

**A comparative study of ultrasonography & magnetic resonance imaging with pathological results in diagnosis, localization & measurement of uterine leiomyomas**

Amjaad Majeed Hameed\*

**Abstract**

Uterine leiomyomas (fibroids or myomas) are the commonest benign tumor of the pelvic organs in females, accurate mapping of myomas is essential for treatment. Many studies, used ultrasonography (US) and magnetic resonance imaging (MRI) to determine myomas localization, number and measurement, recently concern has been increasing rate of hysterectomy for myoma in women who have complete childbearing. The aim of the study is to compare US, MRI results with pathology that is regard as a gold standard in detection, localization and measurement of the uterine lieomyoma. A comparative study was done during the period from July 2012 to April 2016 in AL-Diawanyia general teaching hospital in Iraq all included female patients had uterine myomas and all of them had pelvic ultrasonography, MRI and hysterectomy, the results were compared with pathological results. Both US and MRI results were compared with pathology result and the correct detection rate of myoma in ultrasound was low (73.3%) if compare with MRI detection rate (98.1%) with significant P 0.001. Mean number of myomas in US was (1.62±1.07), in MRI was (2.14±1.49) and in pathology was (2.15±1.50), mean diameter of myomas in pathology was 3.49±2.21, in MRI was 3.58±2.21 with P value 0.360 while in US mean number was 4.37±1.73 with P value 0.002. Regarding myomas' localization, there is no significant difference between MRI & pathology (P =0.1573) but there is high significant difference in myomas' localization in US and pathology (P=0.00889). In conclusions; MRI is indicated when exact myoma mapping is required.

**Keywords:** Uterine myoma; Magnetic resonance imaging; Ultrasonography\*Corresponding Author: [amjad.majed@qu.edu.iq](mailto:amjad.majed@qu.edu.iq)

College of Medicine, AL-Qadisiya University

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## Introduction

Uterine leiomyomas are the commonest benign tumor of the pelvic organs in females of late reproductive age and can be single or multiple, but often multiple, fibroids are mainly benign but may have significant symptoms to about 40% of females [1, 2, 3,4, 5] precise localization of myomas is essential especially if they arrange to treat fibroids by embolization or selective removal of myomas [6, 7].

Several studies, including US and MRI may be helpful in myoma evaluation. Ultrasonography whether it's trans-abdominal or endo-vaginal is an essential techniques in determine pelvic pathology and it's used to confirm the diagnosis of myoma, MRI is an important technique in the evaluation of pelvic pathology and it provides an accurate assessment of the leiomyomas, [8, 9] hysterectomy is a treatment of choice if the fibroids causing symptoms that deteriorated life style of female like irregular or prolonged vaginal bleeding or pelvic pressure symptoms, (obstructive uropathy) [10], recently concern has been increasing rate of hysterectomy for myoma in women 30-49 years of age who have complete childbearing [11, 12, 13].

## The aim of the study

The purpose of this study was to compare ultrasonography, MRI with pathology that is regard as a gold standard in detection, localization and measurement of the uterine lieomyoma.

## Patient and method

This study was conducted at Department of Radiology and Pathology in Al-Dywanvia general teaching hospital & in maternity & pediatric hospital in Al Dywanvia in Iraq during the period from July 2012 to April 2016. All females included in this study were referred to ultrasonography for different reasons, they had uterine myoma at ultrasonography and all of them referred to MRI of the pelvis within few hours-days after ultrasonography all patients undergo surgical treatment by hysterectomy. All myomas were independently evaluated according to their number, maximum myoma diameter & categorized according to their location in the uterine wall as submucosal, intramural, subserosal and peneculated myomas. All the results of US & MRI were compared statistically with pathological results

**Inclusion criteria:** All included patients had symptomatic fibroids, that evaluated by ultrasonography & MRI, all of them had no

desire for childbearing, hysterectomy was the definitive solution.

**Exclusion criteria:** Patients with MRI claustrophobia, metal implant, refused surgery or hysterectomy, patient with a known case of adenomyoma & pregnant female were excluded from this study.

**Ultrasonography:** All ultrasonography was done by same radiologist. Both transabdominal and transvaginal ultrasound were done to the patients by using Acuson X300 diagnostic ultrasound system (Siemens) with 2-5MHz convex probe for adnominal ultrasound and 8MHz transvaginal probe for transvaginal ultrasound.

**MRI technique:** MRI images were evaluated by other radiologist who was unaware of ultrasound results, unenhanced MRI was done by 1.5 Tesla of Magnetom Avanto, Siemens, Germany with 4mm slice thickness & gap of 1mm in axial, coronal & sagittal plans using T2 weighted turbo spin-echo sequences, time of repetition range /time of echo range =3500-5423mes/80-100mes & in T1 weighted spine echo sequences, time of repletion /time of echo range =400-

650mes/8-12mes by using phased array pelvic coil.

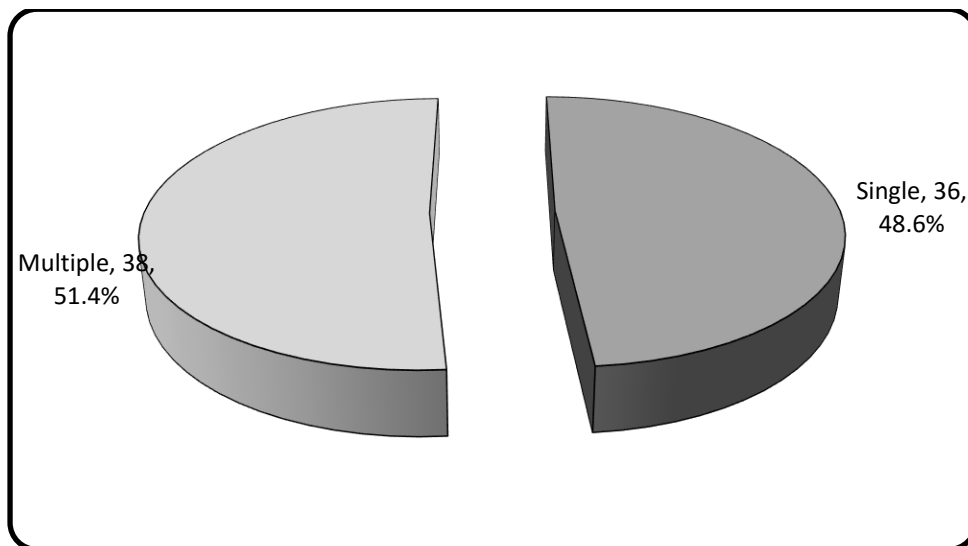
**Surgical & histopathological assessment:**

Hysterectomy was done within a period 1-3weeks of MRI study, all specimen was examined by one pathologist, cross and microscopic histopathological examination were performed. Examination of the uterus & myomas was done before fixation, the uterus cut in midsagittal plane, all abnormal uterine masses were recorded & all specimens were evaluated without ultrasound or MRI results.

**Statistical analysis:** Data were analyzed using SPSS version 22.0 and Microsoft Office Excel 2010. Numeric variable was expressed as mean $\pm$ SD whereas categorical variables were expressed as number and percentage. One proportion Z-test was used to compare between ultrasound detection rate and MRI detection rate; Wilcoxon test was used to compare the number and largest diameter of uterine fibroid between any two different methods. The level of significance was considered at P-value of  $\leq 0.05$ . Wilcoxon test was used to compare the location of myomas in MRI & US with pathological result.

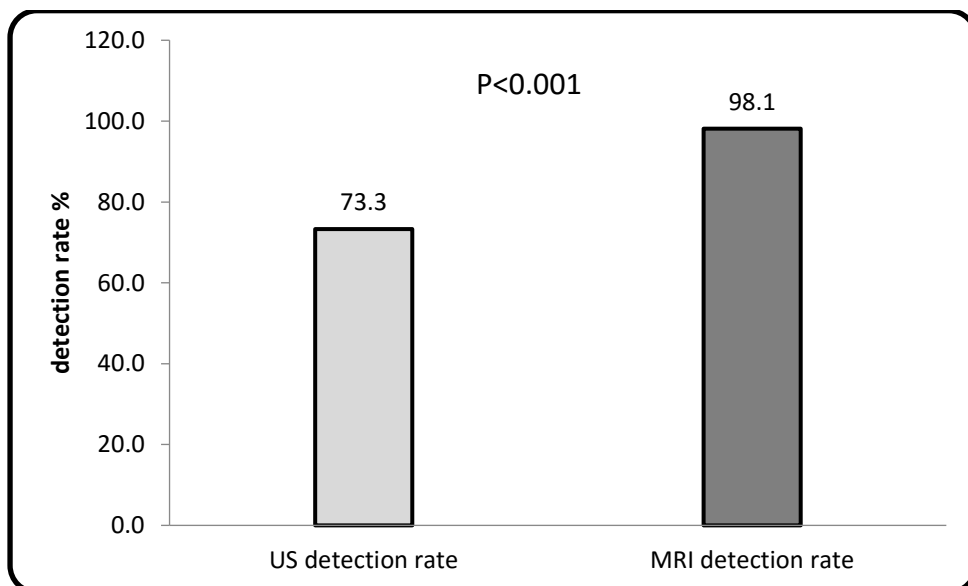
## Results

The study included 74 female patients with 161 uterine myoma according to histopathology (age range :38-54 years).



**Figure 1.**

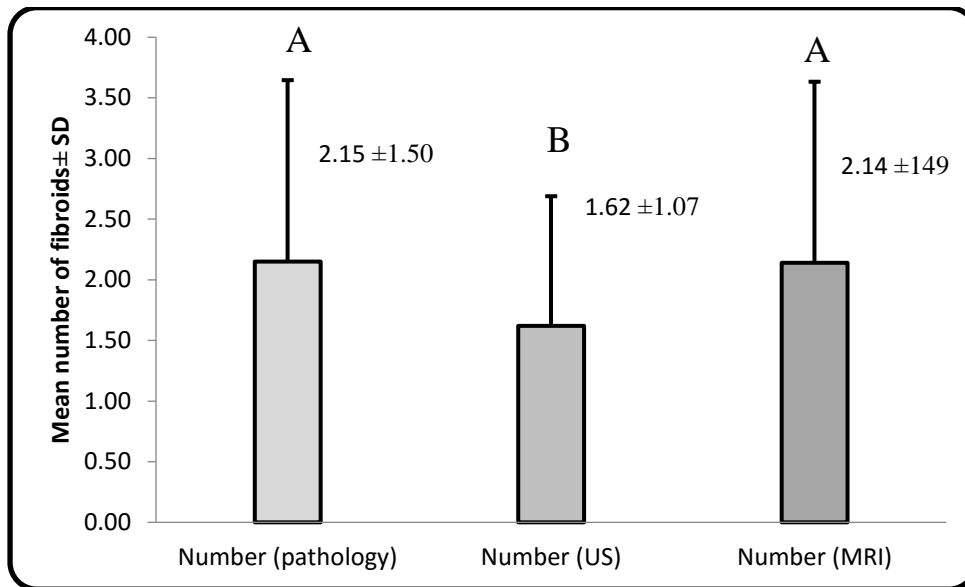
Number and percent of solitary & multiple uterine myoma.



**Figure 2.**

Comparison of detection rate between U/S and MRI

Both US & MRI were compare with pathology result & the correct detection rate of myoma in ultrasound was low (73.3%) if compare with MRI detection rate (98.1%) with significant P 0.001



**Figure 3.**

Mean number of detected myoma

According to figure 2 the mean number of myoma in US was (1.62±1.07), in MRI was (2.14±1.49) & in pathology was (2.15±1.50)

**Table 1.**

Mean diameter of fibroid by different methods

| largest diameter (cm) | N   | Mean ±SD   | Range  | P         |
|-----------------------|-----|------------|--------|-----------|
| Pathology             | 161 | 3.49 ±2.21 | 0.3 -9 | reference |
| US                    | 119 | 4.37 ±1.73 | 0.4 -9 | 0.002     |
| MRI                   | 159 | 3.58 ±2.21 | 0.3 -9 | 0.360     |

Myomas maximum diameter range 4mm – 15cm and table 1 compare mean diameter in different study. Mean myomas diameter in pathology was (3.49±2.21), in US (4.37±1.73) & in MRI (3.58±2.21).

The number of myomas detected correctly in both study (MRI & US ) was 117 which is included in statistical evaluation of myomas localization.

**Table 2.**

Number of myomas that correctly localized.

| Location | Number of myomas | No. that correctly localized |
|----------|------------------|------------------------------|
| Path     | 117              | 117                          |
| MRI      | 117              | 115                          |
| US       | 117              | 105                          |

The number of myomas that correctly localized in MRI was 115 while it was 105 in US.

**Table 3.**

Correlation among US, MRI & histopathology in myomas localization & P value

| Correlation | Path  | US    | MRI   | P value   |
|-------------|-------|-------|-------|-----------|
| Pathology   | 1     | 0.451 | 0.978 | Reference |
| US          | 0.451 | 1     | 0.505 | 0.00889   |
| MRI         | 0.978 | 0.505 | 1     | 0.1573    |

There is mild correlation between US and pathology ( $R=0.451$ ), but there is high significant correlation in myomas localization between MRI & pathology ( $R=0.978$ ) in addition to that, there is poor correlation between MRI and US ( $R=0.505$ ).

In myomas' localization there is no significant different between MRI & pathology ( $P=0.1573$ ) also there is high significant difference in myoma's localization in US and pathology ( $P=0.00889$ ) according to Wilcoxon Signed Ranks test.

## Discussion

Most myomas have no symptoms and no need treatment or further investigation. The symptoms depending on the location and size of fibroids. Ultrasonography is essential to diagnose fibroids and to know their number, size and location, as this will guide us to choose suitable treatment [14]. Pelvic MRI is better than sonography in the diagnosis of female pelvic diseases included ovarian masses and uterine masses like uterine fibroids, it assesses uterine fibroids site, size and number accurately even when it is small in size [15, 16, 17, 18]. Although transvaginal US is the most reliable technique for differentiation myomas from other pelvic pathology and it's more sensitive to detected small size fibroid but when the uterus is large size or retroverted the uterus fundus may be not well asses as a result fibroids best diagnose with both transvaginal and transabdominal sonography [19, 20] in this study we use transvaginal and transabdominal ultrasonography for good mapping of large myomas, cervical myomas and small myomas. In our study (according to figure 2) the detection and correct diagnosis rate in ultrasonography (73.3%) was low if compare with MRI (98.1%), with significant p value  $< 0.001$ , ultrasound not detect 37 myomas that

measure less than 8mm in largest diameter and 28 of them were found in patients who had more than 3 myomas. Furthermore; US not detected 5 of pedunculated fibroids in the adenaxa they diagnosed as ovarian masses. We found that US missed 37myomas which are measure less than 8mm but they detected in MRI and this finding was close to Dudiak *et al* [14] finding who found that MR has been shown to be superior to ultrasound for small fibroids that smaller than 5mm. More missed small myomas (28 out of 37) in ultrasonography were in patients with more than three myomas and this finding close to the finding of Dueholm *et al* [6] who found that US was insufficient if myomas number was  $\geq 5$ .

According to figure 3, the mean number of myomas is low in ultrasound ( $1.62 \pm 1.07$ ) if compare with MRI ( $2.14 \pm 1.49$ ) & with histopathology ( $2.15 \pm 1.50$ ) which is accordance to the findings of Dueholm *et al* [6] and Hricak *et al* [23] who found that the mean number of myomas in MRI close to the mean number in pathology. If we compare detection rate and mean number of myomas in both ultrasound and MRI with pathological results, we will find that ultrasound lost more myomas than did MRI.

According to table 1, mean diameter of myomas in pathology was  $3.49 \pm 2.21$ , in MRI was  $3.58 \pm 2.21$  with no significant P value 0.360 which is close to findings of Hricak *et al* [23] while in US mean number was  $4.37 \pm 1.73$  with significant P value 0.002. US was underestimated of the myoma maximum diameter that's consistence with the findings of Spielmann *et al* [24] who found that there is significant difference is shown between the largest myoma diameter measure on MRI and that on US, also they found that US tended to underestimate the fibroid volume if it compare with MRI.

Growth and location of myoma are essential to decide if myomas cause morbidity and significant symptoms [22] in our study regarding the myoma's localization, 117 myomas were included statistically in myomas localization and according to our results, there is high significant correlation in myomas localization between MRI & pathology ( $R=0.978$ ), also there is no significant different between MRI and pathology ( $P=0.1573$ ) according to Wilcoxon Signed Ranks test, this findings go with findings of Herick H *et al* findings [23].

There is mild correlation between US and pathology ( $R=0.451$ ) also there is high significant difference in myomas localization in US and pathology

( $P=0.00889$ ) according to Wilcoxon Signed Ranks test. There is poor correlation between MRI and US in myomas localization ( $R=0.505$ ). This was accordance with the study of Spielmann *et al* [21] and this is also in agreement with Dudiack *et al* [15].

Both techniques ultrasonography and MRI detect and correct localization all myomas in patients with 3 or less than 3 myomas, that's close to findings of Dueholm *et al* [6] who found that some myomas in patients with more than 4 myomas were not even identified with US. From the figure 2, figure 3, table 1 and table 3 in the results we found that MRI is superior in detection, measuring and localization of uterine myomas that is go with findings of Zawin M *et al* [24], Varpula M *et al* [25] and Levens E D *et al* [26]. Our and other findings explain by fact that MRI has superior tissue contrast and native multiplanar capabilities making it appropriate to diagnose uterine pathology, although US is usually regards as a 1<sup>st</sup> line for assessment of female reproductive organs, it can be limited by obesity, uterus size, depth of acoustic penetration and ability to discriminate between specific tissue types furthermore it's an operator dependent [27, 28, 29].



**In conclusion;**

1. Although MRI is the most expensive & till now its remain restricted to many parts of the world and to many patients it is indicated when precise myoma mapping is needed especially for surgical treatment and embolization. MRI provides important additional information compare with US and affect mode of treatment.
2. Combination of transabdominal and trasvaginal utrasonography used in initial evaluation of the fibroid, as U/S

is available, low cost, no radiation and remains the 1st imaging technique in the uterine disorders.

3. Ultrasonography can detect and precise localization of myomas in patients with  $\leq 3$  myomas therefore it can be use alone in categories the myomas in patient with 3 or less than 3 myomas, also it can be used alone in asymptomatic myomas.
4. Ultrasonography missed small myomas in patients with more than three myomas.

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Contact us

Postal Mail

Muthanna Medical School

Samawah

Tel: +964 (782) 542-5669

Office's business hours: Sunday-Thursday 9.00 am – 1.00 pm

Email: [yousif\\_ghaly@yahoo.com](mailto:yousif_ghaly@yahoo.com)

Email for technical assistance: [shatha.farhan@gmail.com](mailto:shatha.farhan@gmail.com)

