The use of real-time elastography in the assessment of uterine disorders

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Keywords: Elastography, ultrasound, fibroids, adenomyosis.
Abstract

**Objectives:** Sono-elastography is an imaging technique added to sonography, measuring tissue strain. The aim of this article is to systematically define specific sono-elastographic characteristics of the myometrium, fibroids and adenomyosis and evaluate the feasibility of sonoelastography in patients suspected of gynecological pathology and to compare it with histology-based and MRI-based diagnoses.

**Methods:** We performed a prospective observational cohort study from 2009 to 2011 using a Samsung Medison Accuvix V10 machine. Women included underwent routine transvaginal ultrasound and additional real-time sonographic elastography. The acquirements of elastographic images were standardized. We analyzed elastographic characteristics of myometrium, fibroids and adenomyosis. An independent observer, unaware of clinical, histological or MRI findings evaluated the recorded elastographic images and cine loops. These elastographic-based diagnoses were compared with histology and/or MRI diagnosis.

**Results:** With elastography the uterus is well delineated from the surrounding bowels. The myometrium was uniform in color in 49% of the cases, with a main color of purple or dark blue. Both fibroids and adenomyosis have different elastographic characteristics with different color patterns. In general fibroids were darker and adenomyosis brighter then adjacent myometrium. The agreement between elastography based diagnosis of fibroids and adenomyosis with MRI were excellent, and with histology it was also excellent for fibroids, but less optimal for adenomyosis.

**Conclusion:** Elastography is able to identify clear discriminating characteristics of the uterus, fibroids and adenomyosis and the elastographic based diagnosis are in excellent agreement with MRI. Agreement between the elastography image of adenomyosis and histology was less optimal.
Introduction

Elastography is an ultrasound technique measuring elasticity of tissue. It is based on differences in elasticity of various tissues, both in physiological and pathological conditions.

To obtain an elastography image it is necessary that there is a source of stress which provides deformation of the tissue. There are different types of elastography and the main difference is the source of stress. This stress can be induced by (physical) compression, vibration or acoustic pulse waves. In this study we use compression elastography. This technique was first described by Ophir et. al.\(^1\) in 1991. For a compression elastography image, the ultrasound machine is tracking the tissue displacement by tracking the ultrasonographic speckles; comparing the condition before and after pressure applications. The change in deformation is color-coded and is superimposed on the corresponding B-mode image (Figure 1). An advantage of this technique is the possibility of making a 2D ultrasound and elastographic image at the same time using the transducer to apply a certain amount of pressure. An additional advantage is the relative easy interpretation of the obtained pictures.\(^2\)

Promising results about the use of elastography have been described in the assessment of tumors of the breast, prostate and liver.\(^3-7\) Publications on the use of elastography in the field of gynecology are scarce. One paper published on the feasibility of compression elastography in the assessment of cervical dysplasia\(^8\), one in the assessment of fibroids\(^9\) and one in the assessment of adenomyosis.\(^10\) Another study reports on the use of compression elastography of the cervix in order to predict the risk of premature delivery.\(^11\) In these studies different machines have been used (Toshiba Aplio MX,\(^11\) Hitachi logos HI Vision\(^10\) and Hitachi EUB-8500 ultra sound system.\(^8,9\)) and standardized methods on settings and probe handling were not reported for the interpretation of images. Some kind of standardization is mandatory to compare the results of future studies and to assess its clinical relevance.
The aim of this article is to systematically define specific sono-elastographic characteristics of the myometrium, fibroids and adenomyosis and evaluate the feasibility of sonoelastography in patients suspected of gynecological pathology and to compare it with histology-based and MRI-based diagnoses.

Methods

Design and population

We performed a prospective observational cohort study using a Samsung Medison Accuvix V10 machine with elastography software and a 4-9 MHz vaginal probe. This ultrasound machine is using real-time displacement elastography also known as compression elastography or strain elastography.

Patients enrolled in this study were all women with abnormal uterine blood loss, dysmenorrhoea or fertility problems who visited our outpatient clinic between August 2009 and December 2011. All patients with a suspicion of adenomyosis or fibroids on normal grey scale sonography underwent additional real time elastography when the machine was available. Elastographic imaging was executed by one sonographist (J.H.) with expertise on routine grayscale imaging. She performed the elastographic imaging in a standardized way (Figure 2). Both the single mode grayscale images combined with dual imaging and real-time recording were stored.

This study has been exempted from ethical approval granted by the Institutional Review Board (13/89).
**Settings**

It is possible to make an elastographic image with both the abdominal and the vaginal probe. We used the vaginal probe, given the best resolution of this probe to visualize the uterus.

The percentage grey mixed with the elastography image is variable, the so-called alpha blending. We prefer a blending level up to 20%. This provides a clear color overlay on a grey scale background, enabling the visualization of the basic pattern as well. There are different options for the elastography color maps to superimpose over the B-mode image: black and white, sepia and ascending colors. (Figure 3). We mostly used the ascending colors color map, which enables some kind of quantification based on the ascending colors. In the Samsung Medison Accuvix V10 ultrasound machine with Elastoscan™, the colors vary from dark purple to red but other machines may display different colors. However, the quantification is not absolute since it depends on the amount of pressure that has been applied to the tissues. Therefore, the elastographic image should be considered as a relative impression of the stiffness of the tissue in comparison to adjacent tissue that is exposed to the same amount of pressure. It is not possible to compare a degree of stiffness between different images or between different patients.

The frequency of refreshment of the dynamic images displayed on the screen, the so-called persistence level, can be adjusted. The persistence level indicates the degree of correlation of different individual elastographic images before an elastographic image is visualized on the screen. The final image on the screen is a kind of average elastographic image.

At a low persistence level, few images are correlated. Advantages of a low persistence level are a better time response and a better approximation of the actual size of a lesion, this is useful for small lesions. With a high persistence level, an average image is produced from more individual elastographic images. An advantage of a higher persistence level is a better signal to noise ratio. The images look cosmetically better, but are lagging a little bit behind in time. In the assessment of uteri, we mostly prefer a persistence level of 80%.

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Besides the persistence level there is the frame rate, the amount of frames per second. Depending on the frame rate per second of the screen, the image will be changed with an adjusted frequency.

*Probe handling: baseline steady state versus dynamic steady state.*

Based on our experiences with elastography using a Samsung Medison Accuvix V10, in patients visiting our outpatient department because of gynecological symptoms, we formulated some basic principles in making an elastographic image using this machine. First of all there should be a steady state: a clear delineation of the uterus from the intestines for more than 40% of the surface and it is obligatory that the normal myometrium is equal in color (figure 4, 5 and 6). Furthermore we used two standardized ways of probe manipulation in all patients. We defined them as “baseline steady state” (figure 5a) and “dynamic steady state” images (figure 5b).

To obtain a baseline steady state image the probe should be held gently to the cervix or vagina without probe movements. The pulsations of the large abdominal arteries will induce natural movements of the uterus and therefore apply a slight deforming pressure. With these slight movements a stable picture will be obtained of the uterus with a regular serosa delineated from the surrounding intestines and in case of fibroids, a capsule becomes slightly visible, giving the first impression of the localization and delineation of fibroids. In order to detect adenomyosis or other pathological conditions of the uterus which are associated with softer tissue, the baseline steady state mode does not always have sufficient discriminatory abilities. We defined that these conditions should be evaluated using the dynamic steady state images.

The dynamic steady state image is defined as a more or less stable image that is acquired during intermittent application of a certain amount of pressure and which can be reproduced.
The sonographer needs to vary the pressure by making intermittent movements with the probe. Little pressure is followed by a release state with less pressure with a frequency of approximately one to two times per second. The dynamic steady state creates a stable image with a clearly visible serosa of more than 40% with several parallel lines and with more color contrast than with the baseline steady state image. We considered such a dynamic steady state image as obligatory for the evaluation of adenomyosis. The use of a dynamic steady state image will reduce the risk of wrongful interpretation of movement artifacts in normal endometrium as soft tissue. In case of excessive pressure or movements of the uterus, bright colors can be induced even in normal myometrium (movement artifacts), resembling the appearance of adenomyosis (figure 4). However in these cases, in contrast to a dynamic steady state image, there will not be a clear delineation of the serosa with the surrounding intestines and in these circumstances the images will not be easily reproduced. An additional artifact the examiner has to be aware of is a probe contact artifact, visible in most elastographic images as an illuminated area at the point of contact with the ultrasound transducer mimicking softer areas (figure 4 and 6). This bright (yellow) area should not be confused with the presence of adenomyosis. Due to this artifact it is difficult to study the existence of adenomyosis in the low anterior part of the uterus.

Due to differences in the mobility of the uterus, the required pressure and frequency of movement differs per patient to obtain a dynamic steady state image. In very mobile uteri, it might be difficult to get a clear image. In these cases we fixated the uterus from form the outside by the examiner's hand or the hand of the patient.

Evaluation of the elastographic images

A second independent researcher (B.S.), who did not perform any of the examinations, and was unaware of clinical information including MRI or histology outcomes, examined all stored grayscale images and elastographic images that had been made and recorded between
2009 and 2011. This second researcher had to register the suspected diagnosis based on elastographic findings (none, intrauterine fibroids or adenomyosis) in all patients. For the diagnosis of adenomyosis we used the criteria as described by Dueholm.\textsuperscript{12}

In addition, she registered elastographic characteristics of the serosa, myometrium and eventual disorders in the uterus. In the midsagittal plane various parameters were registered. Number and color of the lines were described and percentage of clear visualization of the total serosa surface was estimated by the researcher. Of the myometrium the color and its homogeneity of the largest area was registered. After scanning through the uterus in both sagittal and transversal planes, the existence, the size and the localization of brighter or darker areas were registered. In case of areas with another color then the general myometrium, the existence of, the number and colors of the lines of a capsule were registered. The suspected diagnosis and the registration of the availability of adenomyosis were only based on dynamic steady state images.

**Evaluation of the MRI images and histology samples**

The used reference standard for the diagnosis of adenomyosis or intrauterine fibroids was MRI and/or histology. MRI was performed with at 1.5 Tesla (Sonata or Avanto, Siemens, Erlangen, Germany).

In case of histological examination the uterus was evaluated without fixation within 2-3 days after hysterectomy. Histopathological slices were obtained at 3 mm interval. The junctionalzone contours were measured. Adenomyosis was thought to be present if the junctionalzone was more than 2.5 mm from the pre-existing endometrium and the presence of ectopic endometrial gland or tissue within the myometrium beyond this line. Intrauterine fibroids were thought to be present if there was a rounded spot of leiomyomateus tissue. In case of fibroids the localization and size was measured.
**Outcome parameters**

Primary outcome: sono-elastographic characteristics of uteri with fibroids and or adenomyosis.

Secondary outcome: level of agreement in diagnosis made on sono-elastographic findings with a reference test (histology or MRI)

**Statistical analyses**

Patients that received a sono-elastography and who received a MRI or of whom histology was obtained were included for analyses. Descriptive outcomes were registered.

For the evaluation of specific elastographic characteristics of fibroids and adenomyosis, we analyzed elastography images of adenomyosis and fibroid images in those patients in whom the elastographic diagnosis was confirmed by histology or MRI evaluation. We compared the color scores between fibroids and adenomyosis using the Fisher Exact Test.

For the analyzes of the level of agreement (Cohen’s Kappa) between elastography based diagnoses with the MRI-based or histology-based we included all patients that that received a MRI or of whom histology was obtained independent of the diagnosis made. Scores over 0.75 can be interpret as excellent agreement, 0.40 to 0.75 as fair to good, and below 0.40 as poor agreement.\textsuperscript{13}

We used SPSS version 20, all tests were performed 2-sided. A p-value < 0.05 was considered to be statistically significant.
Results

218 women received elastographic imaging. In 69 patients a reference test was preformed. It was possible to achieve a steady state elastography image in 67 cases. From these patients histology was obtained in 59 cases, and 23 underwent additional or only an MRI. Baseline characteristics of all patients with both saved elastographic images and histology or MRI findings are shown in table 1.

Elastographic characteristics of fibroids and adenomyosis

The saved dynamic steady state images were analyzed by scoring the elastographic characteristics of the uterus and intrauterine abnormalities that were confirmed by histology (n=59) and/or MRI (n=23). In most cases myometrium and serosa of the uterus rendered a uniform elastographic image. The uterus is well delineated from the surrounding bowels with a couple of small bright parallel lines. The mean number of colored lines was 4.3, range 2-13. In most cases (95%) the serosa starts with a purple line followed by a dark blue, light blue one and a yellow line (Figure 6). The myometrium was uniform in color in 49% of the cases, with a main color of purple or dark blue. Most elastographic images (87%) showed a probe artifact (Figure 4 and 6).

Both fibroids and adenomyosis have different elastographic characteristics with different color patterns. Examples elastographic images of intramural fibroids are illustrated in figure 6 and of adenomyosis in figure 7. In general fibroids were darker and adenomyosis brighter than adjacent myometrium. Most fibroids had a regular shape with a clear visible and regular capsule whereas adenomyosis was mostly irregular shaped and without a clear border. The shape of fibroids was mostly regular whereas the shape of adenomyosis was mostly irregular. The fibroid capsule started in most cases (in case of a dynamic steady state image) with a purple line followed by a dark blue, light blue one and in some cases also a yellow and
red line (from inside out) (Figure 6). Adenomyosis started with a yellow line followed by a green line and a light blue line from inside to outside (figure 7). The specific characteristics and the main differences of fibroids and adenomyosis are presented in table 2. The delineation of fibroids in case of multiple fibroids was mostly very clear in the elastography image (figure 8)

Agreement between elastographic and MRI or histology findings

Based on elastography the majority of the patients (n=54) were suspected to have uterine fibroids, 10 patients were suspected to have adenomyosis and 3 patients to have both adenomyosis and fibroids.

All elastography-based diagnosis of uterine fibroids were confirmed with histology and/or MRI. Resulting in a Cohen’s Kappa for the diagnosis of fibroids of 1.0 with MRI and 1.0 with histology. Three patients with suspicion of uterine fibroids on elastography and MRI scan had also histological signs of adenomyosis which was neither seen with elastography nor with MRI.

All elastography-based diagnosis of adenomyosis were confirmed with MRI. Only in 7 cases histology was obtained. In 5 out of these 7 cases adenomyosis was confirmed. One of the patients with a negative histology for adenomyosis had several months of GnRH analogue pretreatment before hysterectomy. Calculated Cohen’s Kappa for the diagnosis of adenomyosis with MRI was 1.0 and with histology was 0.39.
Discussion

Main findings

Normal myometrium, endometrium, fibroids and adenomyosis can be visualized well with elastography. We defined and used a standardized way of using elastography in the diagnosis of fibroids and adenomyosis. Specific patterns and characteristics in terms of shape and color can be recognized in association with these conditions and can be of use for discrimination between these pathologies and normal uteri. The agreement between elastography based diagnosis of fibroids and adenomyosis with MRI were excellent, and with histology it was also excellent for fibroids, but less optimal for adenomyosis.

Strengths and weaknesses of the study

Before we started there were no standardized method on how to perform elastography in gynecology and how to interpret the images under what conditions. We had to define them first on our experiences before we started with the study. In this study we used the Samsung Medison Accuvix 10. With other machines some principles may be similar, but we expect that our recommendations on settings should be adjusted in case other machines are used.

An additional limitation of this study is that we were only able to verify the diagnosis in those patients that underwent surgery or received an MRI scan. Thus by definition this is a selected population and diagnostic accuracy can not be evaluated in these patients accurately. Future studies should include patients with and without suspected pathology. An additional limitation is that the number of included patients with adenomyosis and obtained histology is limited, only seven and one of these patients histology was obtained after a long period of GnRH suppression. With respect to adenomyosis it is difficult to define the golden standard.
Both MRI and histology have their own limitations. To overcome this problem both our histology samples and our MRI images were evaluated by one experienced radiologist and one experienced pathologist using standardized criteria.

In addition inter- and intra-observer variation of both the acquirement of the images and their interpretation has not yet been evaluated yet. This study should be considered as a first study exploring the elastographic characteristics in gynecology and in this way producing a practical manual for its use in the diagnosis of fibroids and adenomyosis using the Samsung Medison Accuvix V10.

**Interpretation of the findings and comparison to published data**

Within the field of gynecology little experience has been gained in this field. The feasibility of elastography for the assessment of intrauterine fibroids and adenomyosis is described in a few other studies.\(^9,10\) The identified characteristics of fibroids and adenomyosis are in line with these papers, however these did not report the characteristics in detail as we did and did not use standardized criteria to evaluate the images. Two other studies reported fibroids to have a dark centre and a clear regular capsule reflected as softer tissue.\(^9,14\) We could not find any other papers reporting on the appearance of small bright spots, that we identified as necrosis of the fibroid. In our study most fibroids had a color with the same intensity as the adjacent myometrium, and only 25% had a darker color. The proportion of patients with a reported darker centre than the myometrium was larger in two other small studies.\(^9,14\) The amount of applied pressure by the probe in order to get a steady state image, different settings or the use of a different machine could explain these differences. Adenomyosis has a soft centre with a stiffer border and an irregular shape using elastography. This is in line with a publication reporting on 15 patients with histology confirmed diagnosis of adenomyosis.\(^10\)
Clinical relevance

Due to the fact that elastography image is influenced by the amount of pressure applied, a certain level of experience is required to obtain good quality and reproducible images and to enable the interpretation of the images, in particular in the evaluation of adenomyosis. The learning curve of elastography lies mainly in the fact that the mobility of the uterus varies per patient. In addition, the pressure of the probe applied to the cervix and the frequency of movements by the sonographer differs, leading to differing images which are more difficult to reproduce. When more experience is gained, it becomes easier to reproduce images. We examined about 300 patients in which we made a sono-elastography image, to develop the standardized way of imaging and learn how to interpret the images. Using our standardized way for the used settings and applied technique in the assessment of uterine pathology it becomes easier to obtain reproducible images. The detailed description of specific characteristics of fibroids and adenomyosis in dynamic state images resulted in a good agreement with histology or MRI based images and could be of use for future studies evaluating the diagnostic accuracy of this method and its additional value to normal grey scale sonography with or without power-Doppler.

In other fields, elastography seems to be a promising technique, and in gynecology there are some papers indicating some additional value. However, current evidence is not sufficient enough to determine the exact additional value in gynecology. Future studies are required to address current gaps in available evidence. These include inter and intra-observer variation using the Samsung Medison Accuvix V10 in the same and other populations and preferably in random patients with and without uterine pathology, but also using other machines. Diagnostic accuracy of elastography should be compared to one reference test, for example MRI, in all patients independent of the outcome of sonography to prevent verification bias.
Conclusion

Elastography is able to identify clear discriminating characteristics of the uterus, fibroids and adenomyosis and the elastographic based diagnosis are in agreement with MRI or histology based diagnoses, with a substantial agreement. More data are needed to confirm its utility in gynecology, including reproducibility and accuracy in the diagnosis of intrauterine pathology.

Acknowledgments

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The study was not supported financially by Samsung Medison. We do have a research machine of Samsung Medison, however the availability of the ultrasound machine was not related to this study.
References


Schematic illustration of the use of real-time (sono) elastography. The probe is used to apply a certain amount of pressure on the uterus causing deformation of the tissue. Deformation due to compression depends on the tissue stiffness. Deformation in soft tissue is high, whereas in stiff tissue there is little deformation. The change in deformation is color-coded and is superimposed on the corresponding B-mode image. We mostly used the ascending colors color map: dark purple or dark blue indicate harder tissue, green and yellow indicate moderate stiff tissue and orange and red indicate soft tissue.
Figure 2 recommendations for the method of sonoelastography using Samsung Medison Accuvix V10 in Gynecology

How to make an elastographic image in gynaecology

Settings
- **Blending:** 20%
- **Persistence level:** 80%
- **Colormap:** Black and White, Sepia or Ascending Colours. We used the latter given the ability to visualize some kind quantification.

Probe Handling
- **Steady State:** ≥40% delineation of the uterus from the intestines; myometrium equal in colour; reproducible.
- **Baseline steady state:** Keep the vaginal probe still and press slightly against the uterus (deformation by pulsation of abdominal arteries).
- **Dynamic steady state:** Move the probe gently back and forth in a frequency of 1-2 second (deformation by intermitting movements).
- **Fixation:** In case of a very mobile uterus stabilize the uterus from the outside.

Interpretation
- **Fibroid:** Centre fibroid colour darker than or equal as myometrium
  - Capsule fibroid: bright parallel lines
  - Eventual necrosis: bright spots within the fibroid
- **Adenomyosis:** Bright colours within darker myometrium
  - Border is irregular of shape

Artefacts
- **Probe artefact:** Illuminated area at the contact point of the probe.
- **Movement artefact:** Bright colours in case of a non steady state image

Recommendations based on experience with Samsung Medison Accuvix V10
Figure 3 Different color maps

Duel mode sonography image. On the left side a conventional grayscale image. On the right side an elastography image: the grayscale image with a color map superimposed on it. With elastography there are different color maps to superimpose on the grey scale image. A: Black and White. B: Sepia. C: Ascending colors.
Elastography images illustrating possible artefacts. The corresponding grayscale image is not shown. 5A: Image without a steady state: the lack of linear regular delineation of the serosa indicates that a steady state image is not acquired. The various bright colors should be considered as movement artifacts. After the adjustment of pressure and probe movements a steady state image is acquired in 5B given the clear delineation in the largest part of the serosa by straight lines. Now it becomes clear that the tissue of interest has a relatively high stiffness level as presented by the dark purple colors. A probe artifact (5B) is visible in most elastography images and shows an illuminated area at the point of contact with the ultrasound transducer mimicking softer tissue.
Elastography images of baseline steady state and dynamic steady state images. The corresponding grayscale image is not shown. On the left side (4 A, B, C) the baseline steady state image is shown. On the right side (4 A", B", C") the dynamic steady state of the same region of interest. 4A+A" and 4B+4B": Intrauterine fibroids. 4C": Adenomyosis. The baseline steady state does not always have sufficient discriminatory abilities to identify adenomyosis as is demonstrated in 4C.
Figure 6 Examples of delineation of fibroids and uterus in a steady state image

(A+B+E) Duel mode sonography image of different uteri with a single intramural fibroid. On the left side a conventional greyscale image. On the right side an elastography image: the greyscale image with a colour pattern superimposed on it. An ascending colour map is used: dark purple or dark blue indicate harder tissue, green and yellow indicate moderate stiff tissue and orange and red indicate soft tissue. In the elastography image (dynamic steady state) the fibroid has a regular appearance. The capsule is well delineated with some bright parallel lines and its relation to the serosa is visible. The delineation of fibroid is less obvious in the conventional greyscale image. C: enlargement of a small part of the serosa: parallel coloured lines are visible. D: Enlargement of a small part of the fibroid capsule: clear coloured parallel lines are identified. 1=fibroid center; 2=fibroid capsule; 3=serosa; 4=bowels; 5=endometrium; 6=myometrium; 7=central softening; 8=probe artefact
Figure 7 A, B and C
Examples of adenomyosis.

Duel mode grey scale sonography and elastography images (A and B). On the left side a conventional grayscale image. On the right side an elastography image (dynamic steady state image): the grayscale image with a color pattern superimposed on it (blending level 20% in A and 40% in B). An ascending color map is used: dark purple or dark blue indicate harder tissue, green and yellow indicate moderate stiff tissue and orange and red indicate soft tissue. A: Adenomyosis diffuse in the anterior wall of the uterus. The centre of the adenomyosis is red/yellow; the border is light blue. B: Adenomyosis in the anterior wall of the uterus. C and D: detailed enlargement of a small part of the border of the lesion: shows a typical irregular of shape of the border.
Figure 8 Example improved fibroid mapping

Dual mode sonography image. On the left side a conventional grayscale image. On the right side an elastography image: the grayscale image with a color pattern superimposed on it, with a blending level of 20%. An ascending color map is used: dark purple or dark blue indicate harder tissue, green and yellow indicate moderate stiff tissue and orange and red indicate soft tissue. On the elastography image three well delineated fibroids are visible with a softer capsule, visualized as a lighter ring. The clear delineation of all individual fibroids is not visible in the conventional grayscale image.
### Table 1 Baseline Characteristics of included patients, with histology or MRI as a reference test

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total 69 (100)</th>
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<tbody>
<tr>
<td><strong>Demographics</strong></td>
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<td>Mean age (years ± SD) 42 ± 6.4 ¶</td>
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<td>Nullipara 29 (42)</td>
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<tr>
<td>Mean BMI (kg/m² ± SD) 26.1 ± 5.6 ¶</td>
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<td><strong>Reason of visit</strong></td>
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<tr>
<td>Dysmenorrhoea 21 (30)</td>
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<td>AUB 47 (68)</td>
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<td>Pain not related with menstruation 23 (33)</td>
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<td><strong>Received MRI</strong></td>
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<td>TCRM 13 (19)</td>
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<td>Other ** 3 (4)</td>
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*BMI= Body Mass Index; AUB= Abnormal uterine bleeding; MRI= Magnetic resonance imaging; # Laparoscopic hysterectomy, vaginal hysteroscopy and abdominal hysterectomy; ¶Mean± Standard Deviation **Other= Diagnostic laparoscopy, diagnostic hysteroscopy
<table>
<thead>
<tr>
<th>MRI or histology based diagnosis</th>
<th>Fibroids n (%)</th>
<th>Adenomyosis n (%)</th>
<th>p</th>
<th>Conclusion</th>
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<tr>
<td>Total</td>
<td>55 (100)</td>
<td>11 (100)</td>
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<td>}&gt;50% uniform in color</td>
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<td>Adenomyosis: &lt;50% uniform in color</td>
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<td>2 (3)</td>
<td>10 (90)</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Local area of softer tissue in the fibroid</td>
<td>24 (42)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ascending colors capsule/border from inside out?</td>
<td>Purple → dark blue → light blue (→ yellow → red)</td>
<td>yellow → green → light blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adenomyosis: centre lighter then myometrium</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear border/capsule</td>
<td>55 (96)</td>
<td>2 (18)</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Regular capsule</td>
<td>24 (42)</td>
<td>1 (9)</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Mean number of lines capsule (range)</td>
<td>5.3 (1-13)</td>
<td>1.5 (0-2)</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

* Patients with MRI or histology based diagnosis of fibroids or adenomyosis, characteristics were only assessed in dynamic steady state images.
<table>
<thead>
<tr>
<th>Elastography based diagnosis</th>
<th>MRI based diagnosis</th>
<th>Histology based diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fibroids</td>
<td>Adenomyosis</td>
</tr>
<tr>
<td>Fibroids</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Adenomyosis</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

The agreement between the diagnosis of fibroids and adenomyosis made by MRI or histology compared with elastography.

*Other = polyps