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Uterine leiomyomas embolization with magnetic resonance imaging follow up

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Abstract---Introduction: Uterine artery embolization (UAE) has been used to treat symptomatic uterine leiomyomas, as women choose to preserve their uterus, uterus sparing techniques such as UAE have been developed. Magnetic resonance imaging (MRI) sequence signal characteristics and the degree of leiomyoma enhancement may be used to predict the response of leiomyoma to UAE. Objective: to investigate role of UAE in different uterine myomas with follow up by MRI. Materials and methods: This prospective observational study was included 40 females with clinical criteria of symptomatic fibroid who weren't suitable or refuse the other modalities of treatment and underwent UAE. All patients were undergone pre-procedure pelvic ultrasound and pelvic MRI, and post-procedure pelvic MRI. Results: There was a significant decrease in the uterine volume post embolization in all patients with infarction more than 50% occurred in 38 (95%) patients. Bleeding and anemia in patients who had improved were significantly higher than those who were unchanged/recurrent (P

value <0.05). Post embolization syndrome occurred in 10 patients (25%), only one patient (2.5%) had puncture site hematoma, two patients (5%) complained with pelvic infection and re-bleeding occurred in 5 (12.55%) patients. Conclusions: Pre and post procedural MRI allows for precise assessment of patients undergoing UAE. In patients with leiomyomas, MRI is the preferred diagnosis approach and if it is not done before UAE, patients may get improper therapy. The use of UAE for the treatment of leiomyomata is safe, with major consequences occurring seldom. Most patients report better symptoms and satisfaction with the treatment outcome.

Keywords---uterine artery embolization, leiomyoma, magnetic resonance imaging.

Introduction

The most common cause of gynecological causes of uterine bleeding is myoma (Mercier et al., 2022). Hysterectomy and myomectomy have performed for long time in the treatment of different causes of uterine bleeding over the last century; however, they are associated with significant morbidity (Giuliani, As - Sanie, & Marsh, 2020). There were multiple alternatives has appeared includes minimally invasive surgery and minimally invasive non-surgical procedures, uterine artery embolization (UAE) considered to be the most effective one (Ukybassova et al., 2019). Research is continuous to evaluate the results of UAE compared with other medical and surgical treatment options for heavy abnormal bleeding due to fibroids, particularly for women wishing to maintain their fertility (Singh & Belland, 2015).

UAE is defined as selective transmission of an embolic agent via a catheter to uterine arteries (Obata et al., 2017). UAE is an angiographic method; the maneuver is done utilizing femoral artery approach, with catheterization then embolization of one or both uterine arteries (Ganguli, Stecker, Pyne, Baum, & Fan, 2011; Gupta & Grünhagen, 2013; Soncini et al., 2007). Uterine arteriography is done under fluoroscopy; the embolic material is transmitted into the uterine artery for its occlusion. This procedure may be repeated in the other uterine artery, allowing for worldwide measurement of uterine flow and improved technical control (Das, Rathinam, Manchanda, & Srivastava, 2017). UAE has been shown to be a safe and effective treatment for uterine myomas and may be used as a primary therapy. Uterine fibroid embolization (UFE) provides symptom alleviation comparable to that of surgery but with fewer serious consequences. Uterine fibroids are the most common tumor of the reproductive tract in women, occurring in over one-half of women of reproductive age. Although most fibroids are asymptomatic, they may produce severe symptoms including pain, pelvic pressure, menorrhagia and reproductive problems including infertility (Khan, Shehmar, & Gupta, 2014).

In the United States, UAE has been used as a method of therapy for fibroids. The American Congress of Obstetricians and Gynecologists has investigated the procedure's safety and effectiveness, and it is now regarded a viable therapy

option for fibroids. Also, UAE has been shown to reduce pain, menorrhagia and other symptoms in most of cases (Laios, Baharuddin, Iliou, Gubara, & O'Sullivan, 2014). Magnetic Resonance Imaging (MRI) is the preferable modality over transvaginal ultrasound in the pre-and post-procedural evaluation for UAE due to its higher accuracy in assessing site and size of uterine leiomyoma (ALLAM, MOUNIR, & DALIA, 2019). Most gynecologic malignancies are managed surgically. However, if the risks of surgery are more than the predicted benefits, transcatheter embolization should be considered. As recurrent bleeding can be decreased by super-selective embolization of the feeding artery to the tumor with the use of permanent particle embolic agents. Transcatheter embolization has been reported in patients with endometrial cancers with high successful rates (Bandura et al., 2018). The aim of this study is to evaluate the role of UAE in different uterine myomas with follow up by MRI.

Materials and Methods

This prospective observational study was carried out on 40 females aged from 29 to 52 years with clinical criteria of symptomatic fibroid who weren't suitable or refuse the other modalities of treatment and underwent UAE. The study was done after approval from the Ethical Committee, Tanta University, Egypt. An informed written consent was obtained from the patients. Exclusion criteria were pregnancy, patients with uterine or adnexal infections, gynecological malignancy (Known cases or suspected), known history of hypersensitivity to contrast media, renal impairment, cardiac pacemaker, clipped aneurysm, or cochlear implant (Absolute contraindication of MRI), or severe bleeding tendency. All patients were subjected to full history taking, laboratory assessment (prothrombin time, INR, CBC, and renal function tests), radiological assessment (pre-procedure pelvic ultrasound examination, and pre-procedure pelvic MRI), interventional procedure, and post-procedure pelvic MRI. The US machine was (Aplio 500 Toshiba, Japan) and was equipped by 5-7 MHz convex and Endo cavitary probes.

Pre and post procedure pelvic MRI examination

MRI GE healthcare 1.5 Tesla in Tanta university hospital and Philips Achievia 1.5 Tesla in Mansoura university hospital. The patients were examined in supine position with headfirst using a standard body surface coil and were asked not to move during examination. Patients underwent Conventional MRI first followed by DCE- MRI. where post contrast gradient spine echo plane was obtained immediately after manually injected gadolinium at a dose of 0.1 mmol/kg of body weight (maximum, 20 mL), this was followed by injection of 20 mL of normal saline flushing the tube.

UAE technique

Before the procedure, non-steroidal anti-inflammatory drug was given intramuscular for pain reduction. The patient was positioned supine, and both groins were prepped with antiseptic solution. This was started by infiltration of local anesthesia around the femoral artery (10 ml lidocaine hydrochloride). Imaging guidance (angiography device) was done using Philips BV Pulsera angiography device in Mansoura university hospital and Toshiba infinix 8000 angiography

device machines in Tanta university hospital. The devices are equipped with serial radiography and digital capabilities. Contrast Media that is non-ionic contrast media [Iohexol 300-350 (Omnipaque®)] were used in all cases. Single (unilateral) right common femoral artery access using Seldenger technique was used in 29 patients while bilateral common femoral access was done in 11 patients. The technique always started by flush aortography using catheter to obtain lower aortic and pelvic mapping and to seek for collateral arterial routes, particularly in patients who have a highly enlarged fibroid uterus.

Then 4F Rim/ 5F cobra catheter was used to cross over the aortic bifurcation to reach the contra-lateral iliac vessels bilaterally which done in 11 patients. Then more advancement by catheter over a hydrophilic wire (0.035 guidewire) to reach the internal iliac artery. More selection to the anterior division where the origin of the uterine artery is selection of the contra lateral uterine artery which was always in line with the catheter using pelvic angiogram. When the catheter tip was seated in the transverse portion of the uterine artery, arteriography was done to ensure proper elective catheterization of the uterine artery which was defined by its corkscrew (spiral) appearance. Once it was confirmed further distal advance of the catheter is done trying to be beyond cervico-vaginal branches to start embolization. In three cases, this position was difficult to be reached by the previous catheters, so micro-catheter was used to go further beyond this position.

Embolization was started using polyvinyl alcohol or Tris-acryl microsphere particles, PVA was used in 32 patients, started with 355 to 500 μm particles for uterine bed arteries and then up size to 500 to 710 μm for main uterine artery. Tris-acryl was used in 8 patients with 500-700 μm particle size. In 29 patients, right common femoral artery access rout was done, the catheter reached to and embolized the left uterine artery, after completion of left UAE, the catheter withdrawal to the right common iliac artery was performed, then a catheter loop was obtained to direct the catheter to the right common iliac artery, then to the anterior division of the right internal iliac artery, then to the right uterine artery, embolization of the right uterine artery was done with the same technique. The endpoint of embolization in uterine fibroid, embolization was continued until there was completed occlusion of the branch arteries penetrating the leiomyoma up to the distal main uterine artery. Once the desired endpoint of embolization was achieved, waiting time of 5 minutes was given to allow any remaining embolic material to redistribute then a repeated angiography was performed to confirm adequate stasis. Proximal withdrawal of the catheter and internal iliac arteriogram was performed to verify completion of procedure. After procedure termination, all catheters, wires, and access sheath were withdrawn, and attention directed at groin hemostasis.

Statistical analysis

The collected data were coded, tabulated, and statistically analyzed using SPSS program (Statistical Package for Social Sciences) software version 25. Descriptive statistics were done for parametric quantitative data by mean, standard deviation, minimum and maximum of the while they were done for categorical data by number and percentage.

Results

Table 1 shows patient characteristics, complaints, embolic materials used, number and location of myomas of the studied patients. There was a significant decrease in the uterine volume post embolization in all patients (P value <0.001). Figure 1. There was a significant decrease in the uterine dominant myoma volume postembolization in study patients (P value <0.001). The degree of infarction ranged from 90 to 100% in four (44.44%) patients with single myoma and 18 (58.06%) patients with multiple myoma, from 70 to 90% in three (33.33%) patients with single myoma and seven (22.58%) patients with multiple myoma, from 50 to 70% in two (22.22%) patients with single myoma and four (12.9%) patients with multiple myoma, and it was <50% in two (6.45%) cases with multiple myoma and none in cases with single myoma. Table 2

Regarding treatment response, bleeding and anemia in patients who had improved were significantly higher than those who were unchanged/recurrent (P value <0.05) while pain and pelvic pressure were insignificantly different. Regarding complications, post embolization syndrome occurred in 10 patients (25%), only one patient (2.5%) had puncture site hematoma, two patients (5%) complained with pelvic infection and re-bleeding occurred in 5 (12.55%) patients. Table 3, Table 4= A 35-year-old female patient complaining from heavy uterine bleeding, anemia symptoms and pelvic pressure symptoms (Frequent micturition and pelvic heaviness sensation). Figure 2 A 43-year-old female patient complaining from attacks of bleeding associated with pelvic pain and pressure symptoms. Figure 3

Discussions

Regarding the location of dominant myomas, our results were in line with study of Manyonda et al.,(I. Manyonda et al., 2020) 58% of the UAE group were interstitial, 24% were subserosal, and 5% were submucosal. In the current study, there was a significant decrease in the uterine volume and uterine dominant myoma volume post embolization in study patients. This was consistent with a study by Czuczwar et al.,(Czuczwar et al., 2014) which included 65 premenopausal patients with symptomatic fibroids to investigate the correlation between the peri-interventional intramural fibroid volume and imaging outcome of UAE. They showed a significance reduction of dominant fibroid volume three months after UAE. Parallel to our results, a study by Sipola et al.,(Sipola et al., 2010) which included 52 women with leiomyoma underwent selective UAEs to investigate the relationship between MRI measures, uterus and leiomyoma size reductions after UAE. They reported a $44\% \pm 31$ reduction in uterine volume. However, it had to be noted that there also is a great variability in fibroid volume reduction after UAE as other fibroids have increased in size by even 43%. Such variability may result from the presence of additional factors influencing UAE outcome. In this study, the degree of infarction ranged from 90 to 100% in 4 (44.44%) patients with single myoma and 18 (58.06%) patients with multiple myoma, from 70 to 90% in 3 (33.33%) patients with single myoma and 7 (22.58%) patients with multiple myoma, from 50 to 70% in 2 (22.22%) patient with single myoma and 4 (12.9%) patients with multiple myoma, and it was <50% in 2 (6.45%) cases with multiple myoma and none in cases with single myoma.

In this study, polyvinyl alcohol (PVA) was used in 32 (80%) of study patients and Tris-acryl gelatin microspheres in 8 (20%) of study patients. PVA was used with particle size: 355-500 μm and 500-710 μm , while TAG 500-700 μm . PVA was used more than Tris acryl gelatin microspheres due to its high cost, this was in accordance with a randomized, prospective study by Shlansky-Goldberg et al.(Shlansky-Goldberg et al., 2014), that compared between PVA and microspheres each was used in 30 patients as embolizing materials. He used TAG microspheres (500–700 μm). However, they reported the use of PVA with particle sizes of 700–900 μm and 900–1,200 μm .

In this study, post embolization syndrome occurred in 10 (25%) of study patients, bleeding recurrence occurred in 5 (12.55%) of patients, pelvic infection occurred in 2 (5%) patients and puncture site hematoma occurred in only 1 (2.5%) patient, this was relatively in compatible with study by Manyonda et al.(Manyonda et al., 2012), as minor complications were reported in nine women (13.2%) which were usually related to post embolization syndrome, including pyrexia, pain, and increased analgesia requirement as well as UTI . However, in a Manyonda et al.(Isaac Manyonda et al., 2020), study, they revealed that post embolization syndrome occurred in 3% of patients, and infection in 14% of patients.

The position of uterine fibroids in the uterine wall is clearly a predictor of complication after UAE. Patients with submucosal fibroids treated with UAE are thought to be at an increased risk for the vaginal passage of necrotic tissue, which can result in significant pain, bleeding, infection, and vaginal discharge for prolonged periods of time (Vilos, Allaire, Laberge, & Leyland, 2015). Regarding the treatment response of patients included in this study, bleeding has improved in 25 patients (75.75%) but was unchanged/recurrent in 8 patients (24.24%) cases, anemia has improved in 17 patients (77.27%) but was unchanged in 5 patients (22.72%), pain has improved in 11 patients (64.70%) but was recurrent in 6 patients (35.29%) case, and pelvic pressure symptoms has improved in 9 patients (60%) but was unchanged in 6 patients (40%).

Limitations

This was an observational study with small sample size. Therefore, further sample size is recommended to validate our results.

Conclusion

Pre and post procedural MRI allow precise assessment of patients undergoing UAE. It may significantly alter the initial diagnosis and treatment approach. MRI may help identify subjects who will benefit most from the surgery and those who, owing to leiomyoma size and location and/or the presence of coexisting uterine and pelvic disease, should have an alternate therapy. In patients with leiomyoma, MRI is the preferred diagnosis approach and if it is not done before UAE, patients may get improper therapy.

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