**Title:**

**The Impact on Anti-Mullerian Hormone (AMH), Uterine Fibroid size and Uterine Artery patency following Uterine fibroid Embolization (UFE) with a Resorbable Embolic Agent**

Running title: The impact on AMH, Uterine Fibroid size and Uterine Artery…

Authors:

Hacking N1, Vigneswaran G1, Maclean D1, Bryant T1, Umranikar S2, Cheong Y3,4 and Modi S1

1. Department of Interventional Radiology, University Hospital Southampton, Tremona Road, Southampton, SO16 7AX, UK
2. Department of Obstetrics and Gynaecology, University Hospital Southampton, SO16 7AX, UK
3. Human Development and Health Faculty of Medicine, University of Southampton, SO17 1BJ, UK
4. Complete Fertility Southampton, Princess Anne Hospital, Coxford Road, Southampton, SO16 5YA, UK

Corresponding author: Dr Ganesh Vigneswaran

g.vigneswaran@nhs.net

**Abstract**

Background: The effect of Uterine Fibroid Embolization on fertility and ovarian reserve
remains uncertain. We assessed the impact of a new resorbable, spherical particle (Gelbead) on concentration of Anti-Mullerian (AMH) hormone, fibroid volume and uterine artery patency

Design: This prospective cohort study recruited consecutive patients from July 2017 to June
2018. Serum AMH, fibroid and uterine volume, UFS-QOL (uterine fibroid score -quality of
life) scores were measured prior to and at 1 month and/or 3 months post embolization

Results: Twenty-four participants were enrolled (median age 44 years, uterine volume 484
cm3, initial dominant fibroid volume 167 cm3). One patient was lost to follow-up. AMH
(median +/- s.d.) immediately prior to embolization was 3.2 +/- 13.7 pmol/L. At 1-month postembolization, AMH was 4.1 +/- 8.6 pmol/L and at 3 months 4.4 +/- 8.6 pmol/L. We found no significant difference in AMH levels between baseline and at 1 month (p=0.58) or baseline and 3 months (p=0.17). The median dominant uterine fibroid volume decreased (167 cm3 to 64 cm3, p<0.001). At 3 months post-embolization, 17/23 patients had patent uterine arteries bilaterally (73.9%).

Conclusion: UFE with Gel-bead did not significantly affect AMH at 3 months post embolization, whilst maintaining a high rate of uterine artery patency.

**Keywords:**

Fibroid, Embolization, Fertility, Resorbable, Uterine

**Introduction**

Uterine Fibroid Embolization (UFE) has become a popular treatment modality for the management of symptomatic uterine fibroids [(Gupta et al., 2014)](https://paperpile.com/c/lsD6Kv/1RBD). It is currently a complimentary form of treatment alongside surgical options such as hysterectomy and myomectomy [(Chodankar & Allison, 2018)](https://paperpile.com/c/lsD6Kv/g6ioN). The non-invasive nature of UFE is potentially appealing to a young patient population and those who do not favour surgery [(Athreya & Moss, 2010)](https://paperpile.com/c/lsD6Kv/PhdrT). However, the former patient population are also likely to have current or future fertility aspirations [(Mailli et al., 2015)](https://paperpile.com/c/lsD6Kv/UwIzv) and therefore the fertility implications of UFE must be rigorously assessed. In addition, regarding the latter patient population, whilst they may not have concerns over the preservation of fertility, preserving their ovarian reserve could be considered crucial in order not to perturb the timing of natural menopause [(Depmann et al., 2018)](https://paperpile.com/c/lsD6Kv/G6iJ)

The long-term implications of UFE are not well understood and there is speculation regarding the detrimental effect of UFE on fertility ([Karlsen et al. 2018; Gupta et al. 2014; Chrisman et al. 2000)](https://paperpile.com/c/pUW7WY/QlQy%2Bf5fc%2B2DUz). Theoretically, there are two main potential methods through which UFE could adversely impact on fertility. Firstly, there is the potential risk of non-target embolization (particles reaching the ovarian vessels) leading to ischaemia of the ovarian cortex, causing reduction in Anti Mullerian Hormone (AMH) secreting antral and pre-antral follicles [(Broekmans et al., 2008; Hascalik et al., 2004)](https://paperpile.com/c/lsD6Kv/n0iGM%2BHTMen). Whilst indirect measures of ovarian reserve such as FSH, oestradiol and ovarian volume do not show a significant effect post embolization[(Broer et al., 2014)](https://paperpile.com/c/lsD6Kv/JF7j8), there have been conflicting data on the impact of UFE on ovarian reserve biomarkers such as AMH[(McLucas et al., 2016)](https://paperpile.com/c/lsD6Kv/oojIf). Secondly, there is a potential detrimental impact of UFE on fertility secondary to the occlusion of the uterine artery. Surgical occlusion of the uterine artery or endovascular embolization of the artery has been associated with a lower rate of live births [(Goldberg et al., 2004; Holub, 2008; Holub et al., 2008)](https://paperpile.com/c/lsD6Kv/IUcY1%2B2V9q5%2BECNL4). Therefore, if patency of the uterine artery can be maintained post-embolization, this bears a theoretical fertility benefit. However, no studies have directly examined if differential uterine artery patency rates post-embolization have resulted in a differential live birth rate.

The main alternative for a patient opting for fibroid treatment but with future fertility wishes is to undergo a partial myomectomy [(Chodankar & Allison, 2018)](https://paperpile.com/c/lsD6Kv/g6ioN). However, patients electing for this uterine-sparing surgery have also been shown to have a reduced fertility rate compared with the normal population [(Gupta et al., 2014; McLucas et al., 2016)](https://paperpile.com/c/lsD6Kv/1RBD%2BoojIf) and a recent Cochrane review concluded that ‘there is very low level evidence suggesting that myomectomy may be associated with better fertility outcomes than UAE, but more research is needed’ [(Gupta et al., 2014)](https://paperpile.com/c/lsD6Kv/1RBD). Conservative therapy is an alternative management strategy that should be discussed with patients. However, uterine fibroids in themselves are associated with a lower fertility rate [(Donnez & Dolmans, 2016)](https://paperpile.com/c/lsD6Kv/p3ZoG). In fact, infertility is in fact not an infrequent presentation of a patient with uterine fibroids [(Carranza-Mamane et al., 2015)](https://paperpile.com/c/lsD6Kv/9w092).

AMH is strongly associated with a woman’s ovarian reserve [(Fleming et al., 2013; Weenen et al., 2004)](https://paperpile.com/c/lsD6Kv/mjIAD%2BUq6Wk) and is a key component of fertility assessment prior to controlled ovarian stimulation [(Hehenkamp et al., 2007)](https://paperpile.com/c/lsD6Kv/qAVJZ). AMH level rises after birth and peaks at approximately 20-25 years and then decreases with age when it becomes undetectable following menopause[(La Marca et al., 2013)](https://paperpile.com/c/lsD6Kv/S7CDm). Additionally, AMH has good inter-cycle consistency, making it a useful test on ovarian reserve [(Hehenkamp et al., 2006; Iliodromiti et al., 2014; La Marca et al., 2013; Tsepelidis et al., 2007)](https://paperpile.com/c/lsD6Kv/jSfn6%2BDpIGq%2BS7CDm%2B6FkLU). Embolic material reaching and affecting the ovaries could theoretically yield a decrease in the ovarian reserve and subsequent decrease in AMH.

Several small studies have examined the impact of fibroid embolization with other embolic agents on AMH levels.  Indeed, one study [(Hehenkamp et al., 2006)](https://paperpile.com/c/lsD6Kv/jSfn6) found that AMH was negatively affected post embolization.  However, larger studies including both non-randomised [(McLucas et al., 2018)](https://paperpile.com/c/lsD6Kv/T9pzM) and case-control [(Tsikouras et al., 2017)](https://paperpile.com/c/lsD6Kv/PpNRt) study designs have demonstrated no significant difference in AMH post embolization at 6 and 12 months respectively. More recently a single centre study that assessed AMH pre and post embolization reported a non-statistically significant decrease in AMH 2 weeks post UFE. They also found no significant difference in AMH between baseline and at 12 months [(Muteshi et al., 2018)](https://paperpile.com/c/lsD6Kv/3INXm). This may reflect a trend towards modern embolization techniques advocating a more selective approach.

Traditionally, intentional microvascular obstruction in Fibroid Embolization is caused by variations of tiny particles manufactured from a permanent, plastic-based material which does not degrade and stays in the patient permanently [(Gupta et al., 2014)](https://paperpile.com/c/lsD6Kv/1RBD). Gel-bead (Teleflex, Minnesota, USA) is a new, calibrated spherical embolic agent licenced for embolization of hypervascular tumours resorbs fully after around 6 weeks when target ischaemia of the fibroid has been achieved. The effect on ovarian reserve for this particular agent has yet to be assessed, but the resorbable nature of the particle theoretically could confer a fertility benefit by minimising ischaemia to the ovaries. Furthermore, as a resorbable agent, Gel-bead has the potential added benefit of enabling a higher chance of uterine artery patency post-embolization. We aimed to assess the impact of Gel-bead on concentration of Anti-Mullerian (AMH) hormone, the uterine fibroid volume and uterine artery patency pre and post embolization.

**Materials and Methods**

This was a prospective longitudinal cohort study where women opting for Uterine Fibroid Embolization (UFE) as their treatment for symptomatic fibroids from 25th July 2017 and 26th June 2018 and met the inclusion and exclusion criteria were invited to participate. We have previously published some outcome findings using this patient cohort [(Hacking *et al.*, 2020)](https://paperpile.com/c/lsD6Kv/8KAZ).

The inclusion criteria were:

●    Females aged over 18 years old

●    Symptomatic fibroids requiring treatment

●    Favourable factors for embolization

●    Patients able to provide written, informed consent

●   Patients must be willing to comply to the study assessments and follow-up requirements

The exclusion criteria were:

●    Known hypersensitivity to porcine products

●    Vascular anatomy precluding embolization

●    Presence of collateral vessels which would risk non-target embolization

**Prior to Embolization**

The recruited patients completed an initial Uterine Fibroid Symptoms Score and Quality of Life questionnaire (UFS-SS and UFS-QOL). The UFS-SS/UFS-QOL questionnaire is a validated commonly used assessment for symptom severity and quality of life. It includes a variety of domains covering symptom severity and health-related quality of life items [(Spies et al., 2002)](https://paperpile.com/c/lsD6Kv/FX09).

In addition,  baseline AMH was measured. The platform was DXI Beckman Coulter, the assay was UniCel Dxl 800 and was measured in pmol/L.  MRI was performed pre-embolization (Siemens 1.5T Aera or 3T Skyra) with axial and sagittal T2, fat-saturated T1 pre-contrast and post-contrast with a volume MR contrast angiogram acquisition sequences.

**Embolization technique**

One of three experienced interventional radiologists performed all the UFE procedures. Common procedural steps include the following stages. A right femoral arterial puncture was performed with ultrasound. A 4Fr sheath and 4 Fr catheter were advanced into the contralateral uterine artery. 100 mcg GTN was introduced to reduce arterial spasm. Injection of 700-1000 micron particles of Gel-bead to complete stasis within the second and third order vessels supplying the fibroid. A micro-catheter was required in 7 of 23 cases due to vessel spasm or tortuosity (0.027 inch Progreat Terumo Corp, Japan). In these cases, Gel-bead 500-700 micron size was used. Intra-arterial 1% Lidocaine at 1 mg/Kg was administered through the arterial catheter for analgesia. Two patients required supplementary antegrade ovarian artery embolization due to a large ovarian artery identified on pre procedural MRA. Both patients were counselled and consented for this additional procedure.

**Follow-up protocol**

All patients were discharged the following day. At 24 hours post-procedure, the patients completed the visual analogue scale (VAS) as a pain score marked out of ten. At 1-month and 3-month post-procedure, AMH was repeated. In addition, ultrasound assessed fibroid vascularity and fibroid and uterine volumes. At 3-months post-procedure, MRI/ MRA was performed (same protocol as baseline scan) to establish the patency of the uterine artery.

UFS-SS/UFS-QOL questionnaire was repeated at the follow up visit with the Interventional radiologist at 3 months post embolization.

**Statistical Analysis**

The required sample size was calculated to achieve a power of 80% for detecting an effect size of 0.8 with a two-sided level of significance of 5%. We calculated that a minimum of 16 paired assessments were required.

Pre-embolization and post-embolization data were assessed with a paired Wilcoxon Signed-rank test. A significance level of 0.05 was used. Box and whisker plots were used for graphical analysis of AMH and dominant fibroid volume with the median, 25th and 75th centile plotted. The whiskers extend to the most extreme data points that are not considered outliers. Outliers were defined as 75th centile + maximum whisker × (75th centile – 25th centile) or less than 25th centile – whisker length × (75th centile – 25th centile).

Pearson’s correlation was carried out to determine correlation of AMH with patient age as a test of principle.  All statistical tests were performed using Matlab.

**Ethical and MHRA approval**

This study was approved by the UK South Central Research Ethics Committee (Study reference: IRAS 222138) with national regulatory approval from the relevant device authority. Adherence to the medical principles of Helsinki was maintained.

**Results**

Twenty-four participants were enrolled (median age, 44 years (range 23-57)), median BMI of 24.8, median uterine volume 484 cm3, dominant fibroid volume 167 cm3)). One patient was lost to follow-up (became pregnant before the end of the study period). All patients (23/23) had multiple fibroids. The dominant fibroid mural position was most frequently intramural (7/23) or subserosal (7/23). Most frequently this was in an anterior location (8/23) (Table 1).

**AMH**

Baseline median AMH +/- s.d. was 3.2 +/- 13.7 pmol/L. At 1 month, the median AMH was 4.1 +/- 8.6 pmol/L and at 3 months 4.4 pmol/L +/- 8.6 (Table 2). There was no significant difference in AMH levels between baseline and at 1 month (p=0.58), baseline and 3 months (p=0.17) or between 1- and 3-months post UFE (p=0.73), see Figure 1A.

As expected, there was a negative correlation between age and AMH at baseline (R2=-0.39, p=0.065) and this was significant at 3 months (R2=-0.5, p=0.01) (Pearson’s correlation).

**Uterine Volume and Dominant Fibroid Volume**

The median dominant fibroid Volume reduced post-embolization from 167 cm3 to 64 cm3 at 3 months (p<0.001, Figure 1B) and the median uterine volume reduced from median 484 cm3 to 246 cm3 (p<0.001)).

**Uterine Artery Patency**

Prior to embolization, all recruited patients had patent uterine arteries bilaterally. At 3 months post-embolization, 17 out of 23 patients had patent uterine arteries bilaterally (73.9%). Four out of 23 patients had unilateral uterine artery patency (17.4%) and two out of 23 patients had no uterine arteries patent  (8.7%) (see Figure 1C).

**Percentage Fibroid Infarct**

Complete infarction (100%) of the dominant fibroid was seen in 21 out of 23 patients. Two out of 23 patients had 90-99% infarction, with no patients having <90% infarction.

**UFS-SS, UFS-QOL and pain score**

Quality of life and pain score for this patient cohort has previously been reported [(Hacking et al., 2020)](https://paperpile.com/c/lsD6Kv/8KAZ). In summary, the median pain score at 24h post-embolization was 7 +/- 2.1. The validated symptom questionnaire (UFS-SS) improved from median 56 +/- 21.9 at baseline to 19 +/- 13 at 3 months (p<0.001). The quality of life assessment (UFS-QOL) also improved from baseline median 40 +/- 23.1 to 88 +/- 18.1 at 3 months , p<0.001 (Table 2).

 **Discussion**

In this study, we assessed longitudinally the levels of AMH before and after UFE using a new embolic Gel-bead in a cohort of women undergoing UFE for treatment of their fibroids. We found that AMH concentration did not significantly alter between pre and post embolization at 1 and 3 months.

Our results are consistent with previous studies in demonstrating stable AMH concentrations, although Muteshi et al,. found that AMH had an initial decrease at 2 weeks post procedure with subsequent rise at 6 months. In our study, we sampled AMH at 1 month post procedure and AMH was already above baseline [(Muteshi et al., 2018)](https://paperpile.com/c/lsD6Kv/3INXm) .

We further demonstrated a high percentage of uterine artery patency post-embolization with Gel-bead . A recent study with another resorbable substance, Gelfoam (Pfizer, New York, USA) showed 100% uterine artery patency, but had fewer patient numbers and lower rates of complete dominant fibroid infarction [(Yadavali et al., 2019)](https://paperpile.com/c/lsD6Kv/S0MfX). In addition, our study showed higher uterine artery patency rates compared with older non resorbable embolics such as polyvinyl alcohol where bilateral patency rates were seen in 64% of patients at 6 months post embolization [(Das et al., 2013)](https://paperpile.com/c/lsD6Kv/cu1i).

This implies that the use of Gel-bead gel bead for those undergoing UFE may be a good option to preserve short term ovarian reserve, although studies with longer term follow up time frame would be useful.

The proposed theory by which UFE can affect ovarian reserve is through non-target embolization and ischaemia to the ovarian cortex. This results in apoptosis of antral and pre-antral follicles that normally secrete AMH [(Hascalik et al., 2004)](https://paperpile.com/c/lsD6Kv/HTMen). Indeed, in cases where there has been proven utero-ovarian anastomosis, embolic particles have been identified within ovarian biopsy specimens [(Payne et al., 2002)](https://paperpile.com/c/lsD6Kv/Rw7en). Hence, a resorbable agent could theoretically limit the negative impact of ischaemia on the ovaries.

The good level of uterine artery patency demonstrated at 3 months post UFE may have important fertility implications and possibly preserving the ovarian reserve sufficiently not to perturb the timing of the onset of natural menopause [(Goldberg et al., 2004; Holub, 2008; Holub et al., 2008)](https://paperpile.com/c/lsD6Kv/IUcY1%2B2V9q5%2BECNL4). Perhaps this resorbable agent, Gel-bead may impact fertility to a lesser extent than other particles; however larger comparative studies are required to further examine the pertinent outcomes of live birth rates and the longer term onset of menopause between different embolic particles.

The limitations of this study were its longitudinal design, although, such a design has advantages, there is an absence of a comparative arm, where a head to head comparison could be made with other embolic particles. Also, the patients included in this study were mostly older, arguably with already lowered ovarian reserve. Other clinical outcomes such as live birth rates or age of onset of menopause should be examined in future studies. In addition, exclusion of patients with vascular collaterals ensured that it was less likely that ovarian blood supply was compromised and therefore a lack of significant AMH level cannot be completely ascribed to the embolic agent used in this study and is likely to be multifactorial. Therefore, the conclusions drawn from this study must be interpreted with caution. Studies with a longer term follow up with the relevant clinical outcomes is now needed.

**Conclusion**

In this prospective longitudinal cohort study, the use of gel-bead based UFE on patients undergoing UFE did not significantly alter the pre and post 1 and 3 month AMH concentrations. The uterine arteries were unilaterally or bilaterally patent in the majority of patients at 3 months post procedure.  However, the conclusions drawn from this study must be interpreted with caution, and larger studies with a longer term follow up with relevant clinical outcomes are now needed.

**Acknowledgements:**

**Declaration of Interest:**

This study was fully funded by a grant from Teleflex who produce Gelbead. Nigel Hacking has received honoraria from Boston Scientific and Celonova as a speaker and has been on Advisory boards for BTG. Tim Bryant has proctored for Boston Scientific and Terumo and has received speaker honorariums from Boston Scientific. Sachin Modi has received a speaker honorarium from Boston Scientific. The authors declare no conflict of interest.

**Reference List**

[Athreya, S., & Moss, J. G. (2010). Uterine Fibroid Embolization. In *Transcatheter Embolization and Therapy* (pp. 231–239). https://doi.org/](http://paperpile.com/b/lsD6Kv/PhdrT)[10.1007/978-1-84800-897-7\_24](http://dx.doi.org/10.1007/978-1-84800-897-7_24)

[Broekmans, F. J., Visser, J. A., Laven, J. S. E., Broer, S. L., Themmen, A. P. N., & Fauser, B. C. (2008). Anti-Müllerian hormone and ovarian dysfunction. In *Trends in Endocrinology & Metabolism* (Vol. 19, Issue 9, pp. 340–347). https://doi.org/](http://paperpile.com/b/lsD6Kv/n0iGM)[10.1016/j.tem.2008.08.002](http://dx.doi.org/10.1016/j.tem.2008.08.002)

[Broer, S. L., Broekmans, F. J. M., Laven, J. S. E., & Fauser, B. C. J. M. (2014). Anti-Müllerian hormone: ovarian reserve testing and its potential clinical implications. *Human Reproduction Update*, *20*(5), 688–701.](http://paperpile.com/b/lsD6Kv/JF7j8)

[Carranza-Mamane, B., Havelock, J., Hemmings, R., REPRODUCTIVE ENDOCRINOLOGY AND INFERTILITY COMMITTEE, & SPECIAL CONTRIBUTOR. (2015). The management of uterine fibroids in women with otherwise unexplained infertility. *Journal of Obstetrics and Gynaecology Canada: JOGC = Journal D’obstetrique et Gynecologie Du Canada: JOGC*, *37*(3), 277–285.](http://paperpile.com/b/lsD6Kv/9w092)

[Chodankar, R., & Allison, J. (2018). New Horizons in Fibroid Management. In *Current Obstetrics and Gynecology Reports* (Vol. 7, Issue 2, pp. 106–115). https://doi.org/](http://paperpile.com/b/lsD6Kv/g6ioN)[10.1007/s13669-018-0242-6](http://dx.doi.org/10.1007/s13669-018-0242-6)

[Chrisman, H. B., M. B. Saker, R. K. Ryu, A. A. Nemcek Jr, M. V. Gerbie, M. P. Milad, S. J. Smith, L. E. Sewall, R. A. Omary, and R. L. Vogelzang. 2000. “The Impact of Uterine Fibroid Embolization on Resumption of Menses and Ovarian Function.” *Journal of Vascular and Interventional Radiology: JVIR* 11 (6): 699–703.](http://paperpile.com/b/pUW7WY/2DUz)

[Das, R., Gonsalves, M., Vlahos, I., Manyonda, I., & Belli, A.-M. (2013). MRI assessment of uterine artery patency and fibroid infarction rates 6 months after uterine artery embolization with nonspherical polyvinyl alcohol. *Cardiovascular and Interventional Radiology*, *36*(5), 1280–1287.](http://paperpile.com/b/lsD6Kv/cu1i)

[Depmann, M., Eijkemans, M. J. C., Broer, S. L., Tehrani, F. R., Solaymani-Dodaran, M., Azizi, F., Lambalk, C. B., Randolph, J. F., Jr, Harlow, S. D., Freeman, E. W., Sammel, M. D., Verschuren, W. M. M., van der Schouw, Y. T., Mol, B. W., & Broekmans, F. J. M. (2018). Does AMH relate to timing of menopause? Results of an Individual Patient Data meta- analysis. *The Journal of Clinical Endocrinology and Metabolism*. https://doi.org/](http://paperpile.com/b/lsD6Kv/G6iJ)[10.1210/jc.2018-00724](http://dx.doi.org/10.1210/jc.2018-00724)

[Donnez, J., & Dolmans, M.-M. (2016). Uterine fibroid management: from the present to the future. *Human Reproduction Update*, *22*(6), 665–686.](http://paperpile.com/b/lsD6Kv/p3ZoG)

[Fleming, R., Fairbairn, C., Blaney, C., Lucas, D., & Gaudoin, M. (2013). Stability of AMH measurement in blood and avoidance of proteolytic changes. *Reproductive Biomedicine Online*, *26*(2), 130–132.](http://paperpile.com/b/lsD6Kv/mjIAD)

[Goldberg, J., Pereira, L., Berghella, V., Diamond, J., Daraï, E., Seinera, P., & Seracchioli, R. (2004). Pregnancy outcomes after treatment for fibromyomata: uterine artery embolization versus laparoscopic myomectomy. *American Journal of Obstetrics and Gynecology*, *191*(1), 18–21.](http://paperpile.com/b/lsD6Kv/IUcY1)

[Gupta, J. K., Sinha, A., Lumsden, M. A., & Hickey, M. (2014). Uterine artery embolization for symptomatic uterine fibroids. *Cochrane Database of Systematic Reviews* , *12*, CD005073.](http://paperpile.com/b/lsD6Kv/1RBD)

[Hacking, N., Maclean, D., Vigneswaran, G., Bryant, T., & Modi, S. (2020). Uterine Fibroid Embolization (UFE) with Optisphere: A Prospective Study of a New, Spherical, Resorbable Embolic Agent. *Cardiovascular and Interventional Radiology*, *43*(6), 897–903.](http://paperpile.com/b/lsD6Kv/8KAZ)

[Hascalik, S., Celik, O., Sarac, K., & Hascalik, M. (2004). Transient ovarian failure: a rare complication of uterine fibroid embolization. *Acta Obstetricia et Gynecologica Scandinavica*, *83*(7), 682–685.](http://paperpile.com/b/lsD6Kv/HTMen)

[Hehenkamp, W. J. K., Looman, C. W. N., Themmen, A. P. N., de Jong, F. H., te Velde, E. R., & Broekmans, F. J. M. (2006). Anti-Müllerian Hormone Levels in the Spontaneous Menstrual Cycle Do Not Show Substantial Fluctuation. In *The Journal of Clinical Endocrinology & Metabolism* (Vol. 91, Issue 10, pp. 4057–4063). https://doi.org/](http://paperpile.com/b/lsD6Kv/jSfn6)[10.1210/jc.2006-0331](http://dx.doi.org/10.1210/jc.2006-0331)

[Hehenkamp, W. J. K., Volkers, N. A., Broekmans, F. J. M., de Jong, F. H., Themmen, A. P. N., Birnie, E., Reekers, J. A., & Ankum, W. M. (2007). Loss of ovarian reserve after uterine artery embolization: a randomized comparison with hysterectomy. *Human Reproduction* , *22*(7), 1996–2005.](http://paperpile.com/b/lsD6Kv/qAVJZ)

[Holub, Z. (2008). Clinical experience and fertility outcome after uterine artery occlusion and embolization. In *Gynecological Surgery* (Vol. 5, Issue 1, pp. 7–14). https://doi.org/](http://paperpile.com/b/lsD6Kv/2V9q5)[10.1007/s10397-007-0318-1](http://dx.doi.org/10.1007/s10397-007-0318-1)

[Holub, Z., Mara, M., Kuzel, D., Jabor, A., Maskova, J., & Eim, J. (2008). Pregnancy outcomes after uterine artery occlusion: prospective multicentric study. In *Fertility and Sterility* (Vol. 90, Issue 5, pp. 1886–1891). https://doi.org/](http://paperpile.com/b/lsD6Kv/ECNL4)[10.1016/j.fertnstert.2007.08.033](http://dx.doi.org/10.1016/j.fertnstert.2007.08.033)

[Iliodromiti, S., Kelsey, T. W., Wu, O., Anderson, R. A., & Nelson, S. M. (2014). The predictive accuracy of anti-Müllerian hormone for live birth after assisted conception: a systematic review and meta-analysis of the literature. In *Human Reproduction Update* (Vol. 20, Issue 4, pp. 560–570). https://doi.org/](http://paperpile.com/b/lsD6Kv/DpIGq)[10.1093/humupd/dmu003](http://dx.doi.org/10.1093/humupd/dmu003)

[Karlsen, K., Hrobjartsson, A., Korsholm, M., Mogensen, O., Humaidan, P., & Ravn, P. (2018). Fertility after uterine artery embolization of fibroids: a systematic review. *Archives of Gynecology and Obstetrics*, *297*(1), 13–25.](http://paperpile.com/b/lsD6Kv/hOMzM)

[La Marca, A., Grisendi, V., & Griesinger, G. (2013). How Much Does AMH Really Vary in Normal Women? *International Journal of Endocrinology*, *2013*, 959487.](http://paperpile.com/b/lsD6Kv/S7CDm)

[Mailli, L., Parthipun, A., & Ahmed, I. (2015). Uterine fibroid embolization: can fertility be preserved? In *Challenging Concepts in Interventional Radiology and Endovascular Procedures* (pp. 171–178). https://doi.org/](http://paperpile.com/b/lsD6Kv/UwIzv)[10.1093/med/9780199664382.003.0020](http://dx.doi.org/10.1093/med/9780199664382.003.0020)

[McLucas, B., Voorhees, W. D., 3rd, & Elliott, S. (2016). Fertility after uterine artery embolization: a review. *Minimally Invasive Therapy & Allied Technologies: MITAT: Official Journal of the Society for Minimally Invasive Therapy*, *25*(1), 1–7.](http://paperpile.com/b/lsD6Kv/oojIf)

[McLucas, B., Voorhees, W. D., 3rd, & Snyder, S. A. (2018). Anti-Müllerian hormone levels before and after uterine artery embolization. *Minimally Invasive Therapy & Allied Technologies: MITAT: Official Journal of the Society for Minimally Invasive Therapy*, *27*(3), 186–190.](http://paperpile.com/b/lsD6Kv/T9pzM)

[Muteshi, C. M., Murage, A., & Ngugi, S. (2018). Anti-Mullerian hormone before and after uterine artery embolisation in reproductive-age women seeking treatment for symptomatic fibroids. In *South African Journal of Obstetrics and Gynaecology* (Vol. 24, Issue 2, p. 57). https://doi.org/](http://paperpile.com/b/lsD6Kv/3INXm)[10.7196/sajog.1331](http://dx.doi.org/10.7196/sajog.1331)

[Payne, J. F., Robboy, S. J., & Haney, A. F. (2002). Embolic microspheres within ovarian arterial vasculature after uterine artery embolization. *Obstetrics and Gynecology*, *100*(5 Pt 1), 883–886.](http://paperpile.com/b/lsD6Kv/Rw7en)

[Spies, J. B., Coyne, K., Guaou Guaou, N., Boyle, D., Skyrnarz-Murphy, K., & Gonzalves, S. M. (2002). The UFS-QOL, a new disease-specific symptom and health-related quality of life questionnaire for leiomyomata. *Obstetrics and Gynecology*, *99*(2), 290–300.](http://paperpile.com/b/lsD6Kv/FX09)

[Tsepelidis, S., Devreker, F., Demeestere, I., Flahaut, A., Gervy, C., & Englert, Y. (2007). Stable serum levels of anti-Mullerian hormone during the menstrual cycle: a prospective study in normo-ovulatory women. In *Human Reproduction* (Vol. 22, Issue 7, pp. 1837–1840). https://doi.org/](http://paperpile.com/b/lsD6Kv/6FkLU)[10.1093/humrep/dem101](http://dx.doi.org/10.1093/humrep/dem101)

[Tsikouras, P., Manav, B., Koukouli, Z., Trypsiannis, G., Galazios, G., Souftas, D., & Souftas, V. (2017). Ovarian reserve after fibroid embolization in premenopausal women. *Minimally Invasive Therapy & Allied Technologies: MITAT: Official Journal of the Society for Minimally Invasive Therapy*, *26*(5), 284–291.](http://paperpile.com/b/lsD6Kv/PpNRt)

[Weenen, C., Laven, J. S. E., Von Bergh, A. R. M., Cranfield, M., Groome, N. P., Visser, J. A., Kramer, P., Fauser, B. C. J. M., & Themmen, A. P. N. (2004). Anti-Müllerian hormone expression pattern in the human ovary: potential implications for initial and cyclic follicle recruitment. *Molecular Human Reproduction*, *10*(2), 77–83.](http://paperpile.com/b/lsD6Kv/Uq6Wk)

[Yadavali, R., Ananthakrishnan, G., Sim, M., Monaghan, K., McNaught, G., Hamoodi, I., Bryden, F., Lassman, S., & Moss, J. G. (2019). Randomised trial of two embolic agents for uterine artery embolisation for fibroids: Gelfoam versus Embospheres (RAGE trial). *CVIR Endovascular*, *2*(1), 4.](http://paperpile.com/b/lsD6Kv/S0MfX)