

# Uterine Fibroid Volume after Myomectomy Compared to Pre-Operative Measurement by Two and Three Dimensional Ultrasound

Hend S Saleh\*, Entesar R Mahdy, Hala E Mowafy, Amr A Alnemr and Ekramy A Mohamed

Department of Obstetrics and Gynecology, Faculty of Medicine, Zagazig University, Egypt

\*Corresponding author: Hend S Saleh, Department of Obstetrics and Gynecology, Faculty of Medicine, Zagazig University, Egypt, Tel: 00201143288238; E-mail: drhendsaleh@yahoo.com

Received date: January 29, 2018; Accepted date: February 12, 2018; Published date: February 20, 2018

**Copyright:** © 2018 Saleh HS, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

#### Abstract

**Introduction and methods:** In this prospective study we compared 2-dimensional and 3-dimensional ultrasound measurements with the actual myomas volume after surgical removal to test the validity and usability of 3D ultrasound as opposed to conventional 2D real-time ultrasound and to assess the reliability of different ultrasound methods to measure volume of uterine fibroids. Fibroid volume was measured for 44 patients by 2D-US using (3 dimensions), (mean of ellipse x its perpendicular diameter) and by 3D-US. After surgery; myoma volume was estimated by Archimede's law using water path.

**Results:** 3D-US measurements were the most accurate method for measuring fibroid volumes with high significant difference (p<0.001), followed by mean of ellipse x its perpendicular diameter of 2D-US dimensions of 2D-US. 3 dimensions of 2D-US was the least accurate method.

**Conclusion:** Using 2D-US with the mean of ellipse x its perpendicular diameter for measuring myoma volume in health care is alternative option where 3D-US is unavailable with nearly similar results.

**Keywords:** Myoma volume; Ultrasonography; Fibroid; Benign tumor; Myomectomy

#### Introduction

Myoma of the uterus is the most frequent benign tumor of the female genital system. The prevalence varies from 30% to 40%, conditional on the parity, age, ethnicity and investigative means by which their existence is confirmed [1]. Pathologically, the incidence of diagnosed fibroids amplifies gradually with age. At 25-30 years the incidence is only 0.31 per 1000 women years, but by age 45-50 years old, the incidence has raised 20 fold. Advanced age increases the risk for fibroids many folds [2].

Volume of fibroid is important for choosing the management options from no need any intervention as in small asymptomatic myomas, to surgical intervention in symptomatic one or in cases of large uterus with myomas comparable to or in surplus of 12-14 week pregnancy [3]. Myomas are not resting as they may show persistent and rapid growth, so it is essential to closely monitor its growth every 4-6 months interval [4]. Uterine fibroid volume is also necessary in follow up of cases under medical treatment (e.g GnRH analogues) to assess its success, while in cases of rapid growth planned for surgical intervention, myoma volume helps us to decide the incision type, site and length to diminish the surgical complications [5,6].

The aim of this study is evaluating the volume and size of myomas by dependable diagnostic possibilities of ultrasound either by 2dimensional or 3-dimensional ultrasound and to clinically analyze the reliability and usability of 3D ultrasound technology in contrasting to conventional 2D real-time ultrasound.

#### **Patients and Methods**

About 66 women who had uterine myoma were included in this prospective study which was conducted at Obstetrics and Gynecology Department, Oncology Unit, Zagazig University Hospital (ZUH), Zagazig, Egypt from October 20016 to September 2017 (Figures 1 and 2).



Sample size was opportunity sampling calculated according to the number of admitted cases per year for myomectomy in Zagazig university hospital. About 11 patients did not rally the inclusion criteria, 2 patients refused to sign the consent, 4 Withdraw from study, 2 had missed records and 2 did myomectomy at other hospital.

So, 44 Patients completed the research work to the end. After the approval on the protocol of our study by the ethics committee and local research of ZUH. All participants were counseled with obvious explanation about the character of study and written informed consent was taken from them. The included patients were scheduled for surgical intervention after diagnosis of having fibroids.



Figure 2: Measuring myoma volume using 3 diameters by 2D.

Full history, abdominal and bimanual examinations were done to all patients. Trans-abdominal or trans-vaginal ultrasound was carried on/to all patients with 2D and 3D US measuring fibroid volumes.

# A: 2D-US using 3 diameters for measuring the volume of myoma

2D ultrasound plan of evaluating the volume of ovoid bodies with three diameters is the most common one in gynecologic diagnosis (Figure 3).



**Figure 3:** Measuring the fibroid volume using mean of ellipse x its perpendicular diameter by 2D US.

First must be measured the D1 expanse between two opposed extremities in the greatest transverse section of myoma. Afterward, tumor width or D2 anterior-posterior diameter is established throughout the middle of tumor in vertical put on view compared with

Page 3 of 5

the previous section. The width or D3 transverse diameter is vertical length on the anterior-posterior diameter or D2. The ultrasound apparatus software automatically determines the volume in accordance with the formula for the volume of ellipsoid.

# B: Measuring the fibroid volume by 2D-US using mean of ellipse x its perpendicular diameter

The fibroid volume is established by means of ellipse and one distance (its perpendicular diameter) in 2 dissimilar planes and receiving the mathematical mean (Figure 4).

#### C: Fibroid volume measurement by using 3D-US

By using 3D MultiPlane technology, exhibit or storing ultrasound images in 3D X, Y and Z systems is necessary. The myoma is shown at the junction of the longest axis. The stirring of one pole toward the opposite one takes place concurrently at all three ultrasound X, Y and Z intersections.

At the connection with the longest axis of ovoid body, the movement of one end towards another one is proscribed. By way of 'slice methodology', drawing of the outlines of the myoma (Figure 5).



Figure 4: Measuring of fibroid volume using 3D-US.



**Figure 5:** Postoperative measuring of fibroid volume using water volume change.

The reproduction of all surfaces and distances between the two opposite ends of provides the ellipsoid volume. Here, the standard of

measuring consists of the so-called 'fan scan' with an essential require that the 2D exhibit is in a vivid image as a central plane for orientation within the volume described.

After myoma was removed either after myomectomy or from the specimen after hysterectomy, the actual volume was measured by Archimedes' law by means of water path "that indicates that the upward buoyant force that is exerted by the fibroid immersed in a fluid, whether wholly or partly flooded, is equal to the volume of the fluid that the myoma displaces".

The mean values of myoma volumes measured by ultrasound were compared to the actual volumes measured by Archimedes' rule, which characterized control histopathology group. All values were represented in tables and figures.

#### **Statistical Analysis**

On statistical data processing, analyses were done using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean  $\pm$  SD median range, the following tests were used to test differences for significance.

Differences between non parametric paired same groups by sign Wilcox test. Correlation was calculated by spearman rho correlation. And regression was used to detect value of dependency and determination. P-value was set at <0.05 for significant results and <0.001 for high significant result.

#### Results

The study included 44 patients of reproductive age and in postmenopausal. The mean of age is  $33.3 \pm 5.4$  with range from 26-62 years old, with mean parity  $2.14 \pm 2.4$  and with mean BMI 27.8  $\pm$  4.8. The chief complaint was menorrhagia in 17 cases (38.6%), followed by postmenopausal bleeding in 12 cases (27.4%), while primary infertility was the chief complaint in 6 cases (14%), and abdominal pain as a complaint was in 5 cases (12%) (Table 1).

Abdominal and bimanual examination was done as a routine evaluation of the cases. By examination, raw data was obtained as the enlarged uterus was observed. It was estimated in terms of gestational weeks. During examination some problems faced us as abdominal obesity, tenderness, bleeding and non-cooperative patients. Also number of myomas cannot be determined from examination but it can be predicted by irregularity of the uterine wall.

Through the cases abdominal hysterectomy was done for 27 cases (62%), myomectomy for 16 cases (37%) and subtotal hysterectomy (3%). The methods used in the study were 2 methods of determining myoma volume on 2D and one on 3D ultrasound displays. Post-operative measurements of the myoma volumes in a test bowl with water served as control group.

Reliability of determining the myoma volume by the ultrasound techniques was tested by use of diagnostics and preoperative measurements. The values measured by each ultrasound method were sorted into appropriate groups, including respective control histopathology group. Citation: Saleh HS, Mahdy ER, Mowafy HE, Alnemr AA, Mohamed EA (2018) Uterine Fibroid Volume after Myomectomy Compared to Pre-Operative Measurement by Two and Three Dimensional Ultrasound. J Women's Health Care 7: 419. doi:10.4172/2167-0420.1000419

### Page 4 of 5

Variable	Mean ± SD (range), N (%)			
Age/years	33.3 ± 5.4 (26-62)			
Parity	2.14 ± 2.4			
Body mass index (BMI)	27.8 ± 4.8			
Complaint				
Menorragia	17 (38.6%)			
Postmenopausal bleeding	12 (27.4%)			
Primary infertility	6 (14 %)			
Abdominal pain	5 (12%)			
Surgical intervention				
Hysterectomy	27 (62%)			
Myomectomy	16 (37%)			
Subtotal hysterectomy	1 (3%)			

Table 1: Demographic profile of the patients (Values are given as mean ± SD (range) or number (percentage).

The correlation between the different methods and the actual volume of myoma was done to determine, the strongest correlation was using 3D-US with coefficient 0.996, followed by mean elapse x its perpendicular diameter method to calculate the volume using 2D-US with coefficient 0.989 and lastly the weakest correlation was with 3 dimensions method using 2D-US with correlation of coefficient 0.980.

The correlation between the using 3D-US and 2D-US shows the strongest correlation was using mean ellipse x its perpendicular diameter volume with coefficient 0.990, followed by using 3 dimensions with coefficient 0.985. The correlation between using different methods of 2D-US (using 3 dimensions and mean ellipse x its perpendicular diameter) was with correlation coefficient 0.987 (Table 2).

		3-dimensions using 2D- US	Mean ellipse using 2D-US	3-dimensions using 3D- US	Actual volume
	Correlation Coefficient	1	0.987**	0.985**	0.980**
	Sig. (2-tailed)	-	0	0	0
3 dimensions using 2D-US	N	44	44	44	44
	Correlation Coefficient	0.987**	1	0.990**	0.989**
	Sig. (2-tailed)	0	-	0	0
Mean ellipse x D using 2D-US	N	44	44	44	44
	Correlation Coefficient	0.985**	0.990**	1	0.996**
	Sig. (2-tailed)	0	0	-	0
3 dimensions using 3D-US	Ν	44	44	44	44

 Table 2: Determination of the correlation coefficient of each method and actual values.

#### Discussion

In the current study, using 2D-US was very useful in decisive the values of myoma volume, with high significance (p<0.001) when compared with actual values. This is in agreement with Yaman et al. [7] as he reported a significant difference (p<0.005) in comparing 2D myoma volumes with the actual volumes. Also positive correlation

between 2D-US and actual volume was reported (0.982) that was higher in our study in comparison to Yaman et al. [7] (0.0827). Stoelinga et al. [8] reported that there was underestimation of myoma volume measurements by using 2D-US in comparison to the actual values, especially myomas less than 233 ml, and also there was over estimation of myoma volume measurements when their volumes

Page 5 of 5

exceed 747 ml. This over or under estimation of myoma volume may be due to abdominal obesity or may be due to lack of experience of the sonographers. In comparison between different methods of 2D-US, the current study documents that, the values obtained by using mean of ellipse x its perpendicular diameter method are near to actual volumes (p<0.001). This method was accepted by Živković et al. [9] who recommended it as an accurate method for determining the volume using 2D-US and even reported that 3 dimensions method was not relevant in comparison to the actual volume (p>0.005).

Regarding 3D-US, although it is expensive and usually unavailable method, its values of myoma volume measurements are the nearest to the actual values with high significance difference in comparison with actual volumes (p<0.001). This was accepted by Bosch et al. [10] and Zivkovic et al. [9]. There were many fallacies documented in Bosch et al. study [10]. This was done during transferring the data to measure myoma volumes using VOCAL (virtual organ computer-aided analysis). These fallacies were avoided in current study by using Voluson° 730 Pro as the volume is automatically and immediately calculated. The study documented the accuracy and the usefulness of 3D-US in measuring myoma volume with high positive correlation (0.996) in comparison to actual volume. In contrary, Yaman et al. [7] reported a lower value of correlation between 3D-US values and actual values (0.896); this may be contributed to excluding fibroid volumes of more than 250 ml from their study. As regards the evaluation on both 2D-US and 3D-US in measuring fibroid volume, we found that volumes measured by 3D-US is more nearer to the actual volumes compared with that of 2D-US with significance difference (p<0.001). This was also documented in Yaman et al. [7] and Zivkovic et al. [9]. Also, it was concluded that there is no significant difference between 2D-US and 3D-US in measuring fibroid volumes by Benacerraf et al. [11] and he explained that due to use of very small sample size. From the obtained results, although measurement values of both 3D-US and 2D-US were near to the corresponding actual volume, 3D-US measurements were superior. In 2D-US, using mean ellipse x its perpendicular diameter is more near to the real volume than that of using 3 dimensions which was the least accurate method in fibroid volume measuring.

#### Conclusion

Using 2D-US with the mean of ellipse x its perpendicular diameter for measuring myoma volume in health care is alternative option where 3D-US is unavailable with nearly similar results.

### Acknowledgements

The authors would like to thank all medical and nursing staff of Obstetrics and Gynecology Department ZUH for their help in data collection to complete this study.

#### References

- 1. Parsanezhad ME, Azmoon M, Alborzi S, Rajaeefard A, Zarei A, et al. (2010) Randomized, controlled clinical trial comparing the effects of aromatase inhibitor (letrozole) and gonadotropin-releasing hormone agonist (triptorelin) on uterine leiomyoma volume and hormonal status. Fertil Steril 93: 192-198.
- Paffoni A, Somigliana E, Vigano P, Benaglia L, Cardellicchio L, et al. (2013) Vitamin D status in women with uterine leiomyomas. Int J Clin Endocrinol Metab 98: E1374-1378.
- Kasum M (2009) Fertility following myomectomy. Acta Clin Croat 48: 137-143.
- 4. Flietcher MH, Frederick J (2005) Abdominal myomectomy revisited. Prog Obstet Gynaecol 16: 277-286.
- Vitello D, McCarthy S (2006) Diagnostic imaging of myomas. Obstet Gynecol Clin North Am 33: 85-95.
- Rovio PH, Luukkaala T, Vuento M, Oksa S, Sundstrom H, et al. (2008) Ultrasonographic assessment of weight of the myomatous uterus. Eur J Obstet Gynecol Reprod Biol 137: 193-197.
- Yaman C, Jesacher K (2003) Accuracy of three-dimensional transvaginal ultrasound in uterus volume measurements: Comparison with Twodimensional ultrasound. Ultrasound in Med Biol 29: 1681-1684.
- Stoelinga B, Huirne J, Heymans M, Reekers J, Ankumd W, et al. (2015) The estimated volume of the fibroid uterus: A comparison of ultrasound and bimanual examination versus volume at MRI or hysterectomy. Eur J Obstet Gynecol Reprod Biol 184: 89-96.
- 9. Zivkovic N, Zivkovic K, Despot A (2012) Measuring the volume of uterine fibroids using 2 and 3-dimensional ultrasound and comparison with histopathology. Acta Clin 51: 579-589.
- Bosch T, Valentin L, Schoubroeck D, Luts J, Bignardi T, et al. (2012) Detection of intracavitary uterine pathology using offline analysis of three-dimensional ultrasound volumes: Interobserver agreement and diagnostic accuracy. Ultrasound Obstet Gynecol 40: 459-463.
- 11. Benacerraf B, Shipp T, Bromley B (2006) Improving the efficiency of gynecologic sonography with 3-dimensional volumes: A Pilot Study. Ultrasound Med 25: 165-171.