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RESEARCH ARTICLE

USE OF ULTRASOUND TRANSMISSION GEL TO SHIELD THE SACRUM IN PATIENTS WHO UNDERWENT MAGNETIC RESONANCE-GUIDED FOCUS ULTRASOUND SURGERY (MRgFUS) FOR UTERINE FIBROIDS

***Sara Mascaretti, Francesco Arrigoni, Carlo Masciocchi, Giulio Mascaretti and Eva Fascetti**

Department of Biotechnological and Applied Clinical Sciences, University of L'Aquila, Italy

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ABSTRACT

Background: Patients who are eligible candidates for the MRgFUS treatment for single and multiple uterine fibroids have been included thanks to the use of the shielding gel, that protects the sacrum from the heat produced by ultrasounds and it creates a bigger distance between the uterus and the last section of the sacrum.
Methods: From October 2011 to June 2016, 60 patients aged between 23 and 53 suffering from single and multiple uterine fibroids sized between 1.5 and 14 cm underwent MRgFUS treatment without any inconvenience on the spinal nerves roots and bone thanks to the use of the intrarectal gel.
Results: 60 patients have been treated with MRgFUS. 10% of it showed an excessive proximity to the sacrum that wouldn't allow them to underwent the treatment and 6.5% of them showed a distance between skin and fibroids of more than 14 cm. Thanks to the intrarectal gel, these exclusion criteria have been overtaken and solved.
Conclusions: This method allows an almost complete access to the MRgFUS treatment in those cases where the excessive proximity of the fibrotic growth to the vertebral column would have caused the exclusion from the protocol. Furthermore, no damage to the surrounding structures have been observed.

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INTRODUCTION

Uterine fibroids are benign growths of the uterus. They can be single or multiple, submucosal, subserosal, intramural, depending on the section of the uterus interested and they have a morbidity of 30% in women after 40 (Parker WH. Etiology, 2007; Stewart *et al*., 2016). They are symptomatic in 25% of women, with severe effects on the quality of life and on the uterine functionality. Symptoms can be metrorrhagia, increasing anemia, pelvic pain, dyspareunia, pelvic pressure feeling, infertility, risk of premature delivery or abortion (Doğan *et al*., 2016). The existing surgery therapies are represented by a radical surgery approach (Hysterectomia) or by non radical approaches that allow to preserve the organ (Myomectomy): both treatment can be, when possible, carried out in laparotomy, laparoscopy or hysteroscopy. In all these cases, patients undergo a surgical treatment, with all its annexes risks and contraindications (Bhandari *et al*., 2016; Alessandri *et al*., 2006). Non surgical alternatives are represented by GnRH agonist therapy (Olejek *et al*., 2016), ulipristal acetate therapy (Maratea, 2016), Uterine artery embolization (UAE) (De Bruijn *et al*., 2016; Domenico L Jr and Siskin, 2006) and Magnetic Resonance-Guided Focus Ultrasound Surgery (MRgFUS) (Ferrari *et al*., 2015). The last is a valid alternative since it allows the preservation of the organ and the preservation of fertility (Mascaretti *et al*., 2016; Morita *et al*., 2007; Hanstede *et al*., 2007), it doesn't imply any surgical scar, it only requires a day surgery (24 h) hospitalization, it has a 48 hours prognosis. The use of the gel allowed the inclusion of an extra 16.5% patients in the treatment, who otherwise should have undergo other more invasive or non decisive treatments.

****Corresponding author: Sara Mascaretti,***
Department of Biotechnological and Applied Clinical Sciences, University of L'Aquila, Italy.

MATERIALS AND METHODS

From October 2011 to June 2016, 60 patients aged between 23 and 53 suffering from single and multiple uterine fibroids were hospitalized in the operating unit of Gynecology and Obstetrics

of L'Aquila, and were treated in the Radiology Department of the San Salvatore Hospital of L'Aquila. Patients have been attentively evaluated by gynecologists in order to outline an anamnestic gynecological frame. They have later undergone magnetic resonance in order to examine in a more defined way the anatomic topography of their pelvis. Patients are included or excluded from the treatment according to specific inclusion and exclusion criteria (Gavrilova-Jordan *et al*., 2007). Right before the MRgFUS treatment begins, the ultrasound transmission gel is inserted by means of a rectal probe and a probe cover, in order to contain the gel without any dispersion in the intestinal cavity. The gel is water soluble, hypoallergenic, salt free, it does not contain abrasive or corrosive materials, and is acoustically suitable to all frequencies used. The exploration of the rectum before the application of the gel is carried out by a gynecologist. This practice allows to "build" a continuous barrier for the dispersion of the heat produced during the sonication. The procedure does not imply any contraindication, it doesn't produce any inconvenience and it is easily beared by patients.

RESULTS

After a careful selection of the patients, 60 out of 180 underwent the Magnetic Resonance-guided Focus Ultrasound Surgery (MRgFUS) for uterine fibroids (Tempany *et al*., 2003). The ultrasound transmission gel has been introduced through a rectal probe in all the patients before the treatment, in order to protect the sacrum and the spinal nerves roots that could be damaged by the beam of heat. Temperature during all the treatment are monitored by a control panel with proton resonance frequency (PRF) system. Thanks to this kind of protection, measured temperatures don't exceed 35° C. No bone or spinal nerves root damages have been reported in our sample of patients. According to inclusion and exclusion criteria, patients who show a distance between the skin and the fibroid larger than 14 cm or patients whose fibroid is too close to the sacrum can't be included in the treatment. These measurements are conducted in the preliminary evaluation by MRI. During the evaluation before the treatment, 6 (10%) of the patients were excluded. The proximity of the fibroid and the last section of the column was at the limit. The ultrasound transmission gel positioning into the rectum created a convenient distance between the structures, so that they were allowed to undergo the MRgFUS treatment. The use of this shield conduced to a 10% increase of the patients who could bear the focused ultrasound treatment, when the proximity between the fibroid and the last section of the column would have lead to an exclusion. Furthermore, 4 patients (6,5 %) who presented an excessive distance between the skin and the fibroids and who were thus excluded from the treatment, have been admitted to the treatment thanks to the technique of the sigma rectum filling, since the thickness produced between the sacrum and the fibroid relocated the uterus and its fibroid, reducing the distance and allowing the treatment.

DISCUSSION

In our operating unit, 60 patients have been treated with MRgFUS instead of traditional surgery. This practice represents a valid option for patients affected by single and multiple uterine fibroids. Both patients with and without symptoms have been treated, and most of them experienced an immediate improvement in their health conditions. During the treatment temperatures from 65°C to 85 °C can be reached inside the fibroid, thus producing a coagulative necrosis. Temperatures are constantly monitored through a proton resonance frequency (PRF) system. The insertion of the ultrasound transmission gel in the last section of the sacrum, that could be an indirect target of the heat generated by the ultrasound beam, the sacrum is shielded and protected thus avoiding possible inconvenience for the bone and the spinal nerves roots. The gel is positioned by means of a rectal probe, it doesn't imply any inconvenience and is easily tolerated by patients. This procedure is carried out by the gynecologist. The gel is removed after treatment. Thanks to this method, 10 patients who had been previously excluded because of the excessive proximity between the fibroid and the last section of the sacrum could be included and underwent the treatment. The ultrasound gel positioning created a distance that allowed the MRgFUS treatment without contraindications. These patients thus escaped a traditional surgery intervention.

Conclusion

The insertion of the ultrasound transmission gel by means of a rectal probe produces several advantages in the patients who underwent MRgFUS treatment. It represents a shield from the heat produced by ultrasounds, thus preserving both bones and nerves structures, and it permitted to increase of 16.5% the number of patients that could be included in the MRgFUS treatment.

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