Gender-Based Variations In Hemodynamic Characteristics And Power Doppler Ultrasound Indices In Developmental Dysplasia Of The Hip (DDH). *Frontiers in Health Informatics*, *13(8) 691-698*

ABSTRACT
Background: The arterial vascularity of the hip has been investigated in normal infants using power Doppler sonography. This study addressed the differences in hip vascularity in infants with respect to gender and acetabular morphology.
Objective: To determine whether there is a relationship between the infant gender in hemodynamic characteristics and power doppler ultrasound indices in developmental dysplasia of the hip (DDH)
Materials and methods: 90 hips left and right (45patients) were enrolled in the study with gray-scale and power doppler ultrasound. The patients were referred have abnormal clinical hip examination and had risk factors for developmental dysplasia of the hip. The infants ranged in age from 6 weeks to16 weeks. There were 20 boys and 25 girls.
Results: This study establishes a valuable foundation for understanding the relationship between Power Doppler ultrasound parameters and gender in infants with hip developmental dysplasia. The gender-specific differences in PD parameters, as well as the relationship between PD parameters and acetabular morphology, provide valuable insights into DDH's vascular characteristics. These findings suggest that PD ultrasound could be used not only as a diagnostic tool, but also to monitor disease progression and guide treatment decisions in DDH
Conclusion: There is a direct linear relationship between power doppler indices and gender infant hip. Female infants have a higher average PDUS indices than male infants. Power Doppler ultrasound and vascularity intensity in abnormal neonatal hips vary based on the anatomical region being evaluated. This observation deserves further investigation into its role in the physiological pathogenesis of neonatal hip disorders.
Keywords: Epiphyseal, Power Doppler, Indices. Gender

1. Introduction

Developmental dysplasia of the hip (DDH) is one of the most common causes of disability among children. DDH encompasses a wide variety of pathologic conditions, ranging from fine Children acetabular (Yusra Almas and Jamal, 2024) dysplasia to irreducible hip dislocation. The previous term congenital dysplasia of the hip has been replaced by developmental dysplasia of the hip, because many of the clinical manifestations of DDH may not be detectable at birth, but are recognized at a later age (Guerado and Caso, 2016) .The incidence of DDH ranges from 1.5 to 20 per 1,000 births. Multiple risk factors have been described, including breech positioning in utero, being the first-born child, , family history, and swaddling(Yusra Almas and Jamal, 2024) In addition, increased joint laxity in the setting of exposure to maternal oestrogens during the perinatal period may play a role in the development of DDH, and the left hip is more frequently affected than the right(SARI and Karakuş, 2024) Ultrasonography (US) is the preferred modality for evaluating the hip in infants aged less than 6months. US enables dynamic evaluation of the hip with stress maneuvering , as well as direct imaging of the cartilaginous portions of the hip that cannot be seen on plain radiographs (Pandey and Johari, 2021) .Hip US has become the most commonly used diagnostic tool for DDH during early infancy because the early and accurate diagnosis of DDH is the most important factor contributing to appropriate treatment(Voitl et al., 2019)Additionally,
US can thoroughly characterize nearly all spinal anomalies during the first days of life. Among the ultrasound techniques, Power Doppler ultrasound is one of the ultrasonography techniques that shows the most potential for evaluating DDH

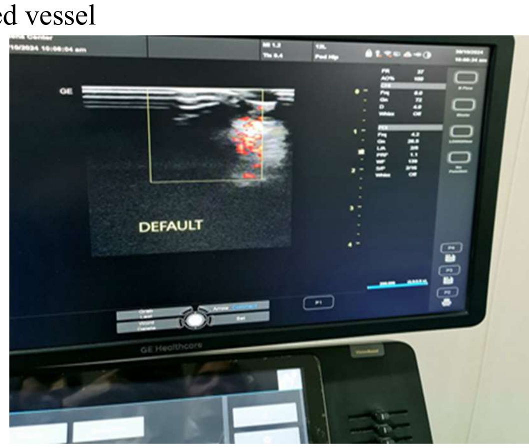
because it allows viewing of both the vascular patterns in the femoral head and the anatomical structures of the hip. Understanding the health and development of the hip joint requires knowledge of blood flow dynamics, which may be obtained by monitoring the vascularity of the femoral head. However, power doppler ultrasonography settings are usually left at default settings in clinical practice, which may not necessarily produce the best findings for every patient, particularly when assessing delicate anatomy in neonates. Although these changes are not currently standard procedure, adjusting parameters like wall filter (WF), pulse repetition frequency (PRF), frame rate (FR) and threshold might greatly improve image quality and diagnostic accuracy.(Meyers et al., 2024) .This study will be carried out to evaluate the diagnostic efficacy of radiography of the hip in diagnosing DDH in newborns and infants from 6 weeks to 16 weeks with reference to hips graded by Graf classification using the US(Barbuto et al., 2019) .Helena specialized center for rehabilitation and treatment of children with special aids is using power doppler ultrasound technique for measuring and imaging of vascularity of femoral head of in infant with DDH, the diagnosis of blood flow in vessel is normally made by images obtained through power doppler ultrasound (Shaw et al., 2016).This study discusses the effect of gender on Power doppler Parameters during DDH's infants examinations ultrasound. Head blood supplying vessels do not disappear; rather they suffer a pathological process which results in blood flow interruption (Guerado and Caso, 2016).The aim of this study is to obtain Power doppler Parameters during DDH's infants examinations and is related with gender.

The objectives of this study are: 1.To assess the relationship between gender of DDH's infants and Power Doppler Ultrasound parameters. 2-Which parameter is related directly with gender and can bring best image (optimization of PD).

2. Materials and Methods

The study Starts the examination by scanning the hips of 45 infants, ranging in age from 6 to 16 weeks, using power Doppler sonography. The study was performed at Helena specialized center for rehabilitation and treatment of children with special aids. After the patient's parent gave written informed consent for participation of their babies in this study. September 2024 and January 2025. The study protocol is approved by the local Ethics Committee (Hawler Medical University -College of Medicine Ethics Committee, Meeting code No. 1, paper code 14 in 22-09-2024). These infants were referred for routine hip sonography because of an abnormal or suspicious clinical examination. In addition, infants referred for hip sonography because of increased risk of DDH were studied (Fig. 1). The patients included those with a(family history as first-degree relatives, breech presentation during third trimester or at birth, and first-born child and swaddling), All infants were fed just prior to the examination, to abate infant movement . A routine sonogram of the hips was performed in all patients using both the coronal and transverse planes. A linear 10–15 MHz transducer was used for both gray-scale and power Doppler imaging. Power Doppler sonography of each femoral epiphysis was performed in both the coronal and transverse planes (Fig. 2). Both the hip and the knee were kept in the flexed position during the gray-scale and Doppler interrogations. The number of vessels visualized in each plane was documented, and spectral analysis was performed on each visualized vessel

A



B

Figure 1: A: Coronal lateral neutral plan, B: PD ultrasound parameters at Helena specialized center

Modified Graf Method:(Yusra Almas and Jamal, 2024)

The hip joint was classified by U/S; the coronal section at rest yielding the following Types:12

(1) Graf Type I (normal hip joint).

(2) Graf Type 2a: age <3 m (representing physiological immaturity).
(3) Graf Type 2b: age >3 months (regarded as delayed maturity).
(4) Graf Type 2c: (dysplastic hip).
(5) Graf Type 2d: (dysplastic hip)
(6) Graf Type III: (partially dislocated hip).
(7) Graf Type IV: (frank total hip dislocation).
(α) Alpha angle normal value >60
(β) Beta angle normal value<55

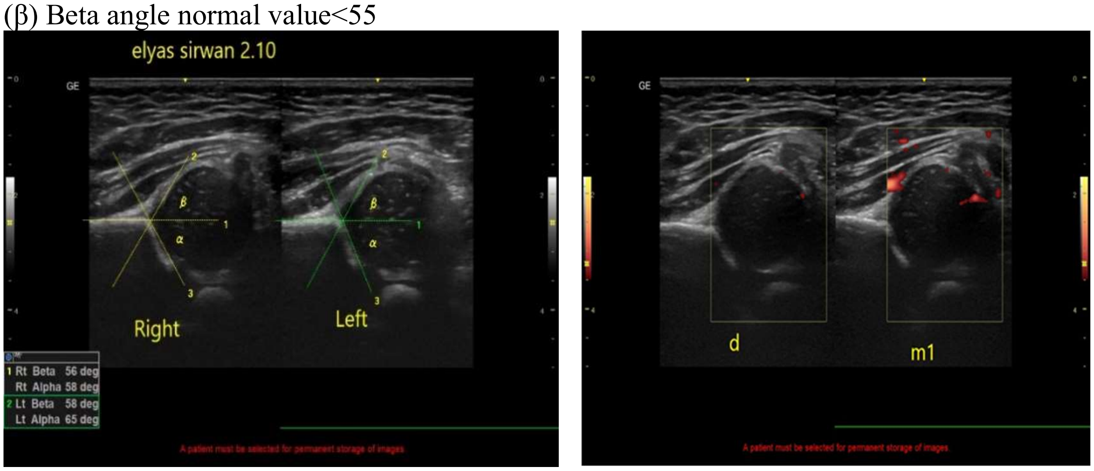


Figure 2.(A) image traditional US both hip (B) images PDUS show the vascular supply to the epiphysis (Helena specialized center)

3. Results

In this study 90 hips of infants with DDH were included, and the mean age of the infants of 9.156± 2.84 weeks with male to female percentage of 44.4% to 55.6% with age of minimum 6 weeks to maximum 16 weeks (Table 1).

Table 1: Demographics of DDH's infants

Demographics	Variable	Total Population
	Mean Age ± SD	9.156± 2.84
	Max	16 weeks
	Min	6 weeks
	Gender (%)	M (44.4%), F (55.6%)

According to PRF parameter is the number of ultrasound pulses that are emitted by the transducer per second. It is measured in Hertz (Hz). In table 2, showed the mean of PRF for female is (0.70) while for male is (0.60), higher PRF for female indicates to better detection of faster-moving blood flow and PRF for male indicates to less detection of blood flow when compare with female. Also the table 2 showed that the FR (frame rate) parameter in female is 26.48 while for male is 24.25 A higher frame rate for female provides smoother and more real-time imaging than male , which is especially important for capturing dynamic processes like blood flow. In Wall filter (WF) parameter, the filtration of female 92.64 more than filtration of male 81.15 that indicates is important to enhance the visualization of blood flow in female more than male by eliminating noise from the surrounding tissue motion and remove low-frequency signals that are generated by the movement of vessel walls or other slow-moving structures .In table 2 showed threshold in male (%79.50) more than female (%76.40) therefore, filtering out noise and artifacts in male better than female

Table 2: Mean and SD of DDH's infants' gender and power Doppler Parameters

	Female		Male	
	mean	SD	mean	SD
Threshold	%76.40	%18.68	%79.50	%15.38
PRF	0.70	0.18	0.60	0.20
WF	92.64	21.51	81.15	24.27
FR	26.48	4.54	24.25	5.37

In the Table 3, in this study, we noted Type 2a according to threshold and gender, for female and male right hip more than left ((90%>68.75%), (85%>82.5%)) that meaning the filtration for removing noise in right hip better than left for both gender, Type 2b showing 70% with left for female dysplasia and right-side no dysplasia so the removing of noise just present in left female. However, the detection of left and right side is relatively different resulting in 70% with left side dysplasia and right side no affected. Its significant to note that according to big baby and 2a there is both of left and right hips dysplasia in female that is reported by using the Graf technique. Some time big baby and twin led to DDH in both legs. In our study 90% of the hips are unstable (late stage of DDH) in left hip of female. and 90% are reported in right hip of female to be unstable/displaced hips. Concerning the relationship between risk factors and dynamic scan stability. With unstable 1a in right hip female 90% and unstable 2a in left female 72% less than < male is 75%.

Table 3| mean of Threshold by Gender

Gender		Female			Male			Total		
Unilateral and Bilateral		Left	Right	Both	Left	Right	Both	Left	Right	Both
Unilateral and Bilateral	2a	68.75	90.00	75.00	82.50	85.00	70.00	73.33	85.71	73.33
	2a,2c	.	.	.	.	.	60.00	.	.	60.00
	2b	70.00	.	90.00	.	90.00	.	70.00	90.00	90.00
	2c	90.00	.	.	.	.	.	90.00	.	.
	big baby,2a	.	.	90.00	.	.	.	.	.	90.00
	twin,2a	90.00	.	.	.	70.00	.	90.00	70.00	.
	unstaible	60.00	.	90.00	.	.	.	60.00	.	90.00
	unstaible sublaxible	.	90.00	.	.	.	.	.	90.00	.
	unstaible,1a	.	90.00	.	.	.	.	.	90.00	.
	unstaible,2a	72.00	.	.	75.00	.	.	73.33	.	.
	unstaible,2b	.	.	.	90.00	.	.	90.00	.	.
Total		71.76	90.00	84.00	80.00	82.22	65.00	74.62	84.17	78.57

In Table 4, PRF of female 2a in right hip more than left (1.1, 0.63), while in male PRF in left side more than right (0.73, 0.67). according to 2a,2c gust present in both legs in male (bilateral) 0.50. about 2b in left female is 0.50 and in both 0.80 while in male in right is 0.50. in left female present 2c (0.50), and big baby 2a bilateral in female is 0.80, twin 2a in female 0.50.Unstable in left female 0.80, unstable 1a right female 0.80. and unstable 2a in female more than male (0.74,0.53), the last one in unstable 2b just present in left male 0.50. high value of PRF provides smoother and more real-time imaging than male.

Table 4 | mean of PRF by Gender

Gender		Female			Male			Total		
Unilateral and Bilateral		Left	Right	Both	Left	Right	Both	Left	Right	Both
Unilateral and Bilateral	2a	0.63	1.10	0.65	0.73	0.67	0.50	0.66	0.73	0.60
	2a,2c	.	.	.	.	.	0.50	.	.	0.50
	2b	0.50	.	0.80	.	0.50	.	0.50	0.50	0.80
	2c	0.50	.	.	.	.	.	0.50	.	.
	big baby,2a	.	.	0.80	.	.	.	.	.	0.80
	twin,2a	0.50	.	.	.	0.50	.	0.50	0.50	.
	unstable	0.80	.	0.80	.	.	.	0.80	.	0.80
	Unstable subluxable	.	0.80	.	.	.	.	.	0.80	.
	unstable,1a	.	0.80	.	.	.	.	.	0.80	.
	unstaible,2a	0.74	.	.	0.53	.	.	0.64	.	.
	unstable,2b	.	.	.	0.50	.	.	0.50	.	.
Total		0.65	0.90	0.74	0.61	0.61	.50	0.63	0.68	0.67

In table 5, WF with gender, 2a in right female more than left (139, 84), and 2a in male right less than left (88.5,96.25). just present in male 2a2c by lateral (70), while 2b in left female the same with right male (70). 2c only present in left female (70). Big baby 2a in female bilateral 105. With twin 2a in left female the same value of right mail (70). Unstable 1a present in right female 105, unstable 2a in left female more than left male 98>71.75. unstable 2b only present in left male 70. PRF is important to enhance the visualization of blood flow, more PRF more visualization of blood flow.

Table 5 | mean of WF by Gender

Gender		Female			Male			Total		
Unilateral and Bilateral		Left	Right	Both	Left	Right	Both	Left	Right	Both
Unilateral and Bilateral	2a	84.00	139.00	87.50	96.25	88.50	70.00	88.08	95.71	81.67
	2a,2c	.	.	.	.	.	70.00	.	.	70.00
	2b	70.00	.	105.00	.	70.00	.	70.00	70.00	105.00
	2c	70.00	.	.	.	.	.	70.00	.	.
	big baby,2a	.	.	105.00	.	.	.	.	.	105.00
	twin,2a	70.00	.	.	.	70.00	.	70.00	70.00	.
	unstable	105.00	.	105.00	.	.	.	105.00	.	105.00
	unstable subluxble	.	105.00	.	.	.	.	.	105.00	.
	unstable,1a	.	105.00	.	.	.	.	.	105.00	.
	unstable,2a	98.00	.	.	71.75	.	.	86.33	.	.
	unstable,2b	.	.	.	70.00	.	.	70.00	.	.
Total		86.88	116.33	98.00	82.44	82.33	70.00	85.35	90.83	90.00

In Table 6 , FR 2a in right female more than left (37>24.5), while in male left more than right (27.75>25.67). 2c2a bilateral only in male 22. 2b the value of left female same value of right male is 22. 2c only present in left female is 22, big baby 2a bi- lateral in both legs only for female 29. Twin 2a the value of left female and right male is the same value. Unstable 1a only in right female 29. Unstable 2a in left female mor than left male (27.60>22). Unstable 2b only present in left male 22. A higher frame rate for female provides smoother and more real-time imaging than male.

Table 6 | mean FR by Gender

Gender		Female			Male			Total		
Unilateral and Bilateral		Left	Right	Both	Left	Right	Both	Left	Right	Both
Unilateral and Bilateral	2a	24.50	37.00	25.50	27.75	25.67	22.00	25.58	27.29	24.33
	2a,2c	.	.	.	.	.	22.00	.	.	22.00
	2b	22.00	.	29.00	.	22.00	.	22.00	22.00	29.00
	2c	22.00	.	.	.	.	.	22.00	.	.
	big baby,2a	.	.	29.00	.	.	.	.	.	29.00
	twin,2a	22.00	.	.	.	22.00	.	22.00	22.00	.
	unstable	29.00	.	29.00	.	.	.	29.00	.	29.00
	unstable subluxble	.	29.00	.	.	.	.	.	29.00	.
	unstable,1a	.	29.00	.	.	.	.	.	29.00	.
	unstable,2a	27.60	.	.	22.00	.	.	25.11	.	.
	unstable,2b	.	.	.	22.00	.	.	22.00	.	.
Total		25.24	31.67	27.60	24.56	24.44	22.00	25.00	26.25	26.00

4. Discussion

Previous studies have tested the feasibility of the use of energy Doppler sonography in assessing blood flow to the femoral epiphyses. However, no prior studies, to our know-how, has explored the relationship among power Doppler indices, gender and acetabular morphology(Mehta, 2024) This study contributes precious baseline statistics as a part of a -phase procedure for diagnosing developmental dysplasia of the hip (DDH). In the primary phase, DDH is recognized thru ultrasonography through measuring alpha and beta angles. The 2nd phase, targeted in a separate paper, specializes in detecting blood flow inside the femoral head of neonatal the use of power Doppler ultrasound and record parameters. Interestingly, our findings monitor that power Doppler indices range by means of gender, with girl infants showing higher averages in pulse repetition frequency (PRF), wall filter (WF), and frame rate (FR), while males exhibit better average thresholds. The reasons behind these variations stay uncertain. Additionally, our observe identifies an instantaneous linear courting among power Doppler indices and acetabular morphology, as meditated through the alpha and beta angles (Ortiz-Neira, 2009)Specifically, as acetabular dysplasia progresses, marked by means of smaller alpha angles, there is a corresponding decline in blood flow to the femoral head, as indicated via decrease Doppler scores .Initially, we hypothesized that the arterial supply to the femoral epiphysis such as cease arterioles without anastomoses might bring about improved Doppler indices in subluxed and dislocated hips due to stretching of those vessels (Lerch, 2018)However, our findings contradict this assumption, showing that Doppler indices decrease in such instances. The mechanism differences of this reduction remains doubtful. Notably, the observed affiliation between decrease Doppler indices and extraordinary hips may additionally give an explanation for the extraordinarily of spontaneous ischemic necrosis in untreated DDH cases (Guerado, 2016). This study highlights the importance of establishing baseline power Doppler ultrasound (PDUS) indices for infants diagnosed with DDH, specially in investigating gender variations.. These findings are consistent with prior studies suggesting physiological differences in vascular flow between genders, potentially inspired by way of hormonal or sex-specific factors(Meyers, 2024). Further investigation is essential to recognize the underlying mechanisms behind those variations, that may offer insights into the pathophysiology and management of DDH.

The relationship between power Doppler indices and acetabular morphology underscores the role of PDUS as a non-invasive diagnostic device for monitoring DDH progression Combining assessments of vascular flow and hip morphology can offer a complete evaluation of DDH severity, thereby guiding remedy choices, in particular in instances involving hip subluxation or dislocation .Epiphyseal vascularity, more often than not supplied through the medial circumflex artery, extends alongside the extra trochanter to the intertrochanteric notch (Sparks, 2017)These vessels traverse ossified channels, and even as traditional color Doppler ultrasound might not ability to depict vessels in different regions is influenced by their degree of ossification. In our study we used power doppler ultrasound to examine the cartilaginous femoral head and found a variety of vascularity patterns, including radial, parallel indeterminate, absent, and blended configurations (Ortiz-Neira, 2009)these distinct patterns appeared to be related only to the plane in which the transducer was placed relative to the axis of the hip joint with radial patterns in coronal views acting parallel in transverse perspectives. Variations together with indeterminate and blended pattern in all likelihood represent normal anatomical differences The lateral ascending cervical artery, a branch of the medial circumflex artery, is important for vascularity in the subtrochanteric vicinity. This artery divides into 3 branches on the intertrochanteric notch, forming the trident sign, and components terminal branches to the epiphyseal vessels within the cartilaginous epiphysis (Ortiz-Neira, 2009) Understanding these vascular pattern is essential for evaluating developmental anomalies like DDH, which may additionally have a vascular etiology . Our findings underscore the want for in addition studies into how stress maneuvers affect vascular hemodynamics and their courting with gender. Gender based differences in vascularity and Doppler parameters ought to provide insights into behind schedule across various anatomic regions of the neonatal hip associated with DDH (Ortiz-Neira, 2009)Recognizing these versions may additionally useful resource in identifying vascular-related etiopathogenic factors, as a end result improving diagnostic accuracy and allowing tailored treatment techniques based totally on character chance profiles. These findings emphasize the changing vascular traits related to hip morphology changes , highlighting the role of power Doppler ultrasound (PDUS) as an vital device for monitoring the development and severity of DDH. By combining vascular drift tests with morphological opinions, clinicians can gain deeper insights into the condition's complexity, which can guide more accurate remedy choices. This is specially beneficial in managing cases related to hip subluxation or dislocation, in which comprehensive checks are crucial for making plans interventions .The vascularity of the epiphyses originates primarily from the medial circumflex artery, which publications alongside the extra trochanter in the direction of the intertrochanteric notch(Sparks, 2017)While conventional color Doppler ultrasound can also fail to visualize smaller vessels because of ossification, power Doppler ultrasound offers an superior potential to come across vascularity patterns inside the cartilaginous femoral head. This study recognized numerous styles, consisting of radial, parallel, combined, indeterminate, and absent configurations (Ortiz-Neira et al., 2009). Especially those pattern regularly trusted the transducer's placement relative to the hip joint's axis. For instance, radial styles seen in coronal imaging regularly regarded parallel whilst regarded transversely, highlighting the importance of specific imaging planes in detecting vascular patterns .This take a look at highlights the want for added studies into the results of stress maneuvers on vascular hemodynamics and their potential connection to gender particular variations. These differences in Doppler indices, inclusive of higher PRF, WF, and FR in female and expanded thresholds in male, might also reflect inherent physiological distinctions in vascular responses. Such variations could offer insights into behind schedule ossification of the femoral head or acetabular deficiencies normally found in DDH (Onay, 2019).The discovered relationships among vascularity, Doppler parameters, and hip morphology may want to have giant clinical implications. Gender hemodynamic profiles may also impact the natural progression of DDH and its response to treatments. Recognizing these differences may also help to identify potential vascular related etiopathogenic factors, resulting in more accurate diagnosis and treatment strategies tailored to individual risk profiles.

5. Limitations and Future Research

While the findings of this study are important in understanding the relationship between PD parameters, gender, and acetabular morphology in DDH, several limitations must be considered. First, the study sample was small, which may limit the generalizability of the results. A larger sample size, including a more diverse population, would be useful in determining whether these gender-specific differences in PD parameters are consistent across groups. Finally, while this study focused on baseline PD parameters, future research should look into how these parameters change with treatment. Assessing how PD parameters evolve in infants treated with abduction devices or casts would provide useful information about the role of vascular changes in DDH management. Furthermore, investigate whether abnormal PD parameters correlate.

6. Conclusion

This study establishes a treasured foundation for understanding the relationship between Power Doppler ultrasound parameters and gender in infants with hip developmental dysplasia. The gender-specific variations in PD parameters, as well as the connection among PD parameters and acetabular morphology, offer treasured insights into DDH's vascular characteristics .These findings suggest that PD ultrasound will be used not only as a diagnostic tool, but also to reveal ailment development and guide treatment selections in DDH. Future research, specifically with larger samples and more various populations, will be critical for validating these findings and investigating the scientific programs of PD ultrasound in DDH management.

REFERENCES

1. BARBUTO, L., DI SERAFINO, M., DELLA VECCHIA, N., REA, G., ESPOSITO, F., VEZZALI, N., FERRO, F., CAPRIO, M. G., VOLA, E. A. & ROMEO, V. 2019. Pediatric musculoskeletal ultrasound: a pictorial essay. *Journal of ultrasound,* 22**,** 491-502.
2. GUERADO, E. & CASO, E. 2016. The physiopathology of avascular necrosis of the femoral head: an update. *Injury,* 47**,** S16-S26.
3. LERCH, T. D., TODORSKI, I. A., STEPPACHER, S. D., SCHMARANZER, F., WERLEN, S. F., SIEBENROCK, K. A. & TANNAST, M. 2018. Prevalence of femoral and acetabular version abnormalities in patients with symptomatic hip disease: a controlled study of 538 hips. *The American journal of sports medicine,* 46**,** 122-134.
4. MEHTA, R., AGRAWAL, A., AROOJIS, A., LAVANDE, A. & KARNIK, A. 2024. Perfusion Changes in Acute Septic Arthritis of the Hip Joint During Infancy Using Doppler USG. *Indian Journal of Orthopaedics,* 58**,** 98-106.
5. MEYERS, M. L., WALKER, J., SEVICK, C., BELTRAN, G. G. & VEMULAKONDA, V. M. 2024. Doppler Ultrasound and Resistive Indices in the Diagnosis of Ureteropelvic Junction Obstruction in the Pediatric Population. *Journal of Ultrasound in Medicine*.
6. ONAY, T., GUMUSTAS, S. A., CAGIRMAZ, T., AYDEMIR, A. N. & ORAK, M. M. 2019. Do the risk factors for developmental dysplasia of the hip differ according to gender? A look from another perspective. *Journal of paediatrics and child health,* 55**,** 168-174.
7. ORTIZ-NEIRA, C. L., LAFFAN, E., DANEMAN, A., FONG, K., ROPOSCH, A., OHLSSON, A., JARRIN, J., WANG, C., WEDGE, J. & DORIA, A. S. 2009. Colour Doppler ultrasound assessment of the normal neonatal hip. *Canadian Association of Radiologists' Journal,* 60**,** 79-87.
8. PANDEY, R. A. & JOHARI, A. N. 2021. Screening of newborns and infants for developmental dysplasia of the hip: A systematic review. *Indian Journal of Orthopaedics***,** 1-14.
9. SARI, A. & KARAKUŞ, Ö. 2024. The assessment of the efficacy of radiography in diagnosing developmental dysplasia of the hip in infants younger than six months with reference to hips graded by Graf classification using ultrasonography. *European Review for Medical & Pharmacological Sciences,* 28.
10. SHAW, B. A., SEGAL, L. S., OTSUKA, N. Y., SCHWEND, R. M., GANLEY, T. J., HERMAN, M. J., HYMAN, J. E. & SMITH, B. G. 2016. Evaluation and referral for developmental dysplasia of the hip in infants. *Pediatrics,* 138.
11. SPARKS, D. S., SALEH, D. B., ROZEN, W. M., HUTMACHER, D. W., SCHUETZ, M. A. & WAGELS, M. 2017. Vascularised bone transfer: History, blood supply and contemporary problems. *Journal of Plastic, Reconstructive & Aesthetic Surgery,* 70**,** 1-11.
12. VOITL, P., SEBELEFSKY, C., HOSNER, S., WODITSCHKA, A., DIESNER, S. & BÖCK, A. 2019. Ultrasound of the infant hip: manual fixation is equivalent to Graf's technique regarding image quality—a randomized trial. *BMC pediatrics,* 19**,** 1-8.
13. YUSRA ALMAS, B. & JAMAL, B. I. 2024. Role of Dynamic Ultrasound Scan in Detection of Hip Instability and Changing Management Plan. *Journal of Pioneering Medical Sciences,* 13**,** 54-59.