(e) ISSN Online: 2321-9599

(p) ISSN Print: 2348-6805

ORIGINAL ARTICLE

Assessment of role of power doppler sonography in the determination of knee involvement in patients with juvenile idiopathic arthritis

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ABSTRACT:

Background: Juvenile idiopathic arthritis (JIA) is an idiopathic inflammatory disease primarily affecting joints with the synovium being the target tissue. The present study was conducted to assess role of power doppler sonography in the determination of knee involvement in patients with juvenile idiopathic arthritis (JIA). **Materials & Methods:** 45 patients with juvenile idiopathic arthritis (JIA) of both genders were diagnosed as Pauciarticular, Polyarticular and systemic JIA. All subjects were subjected to full clinical examination and laboratory investigations. The knee joints were evaluated with plain radiography, US, and color doppler. The Juvenile Arthritis Functional Assessment Report (JAFAR) was performed for all patients. **Results:** There were 20 cases of Pauciarticular, 13 cases of Polyarticular and 12 cases of Systemic JIA. The mean morning stiffness in Pauciarticular, Polyarticular and Systemic JIA patients was 72.4 minutes, 56.4 minutes and 75.3 minutes, knee score was 3.1, 3.6 and 4.6, JAFAR score was 6.5, 10.2 and 12.7 and plain radiography score was 6.7, 6.2 and 7.3 respectively. The difference was significant (P< 0.05). In Pauciarticular, Polyarticular and Systemic JIA, mean synovial thickness (cm) was 1.1, 0.7 and 0.9, effusion volume (ml) was 2.6, 3.2 and 4.8, loculation of effusion (n) was seen in 0, 3 and 6, C of medial condyle thickness (mm) was 3.4, 2.6 and 2.8 and C of lateral condyle thickness (mm) was 2.6, 2.7 and 2.9 and Cartilage IE was seen in 1, 4 and 6 respectively. The difference was significant (P< 0.05). **Conclusion:** Doppler sonography as a non-invasive, low-cost, and readily available tool for the assessment of articular involvement in knees of JIA patients.

Key words: Doppler sonography, Juvenile idiopathic arthritis, polyarthritis rheumatoid

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This article may be cited as: Agarwal N. Assessment of role of power doppler sonography in the determination of knee involvement in patients with juvenile idiopathic arthritis. J Adv Med Dent Scie Res 2015;3(1):303-305.

INTRODUCTION

Juvenile idiopathic arthritis (JIA) is an idiopathic inflammatory disease primarily affecting joints with the synovium being the target tissue, but also extra articular tissue.[1]The JIA diagnosis encompasses distinct sub-classifications, defined by the ILAR in 2001 to include systemic-onset arthritis, oligoarthritis, polyarthritis rheumatoid factor positive, polyarthritis rheumatoid factor negative, psoriatic arthritis, enthesitis-related arthritis and undifferentiated arthritis.[2,3] This classification system has faced criticism as there is increasing evidence that some of these categories are more heterogenous and may be more accurately defined by a new system. In 2019, the Paediatric Rheumatology International Trial Organization (PRINTO) began the verification process for a new classification system.[4]

US of the knee provides the ability to assess changes in the synovial membrane, the presence of joint effusion and changes in the articular cartilage; all of which can differentiate between active knee involvement and subjects in clinical remission.[5]Color Doppler US could be used to study the vascularization of the synovial membrane and periarticular tissue of the knee. Power Doppler sonography (PDS) is able to detect low levels of flow in tissue (tissue perfusion) independent of direction or vessel type. Power Doppler can also be used to visually quantify tissue flow in relation to disease activity.[6]The present study was conducted to assess role of power doppler sonography in the determination of knee involvement in patients with juvenile idiopathic arthritis (JIA).

MATERIALS & METHODS

The present study comprised of 45 patients with juvenile idiopathic arthritis(JIA) of both genders. Parental written consent for the participation in the study was obtained.

Data such as name, age, gender etc. was recorded. Patients with clinical signs of knee involvement were diagnosed as Pauciarticular, Polyarticular and systemic JIA. All subjects were subjected to full clinical examination and laboratory investigations. The knee joints were evaluated with plain radiography, US, and colordoppler.The Juvenile Arthritis Functional Assessment Report (JAFAR) was performed for all patients. Both knees were scored clinically according to Suerda et al[7]by indicating the presence or absence of the following: Pain; 0= absence, 1 = presence. The degree of swelling; 0= absence, 1=mild, 2 =moderate, 3= severe. The degree of limitation of extension: 0 = no limitation, 1 < 5 extension, 2 < 10 extension, 3 < 15 extension, 4> 15 extension. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Groups	Pauciarticular	Polyarticular	Systemic JIA
Number	20	13	12

Table I shows that there were 20 cases of Pauciarticular, 13 cases of Polyarticular and 12 cases of Systemic JIA.

Table II Comparison of parameters

Parameters	Pauciarticular	Polyarticular	Systemic JIA	P value
Morning stiffness (min)	72.4	56.4	75.3	0.05
Knee score	3.1	3.6	4.6	0.02
JAFAR score	6.5	10.2	12.7	0.01
Plain radiography score	6.7	6.2	7.3	0.07

Table II, graph I shows that mean morning stiffness in Pauciarticular, Polyarticular and Systemic JIA patients was 72.4 minutes, 56.4 minutes and 75.3 minutes, knee score was 3.1, 3.6 and 4.6, JAFAR score was 6.5, 10.2 and 12.7 and plain radiography score was 6.7, 6.2 and 7.3 respectively. The difference was significant (P< 0.05).

Graph I Comparison of parameters

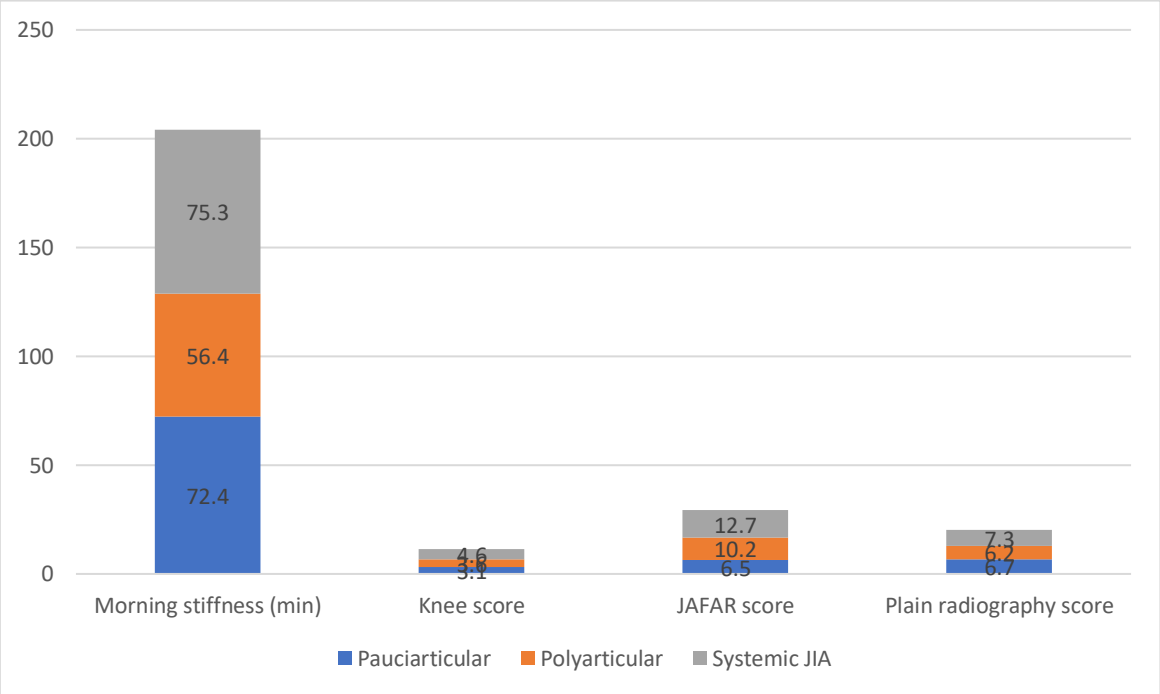

Table III Ultrasound findings

Parameters	Pauciarticular	Polyarticular	Systemic JIA	P value
Synovial thickness (cm)	1.1	0.7	0.9	0.04
Effusion volume (ml)	2.6	3.2	4.8	0.02
Loculation of effusion (n)	0	3	6	0.01
C of medial condyle thickness(mm)	3.4	2.6	2.8	0.05
C of lateral condyle thickness (mm)	2.6	2.7	2.9	0.04
Cartilage IE	1	4	6	0.12

Table III shows that in Pauciarticular, Polyarticular and Systemic JIA, mean synovial thickness (cm) was 1.1, 0.7 and 0.9, effusion volume (ml) was 2.6, 3.2 and 4.8, loculation of effusion (n) was seen in 0, 3 and 6, C of medial condyle thickness (mm) was 3.4, 2.6 and 2.8 and C of lateral condyle thickness (mm) was 2.6, 2.7 and 2.9 and Cartilage IE was seen in 1, 4 and 6 respectively. The difference was significant (P< 0.05).

DISCUSSION

JIA is the most common rheumatic disease of childhood, with an average prevalence of 70 in 100,000 in Europe. The data on the prevalence of JIA are varied, depending on disease classification, geographical area and study design and have been reported to vary between 3.8 to 400 cases per 100,000 worldwide.[8] JIA more commonly affects females than males (>2:1); however, this distribution varies within the disease classification system.[9] The age of onset of JIA also varies significantly between different subtypes; for example, the median age of presentation

of systemic-onset arthritis has been reported as 2 years, whereas for enthesitis-related arthritis, this has been reported as 11 years.[10]The present study was conducted to assess role of power doppler sonography in the determination of knee involvement in patients with juvenile idiopathic arthritis (JIA).

We observed that there were 20 cases of Pauciarticular, 13 cases of Polyarticular and 12 cases of Systemic JIA. The mean morning stiffness in Pauciarticular, Polyarticular and Systemic JIA patients was 72.4 minutes, 56.4 minutes and 75.3 minutes, knee score was 3.1, 3.6 and 4.6, JAFAR score was 6.5, 10.2 and 12.7 and plain radiography score was 6.7, 6.2 and 7.3 respectively. Shahin et al[11] in their study 30 patients with JIA who had clinical signs of knee involvement as well as 15 healthy children as a control were included. A highly significant difference in synovial thickening and cartilage thickness detected by US between JIA affected knees and those of controls ($p< 0.0001$). Knee effusion was demonstrated in 93% of patients. Synovial vessels were detected by Doppler in 76.7% of patients. A significant correlation was detected between the degree of vascularity detected by PD and knee score ($p< 0.05$), and JAFAR score ($P < 0.05$). On comparing the findings of the follow-upwith those of the initial examination, a significant positive correlation was detected between the differences in the knee score and those in synovial thickness ($p< 0.05$), and with the vascularity scale detected by PD ($p< 0.05$).

We found that in Pauciarticular, Polyarticular and Systemic JIA, mean synovial thickness (cm) was 1.1, 0.7 and 0.9, effusion volume (ml) was 2.6, 3.2 and 4.8, loculation of effusion (n) was seen in 0, 3 and 6, C of medial condyle thickness (mm)was 3.4, 2.6 and 2.8 and C of lateral condyle thickness (mm) was 2.6, 2.7 and 2.9 and Cartilage IE was seen in 1, 4 and 6 respectively.Imaging is regularly used as a diagnostic adjunct in JIA to support clinical evaluation. Plain radiographs have previously been the traditional first-line imaging of choice. However, increasingly more varied imaging techniques are being employed to detect active inflammation such as musculoskeletal ultrasonography and contrast enhanced magnetic resonance imaging (MRI).[12] These imaging tools contribute greater diagnostic value than plain radiograph imaging, but they are relatively expensive and remain less accessible than is needed for routine use in the outpatient clinic setting. These tools may be particularly useful in assessing joints such as the TMJ and hip, which are harder to assess clinically (as swelling and warmth are rarely appreciated) compared with joints such as the knee or ankle.[13] Despite these tools, there is still no definitive diagnostic test for JIA; therefore, there is a pressing need to develop novel diagnostic techniques to improve the speed and accuracy of diagnosis.A preliminary investigation performed by Newman et al[14] suggested a role for power Doppler sonography in assessment of serial changes in synovial inflammation.

The limitation the study is small sample size.

CONCLUSION

Authors found that Doppler sonography as a non-invasive, low-cost, and readily available tool for the assessment of articular involvement in knees of JIA patients.

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