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Comparing vascularization assessed by transvaginal sonography and colour Doppler with pelvic pain and Revised American Society for Reproductive staging in women with endometriosis

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Abstract
Background: Endometriosis is a disease causing severe pelvic pain. Previous data has shown that it has contributed to 15% infertility. Transvaginal Color Doppler is the noninvasive tool to assess ovarian endometrial vascularity.
Aims and Objectives: To study severity of pain and compare it with site, size, laterality and vascularity of the lesions in terms of resistance index (RI), PI (Pulsatility index), PSV (Peak Systolic Velocity) and to compare the colour Doppler findings with ASRM Staging.
Materials and Methods: Thirty women with endometriosis were studied in the Department of Obstetrics and Gynaecology. Pain intensity was assessed by visual analogue scale (VAS). A score of 1-3, 4-6 and ≥7 is classified as mild, moderate and severe pelvic pain respectively and were also classified based on the American Society for Reproductive Medicine staging. All the patients underwent trans-vaginal sonography and colour Doppler and the site, size, laterality and vascularity of the lesions in terms of RI, PI and PSV were assessed.
Results: Mean RI, PI and PSV among the women with mild pain was 0.71±0.41, 1.49±0.29, 23.83±9.68, with moderate pain was 0.81±0.07, 2.01±0.40, 24.50±5.91 and with severe pain was 0.84±0.03, 2.33±0.14, 28.80±7.46 respectively. A significant correlation was obtained between RI and PI ($p<0.001$) with severity of pain whereas PSV had no relation with severity of pain ($p=0.470$).Mean RI and PI in stage I, II,III and IV were 0.71± 0.01 and 1.40± 0.10; 0.69± 0.02 and 1.54± 0.24; 0.80± 0.07 and 1.96± 0.51; 0.85± 0.03 and 2.24± 0.17 respectively. There was a positive correlation between RI and PI and advancing stages of endometriosis ($p<0.001$ and 0.001 respectively). The mean PSV in stage I, II, III and IV were 26.23± 10.42, 22.55± 4.38, 24.71± 9.38 and 26.82± 6.67 respectively. There was no correlation between PSV and severity of disease ($p=0.736$).
Conclusion: RI and PI showed significant correlation with the severity of pain and advancing stages of endometriosis whereas PSV does not.

Keywords: trans-vaginal sonography, colour doppler, pain severity, endometriosis staging

Introduction
Endometriosis is more prevalent among the women of reproductive age. Endometriosis results in pelvic pain and it can also lead to chronic pain. Previous studies have shown that endometriosis has contributed to infertility in 15% of women. Pelvic peritoneum, rectovaginal septum and ovaries are the frequently affected site among the women with endometriosis [1, 2].
Revised American Society for Reproductive (r-ASRM) is the most validated way of classifying endometriosis. r-ASRM assesses the presence, size and number of endometriotic deposits and cysts, the presence and severity of any adhesions, and the degree of obliteration of the pouch of Douglas [3].
Ultra sonography is routinely performed in women with endometriosis as the most common diagnostic tool. Previous authors have demonstrated the efficiency of ultrasonography among the women with ovarian endometrioma. Transvaginal color Doppler allows for the assessment of ovarian endometrial vascularity [4, 5].
There are limited evidences available comparing transvaginal sonography and colour Doppler findings with pelvic pain and Revised American Society for Reproductive stages in women with Endometriosis. Hence in present study we tried to compare the vascularization assessed by transvaginal sonography and colour Doppler with pelvic pain and Revised American Society for Reproductive staging.

Materials and Methods
A prospective observational study was performed on 30 women with endometriosis in Department of Obstetrics and Gynaecology in collaboration with Department of Radiology at Lady Harding Medical College and Smt. Sucheta Kriplani Hospital, New Delhi from November 2012 to March 2014.
A series of 30 women, aged 20-49 years, diagnosed as having endometriosis by clinical history, abdominal and pelvic examination, transvaginal sonography and colour Doppler were included in the study. Patients with other causes of pelvic pain and infertility like pelvic inflammatory disease, torsion ovarian cyst, ectopic pregnancy, or treatment with any kind of hormonal therapy (oral contraceptives, LH-releasing hormone analogues, clomiphene, or gonadotropins) in the previous 3 months were excluded. Written informed consent was taken from all women after explaining the nature of study.

Pain intensity was assessed by visual analogue scale (VAS). Pain intensity was scored from 0 to 10, in which score 0 means no pain and 10 means worst pain. A score of 1-3, 4-6 and ≥7 is classified as mild, moderate and severe pelvic pain respectively by looking at the facial expression of the patients (Wong Baker faces).

All the patients underwent trans-vaginal sonography and colour Doppler and the site, size, laterality and vascularity of the lesions in terms of RI, PI, PSV were assessed.

All the data analysis was performed using IBM SPSS ver. 20 software. Means and standard deviations were calculated for all continuous variables and chi square and ANOVA were used to determine statistically significant differences. Probability value less than 0.05 was set in order to determine significance.

Results

Mean age of study cohort was 30 ±5.75 years. Majority of the women were in the age group of 25-29 years [11 (36.7%)]. Out of 30 women with endometriosis, 10 women (33.3%) had mild pain, 15 women (50%) had moderate pain and 5 women (16.7%) had severe pain.

Size of endometriotic cysts on ultrasound varied from 0.9 to 12.5 cm; the mean size was 4.54±2.90 cm. Out of 30 women, 18 (60%) had cyst size of upto 5 cm and 12 (40%) had cyst size of more than 5 cm. Among 30 women with endometriosis, the mean resistance index (RI) was 0.78± 0.08, the mean pulsatility index (PI) was 1.89± 0.45 and the mean peak systolic velocity (PSV) was 24.99± 7.53 of blood vessel on the endometriotic cyst wall.

Cyst size measured by transvaginal sonography revealed that out of 10 women with mild pain, 8 (80%) women had cyst size less than 5 cm and 2 (20%) had cyst size >5 cm. Out of 15 women with moderate pain, 9 (60%) had cyst size less than 5 cm and 6 (40%) had size >5 cm. Out of 5 women with severe pain, only 1 (20%) women had cyst size less than 5 cm while the rest 4 (80%) had cyst size >5 cm. The correlation of cyst size with visual analogue scale for pain was not statistically significant (p =0.082).

Table 1: Correlation of colour Doppler indices with degree of pain by visual analogue scale (vas) in endometriosis

VAS	RI	PI	PSV
Mild	0.71±0.41	1.49±0.29	23.83±9.68
Moderate	0.81±0.07	2.01±0.40	24.50±5.91
Severe	0.84±0.03	2.33±0.14	28.80±7.46
P value	<0.001	<0.001	0.470

VAS: visual analogue scale, RI; resistance index, PI; Pulsatility index, PSV; Peak Systolic Velocity. P value of <0.05 is considered as significant.

Table 2: Correlation of colour Doppler indices with American Society for Reproductive Medicine staging of endometriosis

ASRM Staging	RI	PI	PSV
Stage I	0.71±0.01	1.40±0.10	26.23±10.42
Stage II	0.69±0.02	1.54±0.24	22.55±4.38
Stage III	0.80±0.07	1.96±0.51	24.71±9.38
Stage IV	0.85±0.03	2.24±0.17	26.82±6.67
P value	<0.001	0.001	0.736

ASRM; American Society for Reproductive Medicine, RI; resistance index, PI; Pulsatility index, PSV; Peak Systolic Velocity, P value of <0.05 is considered as significant.

Discussion

Women with endometriosis often experience the pelvic pain and pain is more common among the women with ovarian endometriosis. The exact cause of pelvic pain among the women with endometriosis is still a matter of debate. However, previous reports have highlighted release of prostaglandins, repeated micro bleeding, adhesion, neurological cause and psychology of women as the few cause of pelvic pain in women with endometriosis [6].

In present study three types of pain were experienced by the women with endometriosis which were dysmenorrhoea, dyspareunia and chronic pelvic pain. Dysmenorrhoea was present in 73.33% women; dyspareunia was present in 13.33% women while chronic pelvic pain was present in 56.66 women. Degree of pain was assessed by VAS and divided as mild, moderate and severe pain. There were 33.33% women with mild pain, 50% women with moderate pain and 16.67% women with severe pain. In a similar study by Somigliana *et al.*, dysmenorrhoea was experienced by 77.4%, dyspareunia by 46.2% of women while chronic pelvic pain was experienced by 51.6% women [7]. Holland *et al.* reported that dysmenorrhoea, dyspareunia and chronic pelvic pain were present in 72.2%, 45.9% and 49.5% respectively [8]. Similarly in agreement to present study Dai *et al.* reported that dysmenorrhoea, chronic pelvic pain and dyspareunia comprised of 61.6%, 20.3% and 21.5% respectively [9].

Size of endometriotic cysts on ultrasound in present study varied from 0.9 to 12.5 cm; the mean size was 4.54±2.90 cm. Out of 30 women, 60% had cyst size of 5 cm or less while rest 40% had cyst size more than 5 cm. When study cohort was divided based on pain severity no significant relation between cyst size and severity of pain was obtained. In a similar study by Chapron *et al.*, the mean size of endometrioma on right side was 4.0±2.2 cm and on the left side was 4.1±2.6 cm. which is in agreement to present study where we found mean size as4.54±2.90 cm [10]. Chapron *et al.* has also not found any significant relation between site and size of endometrioma with dysmenorrhoea, dyspareunia and chronic pelvic pain. In present study **c**olour Doppler of endometriotic cysts was done and vascularity was assessed on the cyst wall. We found that mean RI, PI and PSV were 0.78± 0.08, 1.89± 0.45 and 24.99±7.53 respectively. In agreement to present study findings Pascual *et al.* [11], Aleem *et al.* [12], Hajialioghlo *et al.* [13] reported the mean RI and PI values as 0.63± 0.13 and 1.17± 0.52; 0.59± 0.02 and0.95± 0.1; 0.67± 0.15 and 1.49± 0.85 respectively.

In the present study we also compared colour Doppler indices with severity of pain. It was found that the RI and PI increased with severity of pain and hence there was a significant correlation between RI, PI and severity of pain (p<0.001). This suggests that low perfusion due to high resistance is associated with severity of pain. However, there was no correlation of PSV with severity of pain (p=0.470).

In present study we also compared Doppler indices with ASRM Staging and found that the mean RI and PI in stage I, II, III and IV were 0.71± 0.01 and 1.40± 0.10; 0.69± 0.02 and 1.54± 0.24; 0.80± 0.07 and 1.96± 0.51; 0.85± 0.03 and 2.24± 0.17 respectively. The RI and PI increased with

advancing stages of endometriosis ($p<0.001$ and 0.001 respectively). This suggests that perfusion is compromised in advanced stages of endometriosis. The mean PSV in stage I, II, III and IV were 26.23± 10.42, 22.55± 4.38, 24.71± 9.38 and 26.82± 6.67 respectively. There was no correlation between PSV and severity of disease ($p=0.736$). In a similar study by Alcazar *et al.*, PI and PSV were taken in symptomatic and asymptomatic groups [4]. The mean PSV in symptomatic and asymptomatic groups were 20.9 and 21.4. There were statistically no difference in both the groups ($p=0.848$). Alcazar *et al.* also showed that there was no correlation of stages with PI ($p=0.054$) [4].

Conclusion

Mean RI, PI and PSV has increased with increasing severity of pain among the women with endometriosis. However we found a significant difference in terms of RI and PI whereas PSV had no significant difference between severity of pain. ASRM is the most accepted tool for classifying endometriosis. Our findings revealed that there was a significant difference between RI and PI between different stages of endometriosis whereas PSV has failed to show significant difference. To conclude Doppler study showed that the RI and PI had a linear correlation with severity of pain which suggests less perfusion. Doppler study also correlated positively with stage of endometriosis.

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